New Paradigms in Monetary Theory and Policy?

New Paradigms in Monetary Theory and Policy?

Edited by
Morten Balling & David T. Llewellyn

Chapters by:
Athanasios Orphanides
Luc Coene
Andy Haldane
Dramane Coulibaly & Hubert Kempf
Nicola Brink & Michael Kock
Amund Holmsen & Øistein Røisland
Guonan Ma & Robert N. McCauley
Fabio C. Bagliano & Claudio Morana
Wim Boonstra
Tobias C. Michalak
Philipp C. Rother

SUERF – The European Money and Finance Forum
Vienna 2012

SUERF Study 2012/1

larcier

CIP

New Paradigms in Monetary Theory and Policy?

Authors: Athanasios Orphanides, Luc Coene, Andy Haldane, Dramane Coulibaly & Hubert Kempf, Nicola Brink & Michael Kock, Amund Holmsen & Øistein Røisland, Guonan Ma & Robert N. McCauley, Fabio C. Bagliano & Claudio Morana, Wim Boonstra, Tobias C. Michalak, Philipp C. Rother

Keywords: Monetary policy, financial stability, economic governance, micro-prudential supervision, macro-prudential supervision; Euro Area; Short-termism, risk premia, public policy, governance, taxation; Inflation Targeting, Exchange Rate Pass-Through, panel VAR; Monetary policy transmission mechanism, South Africa; Interest rate forecasting, policy intentions, Norway; China, Renmimbi, exchange rate, global imbalances; Macro-finance, United States, business cycle; SDR, global financial infrastructure; risk-taking channel, competition, concentration, bank soundness, European banking; EU fiscal framework, fiscal sustainability, government debt

JEL Codes: E31, E43, E44, E5, E52, E55, E58, E63, F41; G01, G28

Vienna: SUERF (SUERF Studies: 2012/1) – January 2012

ISBN: 978-3-902109-61-3

Table of Contents

List of Authors

Fabio C. Bagliano
Professor of Economics and Deputy Director of the Department of Economics and Finance at the University of Turin

Wim Boonstra
Chief Economist of Rabobank Nederland, Utrecht, The Netherlands, teaches money and banking at VU University, Amsterdam and is also President of the Monetary Commission of the European League for Economic Cooperation (ELEC), Brussels

Nicola Brink
Head of the Financial Safety Net Division in the Financial Stability Department at the South African Reserve Bank

Luc Coene
Governor of the National Bank of Belgium

Dramane Coulibaly
Economist CEPII (Centre d'Etudes Propectives et d'Informations Internationales)

Richard Davies
Economist, Bank of England

Andy G. Haldane
Executive Director, Financial Stability, Bank of England

Amund Holmsen
Deputy Executive Director in the Monetary Policy Wing of Norges Bank

Hubert Kempf
Senior Economist at the Banque de France and Professor of Economics at the University Paris-1 Panthéon-Sorbonne

Michael Kock
Senior Economist in the Financial Analysis and Public Finance Unit of the Research Department of the South African Reserve Bank

Guonan Ma
Senior Economist at the Bank for International Settlements' Representative Office for Asia and the Pacific in Hong Kong

Robert N. MCCAULEY
Senior Adviser in the Monetary and Economic Department of the Bank for International Settlements in Basel

Tobias C. MICHALAK
Research Assistant at the Chair of *Banking & Finance* (Department of Economics) and the *Institute for Banking and Finance* (ikf) at the Ruhr-University of Bochum

Claudio MORANA
Associate Professor of Economics at the Faculty of Economics of the University of Piemonte Orientale in Novara, Italy

Athanasios ORPHANIDES
Governor of the Central Bank of Cyprus

Øistein RØISLAND
Head of the Research Department at the Monetary Policy Wing at Norges Bank

Philipp C. ROTHER
Head of theFiscal Surveillance Section in the Directorate General Economics of the European Central Bank

1. INTRODUCTION

Morten Balling and David T.Llewellyn

On 11-12 May 2011, SUERF and the Belgian Financial Forum, in association with the Brussels Finance Institute and the Centre for European Policy Studies (CEPS) organized the 29th SUERF Colloquium "New Paradigms in Money and Finance?" All the papers in the present SUERF Study are based on contributions to the Brussels Colloquium.

Chapter 2 is based on the SUERF Marjolin Lecture 2011 given by *Athanasios Orphanides,* Governor of the Central Bank of Cyprus. For 200 years, it has been the business of central banks to ensure price stability, financial stability and economic stability. The understanding of the elements and the focus has, however, changed. Several lessons can be drawn from the most recent crisis. The importance of central bank independence and credibility has been underlined. The massive increases in liquidity in the autumn of 2008 could have caused increased inflation expectations but this did not happen due to the credibility of central banks. There is a debate on how to pursue a systematic monetary policy, and the speaker addressed several questions. How ambitious should monetary policy be? Do central banks know enough? There is a recognised need to strengthen macroprudential supervision, but can greater central bank involvement in regulation and supervision pertaining to credit and finance contribute to better management of overall economic stability? A partial answer is: not unless central banks have the appropriate tools. In Europe, the Stability and Growth Pact should have encouraged a sound fiscal policy, but it did not work. Doubts about some governments' ability to fulfil their debt obligations have led to the crisis. A strengthening of economic governance in the euro area must in the future prevent irresponsible fiscal behaviour and make it difficult to postpone necessary fiscal consolidation when it is needed. Today, a lack of clarity about euro area governance and crisis resolution has an adverse impact on the euro area.

In chapter 3 *Luc Coene,* Governor of the National Bank of Belgium refers to the turmoil in May 2010 in financial markets due to the worsening of the sovereign debt crisis. As a response, the Eurosystem announced a set of measures including a programme to intervene in markets for debt instruments. Against this background, the Governor focusses on monetary policy in the euro area, and in particular on the challenges posed by the current macroeconomic outlook and how the sovereign debt turmoil has an impact on euro area monetary policy decisions. In its latest *World Economic Outlook*, the IMF talks about a two-speed recovery. Emerging market economies show significant growth while the advanced economies still have low growth and excess capacity. In the euro area, the so-called

'core countries' are posting good growth numbers while the countries most affected by the sovereign and banking crises are lagging behind. Higher inflation can be observed and this has caused the ECB Governing Council to raise interest rates. But how do such increases square with the ongoing sovereign debt turmoil? The securities market programme and the re-introducing of the regime of fixed-rate full allotment for longer-term operations contribute to maintaining financial stability, but these measures are temporary in nature. Fiscal consolidation is indispensable to secure sustainable public finances over the longer term. In the view of the Governor, heterogeneity across euro area countries does not greatly complicate the task of the Eurosystem. It is part of a necessary process of adjustment through which some countries have to go in order to regain competitiveness and to repair their balance sheets. Although monetary policy cannot be tailored towards the needs of specific countries or regions, national developments are to some extent taken into account. When deciding on monetary policy measures, the Governor sees no problems in raising interest rates, while at the same time continuing to provide banks with unlimited liquidity. The two types of measures are geared towards different, but complementary goals. The Eurosystem has the will and the tools to cope with the challenges in front of us, and there is a lot of work to do.

In chapter 4 *Andrew G. Haldane,* Executive Director for Financial Stability, at the Bank of England presents a thought-provoking contribution 'The short long'. He asks: "Is the world becoming short-sighted?" Evidence on short-termism can be found in equity market experience. The evidence suggests that short-termism is both statistically and economically significant in capital markets. It appears also to be rising. Investment choice, like other life choices, is being re-tuned to a shorter wave-length. Public policy intervention might be needed to correct this capital market myopia. But which public policy response would be appropriate? The lightest touch approach would be to require greater disclosures by financial and non-financial firms of their long-term intentions. For financial firms, this might include metrics of portfolio churn. A more intensive approach would involve acting directly on shareholder incentives through their voting rights. For example, fiduciary duties could be expanded to explicitly long-term objectives. Shareholder rights could be enhanced for long-term investors, perhaps with a duration-dependent sliding scale of voting rights. Employment contracts could be conditioned on long-term performance. Government could through taxation or subsidies penalise short-duration holdings of securities, or incentivise long-duration holdings. Public policy could help keep the plums in the pudding.

In chapter 5 *Dramane Coulibaly,* Centre d'Etudes Prospectives et d'Informations Internationales and *Hubert Kempf,* Banque de France ask: "Does inflation targeting decrease exchange rate pass-through in emerging countries?" The analysis is based on empirical evidence from 27 emerging economies, 15 are inflation tar-

geters while 12 are non-targeters. The evidence suggests that inflation targeting has helped to reduce the pass-through to various price indexes. The analysis indicates that the contribution of exchange rate shocks to price fluctuations in targeters countries is important, while the contribution of exchange rate shocks to price fluctuations in non-targeting countries is insignificant.

In chapter 6 *Michael Kock* and *Nicola Brink* of the South African Reserve Bank study the monetary policy transmission mechanism in an open emerging-market economy. The paper describes the channels of monetary policy transmission in the South African context. The SARB uses a number of instruments to ensure that the money market remains in a liquidity-deficit position. It is concluded that the policy rate has a significant impact on credit, aggregate demand, asset prices, output and inflation, but in a more complex way than proposed by the conventional theory on the transmission mechanism of monetary policy.

Øistein Røisland of the Norges Bank explains in chapter 7 the role of interest rate forecasts in Norwegian monetary policy. One of the reasons behind publishing the forecasts is to improve the general understanding of the Bank's reaction pattern. In general, interest rate forecasting has worked well. There is little doubt that the contingency of the forecasts is well understood. Interest rate forecasts are an essential part of Norges Bank's communication policy with a view to managing market expectations.

In chapter 8 *Guonan Ma* and *Robert N. McCauley* from the BIS analyse global imbalances and Chinese exchange rate policy. They describe the interplay between the high saving rate in China, the People's Bank of China's exchange rate policy and global imbalances. The authors characterise China as a large, fast-growing surplus economy. The government has led the impressive rise in saving. Since the USD-zone represents about half of the global economy and since China is the biggest country in the world, international competitiveness, trade patterns and capital flows are strongly dependent on the choice by the Chinese monetary authorities between stabilisation of the renminbi's (RMB) relation to the USD or to a basket of currencies. The evidence referred to suggests that in recent years (except some months in 2008) the RMB has been managed to appreciate gradually over time against a trade-weighted basket of currencies. The policy which is followed by some other Asian monetary authorities as well can be described as a crawling band against a basket.

In chapter 9 *Claudio Morana,* (University of Piemonte Orientale, Italy) and *Fabio C. Bagliano,* (Universita di Torino, Italy) investigate the domestic interactions of US macro and financial shocks within a global framework. In the paper, the authors assess the mechanics of the 2008-2010 recession considering both its domestic propagation within the US and its spillovers to advanced and emerging economies. Based on very comprehensive empirical evidence from 50 countries

they conclude that asset price misalignments in the housing and stock markets, as well as low real interest rates, over the boom phase of the cycle, might have been driven by excessively generous liquidity in the system. Concerning the real effects of the crisis, there is stronger evidence of an asset price channel than a liquidity channel. The trade channel seems, however, to be the key transmission mechanism of the US economic crisis to the rest of the world.

Wim Boonstra, (Rabobank Nederland) describes in chapter 10 how the US dollar's role as a global currency has contributed to the current situation of global balance of payments disequilibria and the US becoming the world's biggest debtor. Calls for an alternative to the USD-dominated international financial system are becoming louder and are also coming from China. According to the author, the stability of the global economy would be greatly enhanced if, instead of a national currency in the role of a global anchor currency, a supranationally managed currency unit were to be introduced. The SDR managed by IMF appears to be an ideal candidate for this role.

In chapter 11 *Tobias C. Michalak,* from the Ruhr University of Bochum, studies the nexus between monetary policy, banking market structure and bank risk taking. He gives an empirical assessment of the risk-taking channel of monetary policy. Taking the 'risk-taking channel' as his point of departure, the author investigates the nexus between low levels of short-term interest rates, monetary policy decisions, the banking market structure and the financial soundness of banks. The empirical findings support the 'risk-taking channel theory'. The analysis shows that banks are less prone to financial fragility when, other things being equal, they operate in concentrated markets, when they operate in a strict regulatory and supervisory regime, and when they are subject to strong market discipline. The author concludes that the risk-taking channel must be considered in the formulation of monetary policy.

Chapter 12 is a paper by *Philipp C. Rother* from the European Central Bank: "Challenges for the EU fiscal framework: fiscal sustainability, government debt and monetary policy". A comparison of the euro area, Japan and USA shows there are government deficits everywhere. The government gross debt in proportion to GDP is close to 85% in the euro area, 92% in the USA and over 220% in Japan. Gross public debt ratios have increased rapidly in recent years. The future debt scenarios depend on the fiscal consolidation paths. The IMF has identified the fiscal adjustment needed over the next decade to bring public debt ratios back to sustainable levels (defined as achieving a debt ratio of around 60% of GDP by 2030). The fiscal adjustment needs are very large in Japan, United States, Ireland, Greece and Spain while Germany, Austria and Belgium are in more manageable situations. Evidence from several countries, from 1994 to 2008, shows that it is possible to reduce high government debt ratios. From this perspective, the correc-

tion of the current fiscal imbalances should in principle be possible. For the euro area, the governance framework for economic policies is being strengthened in response to the shortcomings identified in relation to the crisis. Having witnessed the spillover risks from imbalances in individual member states, euro area governments have all incentive to apply peer pressure early on when economic imbalances are detected. In addition, market reactions are likely to play a more important signalling role for national policy makers than in the past.

2. New Paradigms in Central Banking?

Athanasios Orphanides[1]

2.1. Introduction

The topic of this year's SUERF colloquium: "New Paradigms in Money and Finance?" and the invitation to talk about central banking in this context could hardly be more inviting for a career central banker like myself. In this light, I would like to express my appreciation to the organisers for the invitation to deliver this year's SUERF Marjolin Lecture. The overall objective of the colloquium is to consider the extent to which the financial crisis we are experiencing has an impact on theoretical and policy paradigms in monetary economics and policy, banking, financial markets, regulation and supervision. The colloquium was organised around three closely related questions: (1) new paradigms in monetary theory and policy? (2) new paradigms in banking and financial markets? and (3) new paradigms in financial regulation and supervision? This led me to organise my remarks around an additional question: new paradigms in central banking?

To assess whether we are moving towards new paradigms, we need to examine things in a historical perspective. Central banking is a relatively young activity and profession. Only a handful of central banks around the world are more than 200 years old and in most countries central banks are younger than 100 years. I would argue that throughout the existence of central banks, the main task has remained the same. In one word: stability. Stability has always been the business of central banking. What has been changing over the history of central banking, and what may be influenced by the experience of the current crisis, is the understanding by central bankers, governments and society in general about what element of stability central banks should focus on, what powers they have in order to do their job and what factors may facilitate or constrain their task.

Our understanding about how to achieve and maintain stability has been evolving over time. One way to see this is to consider different aspects of stability and the relative emphasis given to these over time. Consider price stability, financial stability and economic stability. Views about the relative importance of each of these as specific objectives for central banks have evolved over time and, I would argue, are again being influenced by the ongoing crisis. Views about the overall policy framework of central banks, including the scope of their responsibilities,

[1] The opinions expressed are those of the author and do not necessarily reflect views of the Governing Council of the European Central Bank or the European Systemic Risk Board.

as well as views regarding operational aspects of policy towards achieving and maintaining stability, have also evolved over time and are being influenced by the ongoing crisis.

The rest of my talk is organised as follows: I will focus on whether and how the crisis has influenced thinking in a few specific areas. The pre-crisis consensus views have not shifted as a result of the crisis in some areas but have shifted in others. In the next section, I will touch upon the institutional framework and the strategy of monetary policy and I will then turn to the interaction of monetary policy and financial stability as well as recent developments regarding macro-prudential supervision. Finally, I will discuss the interaction of monetary policy and economic governance which I find to be one of the most vexing issues we face in Europe today, and something that requires immediate attention to restore stability.

2.2. Institutional Framework and Strategy of Monetary Policy

Let me talk first about the institutional framework of monetary policy. This is an area where I believe views about best practices have not shifted materially as a result of the crisis. Two key elements I would like to highlight are the independence of the central bank and the primacy of price stability as a monetary policy objective.

Consider first the role of price stability. Over the past few decades, price stability has been accepted as the main objective of a central bank, a precondition for attaining overall stability in an economy. But there are numerous examples where central banks have failed to achieve this objective. History suggests that if the central bank places insufficient attention on maintaining price stability, overall stability eventually suffers. For example, in Europe during the 1970s and 1980s considerable economic malaise was experienced when inflation was allowed to be ingrained. In some states inflation was tolerated for a time in the belief that it might facilitate better outcomes regarding economic growth and employment. In the event, the opposite occurred-stagflation.

Next we consider the importance attributed to central bank independence. That is, ensuring that monetary policy remains independent of politics. In the European Union, for example, we live in democracies and recognise the issues that may arise when political motivations have the potential to influence some decisions. One of the limitations of democracies is that some discretionary political decisions may at times be more myopic than would be desirable for social welfare. The electoral calendar may prompt a government facing an unfriendly electorate to not fully account for the negative consequences of a policy decision far into the

future if it provides the appearance of short-term gains that might provide an electoral benefit. The temptation to generate inflation has exactly these characteristics. Pursuing inflationary policies for some time may provide the appearance of faster growth and greater employment in the short-run while the detrimental effects may be recognised with considerable lags. Thus, if democratic governments have discretionary power over monetary policy, socially inefficient inflationary policies might be pursued at times. Having recognised the potential social inefficiency of political interference in monetary policy under these circumstances, our democracies have agreed to safeguard central bank independence in order to ensure that central banks can deliver on the primary task of price stability over time. In this manner, political influences determining potentially short-term inflationary dynamics that could be detrimental to welfare as a whole are avoided.

Let me now turn to the strategy of monetary policy. A broad consensus had developed before the crisis on a number of issues in this area. I would like to highlight four elements that summarise how I interpret the consensus that emerged on best policy practice. The first element is the usefulness of a clear definition of the central bank's price stability objective. Most central banks around the world by now have a clear numerical definition of price stability, and even in those cases where a formal numerical definition has not been adopted, an implicit definition is communicated and respected. The second element is a forward-looking policy orientation. Such an orientation is essential for policy to account properly for anticipated developments in the economy and the lags in the transmission of policy. In addition, a forward looking policy orientation is essential to incorporate information about expectations that businesses and households hold about economic prospects since such expectations influence current behaviour and economic outcomes. The third is the focus on maintaining well-anchored inflation expectations over the medium and longer term. This is an area where the academic work on the formation of expectations, starting with the rational expectations revolution and continuing with the learning literature, has helped us better comprehend how expectations are formed by households and businesses and has played a key role in enhancing our understanding of their role for policy. When private inflation expectations become unmoored from the central bank's objectives, macroeconomic stabilisation suffers as well. Indeed, the crisis has offered additional evidence reaffirming the stabilising role of well-anchored expectations, especially when the economy is under stress. Well-anchored inflation expectations facilitate the monetary policy response to adverse supply shocks, thereby enabling central banks to better stabilise economic fluctuations. The fourth is the recognition that policy must be systematic, based on a contingency plan or well understood policy rule, rather than purely discretionary in nature. Unsystematic policy has serious

drawbacks in that its inherent unpredictability can mislead and confuse market participants, businesses and households.

An area where a consensus was not clear cut prior to the crisis and debate is continuing concerns how ambitious monetary policy should be in dampening economic fluctuations, in addition to the pursuit of price stability. The debate can be framed as a comparison of simplicity and robustness versus perceived optimality. Does a complex optimal policy rule obtained from a policy evaluation experiment on the basis of a macroeconometric model provide a solid basis for formulating policy in practice or are better policy outcomes to be expected over time if policymakers are guided by simple rules that are robust to model misspecification and uncertainty? Another related way of framing the debate is in terms of policy activism versus a stability-oriented policy approach. The activist view suggests that, in addition to price stability, an equally important goal of monetary policy is to guide the economy towards attainment of its ideal 'potential' level of activity. That is, an important guide to policy is the 'output gap', which measures how far GDP deviates from its potential. In contrast to the activist view, the stability oriented approach could be characterised as attempting to dampen economic fluctuations by promoting stable economic growth over time, subject to a primary focus on maintaining price stability.

The two alternative ways to frame this question are related in that the answers economists give are informed importantly about their views on the limits of our knowledge about the economy. Those who trust that our understanding of the economy, as reflected by empirical measurement and estimated models, is sufficiently complete, tend to support greater policy activism and trust more model derived optimal policy recommendations. Those who acknowledge how limited our knowledge is tend to be more modest. They trust more simple and robust policy guides and are content not to guide policy decisions in pursuit of the economy's elusive 'potential' at the risk of price stability.

By experience, central bankers appreciate much more how imperfect our knowledge regarding the economy is and, as a result, they tend to be less activist than is often suggested as best practice in the academic literature. At times this can create a disconnect between theory and practice. A theoretical modeller can assume that central bankers and every other agent in a model have much more information about the economic system than they actually do. On the basis of that assumption, an optimal policy can be formulated and then actual policy decisions can be contrasted against that theoretical optimum. A central banker can be criticised for not acting 'optimally' simply because in the model he is assumed to know things which in reality he does not. Similarly, the modeller can be critical of businesses or households for not forming their expectations 'efficiently'

because their forecasts deviate from what the model would have suggested simply because they cannot form expectations in the manner the model assumes.

Our experience during the crisis has given us more reasons to be cautious with the activist approach. Let me provide an example. Let p and q denote (the logarithms of) the price level and real output, respectively, and define the rate of inflation $\pi \equiv \Delta p$. Using 'stars' to mark the ideal target values of respective variables, we can use π^* to denote the numerical definition of price stability and q^* to denote the level of potential GDP.

Both the activist and stability-oriented approaches to monetary policy would aim at achieving price stability that can be interpreted as closing the inflation gap $(\pi - \pi^*)$. The difference in the two approaches is that another key objective of the activist approach to monetary policy is to close the output gap $(q - q^*)$ and perhaps place as much importance on that objective as on maintaining price stability.

A fundamental practical difficulty, however, is that the output gap cannot be measured in real time, that is when policy decisions are taken, and retrospective estimates can vary dramatically from real time estimates, primarily because the notion of the economy's level of 'potential' output, q^*, is fundamentally unknowable. Output gap estimates may not even have the correct sign in real time and as a result can lead to very serious policy mistakes, especially at turning points. Although as a theoretical construct the concept of the output gap may be useful, as an empirical construct it is not, especially at turning points, when it is not unusual to find out years after the event that not even the sign of the output gap estimated in real time was correct.

Let me be more explicit by using the euro area as an example, following Orphanides (2010a). Let us take the first ten years of the euro area and look at real-time estimates of the output gap as presented by the International Monetary Fund (IMF) in the World Economic Outlook (WEO) in the spring of each year (similar results apply also to the estimates of the European Commission). Figure 1 (p. 29) compares these real-time estimates to the most recent retrospective estimates. A significant bias is evident. The bias is mainly due to the fact that the experts are now more pessimistic about what potential output was in the euro area than they were in the past. This is not the experts' fault. We simply cannot know in real time. Notably, this applies not only to the size of the output gap, but also to its sign. In comparing what the experts tell us now and what they were telling us then, in real time, the sign of the output gap is revealed to be incorrect in more than half of the years in the first decade of the euro area.

The problem associated with aiming to close the output gap as a policy guide can be examined in more detail in the context of the crisis by focusing on estimates of the output gap for 2006, the year before the financial turmoil began. Would use

of the output gap for 2006 have helped guide monetary policy in the right direction? The answer is no, as can be confirmed by tracing the evolution of output gap estimates for that year. According to the IMF, the euro area operated below its potential that year with the gap being around minus 1 ½ percent (see Figure 2, p. 29). As late as 2008, the year 2006 was still being seen as one of wasted resources. But by 2009, with revised estimates, the experts were telling us that three years earlier in 2006, the euro area was overheated and output exceeded its potential by a significant amount. Seen from the present, the activist approach would have led policymakers in the euro area to a serious policy error by suggesting that monetary policy should be loosened when in retrospect the recommendation would have been for policy to be tighter. It is of no use telling the monetary policymaker five years after the fact that the economy was overheated. This is yet another illustration as to why one should not rely on the activist approach.

A central bank need not rely on an unreliable activist approach for formulating policy. An alternative, stability-oriented approach, for example, does not rely on the concept of the output gap but focuses instead on stable growth, in addition to the inflation outlook. Such guidance can be obtained from the outlook of output growth Δq compared to its trend Δq^*. In Orphanides (2010a), I presented a very simple difference policy rule motivated by the writings of Wicksell (1898) and Friedman (1960) that could be used for policy guidance. Specifically,

$$\Delta i = \theta_{\Pi}(\Pi - \Pi^*) + \theta_{\Delta q}(\Delta q - \Delta q^*)$$

The robustness of this simple family of policy rules has been extensively examined in econometric evaluation exercises (see, for example, Orphanides and Williams (2002, 2010). The underlying idea was to identify a monetary policy guide that can lead to reasonably robust policy without requiring precise information about theoretical concepts such as the various natural rates (*e.g.* the definition of full employment or potential output, or the equilibrium real interest rate) that cannot be reliably observed or measured when policy is set. Estimates of output gaps are not needed for guiding policy in this approach, but instead only a sense of the economy's trend growth, which is subject to considerably less uncertainty.

A suggestive illustration for the euro area can be implemented, updating the work shown in Orphanides (2010a). For this implementation, the rule coefficients with quarterly frequency are set as follows: $\theta_{\Pi} = \theta_{\Delta q} = ½$.

Near term forecasts from the ECB's Survey of Professional Forecasters (SPF) are employed as indicators of the outlook for inflation and output growth. Specifically, the illustration uses the average of the survey responses regarding year-on-year forecasts with horizons ending about one year ahead from the data available when the survey is conducted (this is about three quarters ahead from the time the survey is taken). These 'year-ahead' forecasts have approximately the

same horizon from quarter to quarter. Figure 3 (p. 30) shows the one-year ahead inflation forecast from the SPF together with two numerical guides for Π^* : an upper guide of 2 percent and a lower guide of 1.5 percent. Comparing the inflation forecast with the corresponding guide, therefore, indicates whether the rule prescribes that the policy rate should be raised or lowered on account of the near-term inflation outlook. Figure 4 (p. 30) shows the one-year ahead GDP growth forecasts from the SPF together with two alternative indicators of what trend or potential GDP growth is. One indicator is from the survey itself, the average response to a question asking what GDP growth is expected to be five years ahead. The second indicator is the potential GDP estimate presented in the IMF's Spring WEO (reproduced for all four quarters of the year). The comparison of the GDP forecast, with its underlying estimated trend, indicates whether the economy is expanding faster or slower than its normal limit in the near term, and therefore signals whether the rule prescribes that the policy rate should be raised or lowered on account of the near-term inflation outlook.

The shaded area in Figure 5 (p. 31) presents the envelope of four prescriptions obtained by the combination of two alternative estimates for trend GDP and the upper and lower guide for the definition of price stability. This can be contrasted with the actual policy change of the MRO rate. (This is the change between policy meetings of the second month of each month, a timing that provided the closest match to the timetable of the SPF.) The shaded area in Figure 6 (p. 31) shows the envelope of prescriptions for the level of the policy rate that emerge from applying the prescribed quarterly changes to the level of the policy rate a quarter earlier.

The illustration just presented is meant to show that one does not need very complicated models to arrive at an understanding of the important drivers of policy. The contours of the policy prescriptions from this simple robust rule line up reasonably well with the actual policy decisions taken by the Governing Council of the ECB. In that sense, this rule is also broadly descriptive of ECB policy. But of course this is just an illustration and as such may miss important elements that cannot be summarised in a simple rule.

The most important deviation of actual policy from the rule shown in the figures is observed during the crisis in 2009 and 2010. This is the period when unconventional measures were relied upon to engineer additional monetary policy easing not reflected in the MRO. When short-term nominal interest rates are very close to zero, additional policy tools that rely on changing the size and composition of the central bank's balance sheet can be pivotal for effective crisis response. During the crisis, unconventional measures were employed both to engineer further policy easing, beyond what is reflected in the official policy rates, and to improve liquidity conditions, market functioning and the monetary policy transmission mechanism. Indeed, the crisis reminded us that monetary policy is *not*

only about the setting of policy rates. This of course is nothing new, but it is an element that many theoretical models ignored in the years immediately prior to the crisis.

2.3. Monetary Policy and Financial Stability

The next area I wish to turn my attention to is the role of central banks in securing financial stability and the interaction of monetary policy and financial stability. Here, the crisis has changed views materially because it proved more virulent than most thought it was likely to be. To be sure, inside central banks, financial stability has been recognised as a crucial central function throughout the history of central banking. But the academic literature tended to underplay this function in the decades prior to the crisis and, in some cases, supervisory responsibilities that can be crucial for safeguarding financial stability were taken away from central banks. The crisis revealed an underappreciation of systemic risks in micro-prudential regulation. This has forced a reconsideration of the attention that should be placed on financial stability in the economy and on the tools central banks should have available to more effectively safeguard financial stability. The crisis has also brought to the forefront the role of central banks in monitoring risks to financial stability and tracking incipient imbalances, as well as drawing attention to the scope for strengthening macro-prudential supervision.

Three questions can guide an assessment of how views have been influenced as a result of the crisis. First, can macro-prudential supervision succeed in preventing the accumulation of large imbalances if central banks can rely only on monetary policy tools? This is doubtful. I do not think central banks can help maintain financial stability unless they have the appropriate tools and the monetary policy tools are not the most appropriate. This is not to say that monetary policy is thoroughly ineffective in tackling threats to financial stability. However, monetary policy is of rather limited effectiveness in addressing financial imbalances and other risks to financial stability to justify redirecting its setting from what it needs to be to maintain price stability in the medium term. Monetary policy seems neither the most effective nor the most efficient tool to use if the aim is to safeguard financial stability. Rather, using regulatory tools that are targeted towards a specific imbalance would appear to be a more effective approach towards reducing threats to financial stability stemming from an incipient imbalance.

Consider, for example, a situation where credit growth directed to real estate appears excessive for a time, leading to a real estate boom in an environment of price stability. In retrospect, this is one of the imbalances observed in some member states in Europe prior to the crisis. Tighter monetary conditions would likely have dampened the boom only partially and at a cost inappropriately high for the

economy as a whole. In contrast, more effective would have been the use of regulatory tools to tighten lending conditions for real estate loans. One example would be imposing lower loan-to-value lending ratios[2].

The second question is the following: can the macro-prudential recommendations presented by a central bank be effectively implemented without the intimate involvement of the central bank in regulation and supervision? This question is pertinent because of the wide variety that is observed around the world in the institutional relationships between central banks and micro-supervisors. It is also of special interest in the context of the EU where, as a result of the crisis and following the recommendations of the de Larosière report (de Larosière, 2009), a new macro-prudential supervisory body has been created, the European Systemic Risk Board (ESRB). This new body includes all of the central banks and all of the micro-supervisors of Europe in order to assess financial stability risks and provide warnings and recommendations towards limiting risks. However, the ESRB has no enforcement power to ensure that its warnings are heeded and recommendations are followed. This may prove a considerable weakness and at the very least raises some legitimate doubts regarding its effectiveness. In particular, the power to issue recommendations by a macro-prudential supervisor may prove inadequate when the pertinent micro-supervisor cannot justify adopting it on the basis of micro-supervisory analysis and finds the macro-supervisory perspective insufficiently compelling to overturn the micro-supervisory perspective.

This brings me to the third and related question: can greater central bank involvement in micro regulation and supervision contribute to better management of overall stability in the economy? I think this is one area where views may have changed quite a bit as a result of the crisis moving the arguments towards an affirmative answer. Prior to the crisis, the tendency in a number of countries had been to separate micro-prudential supervision from central banks. An argument in favour of that separation was that it better protected the independence of the central bank in pursuing its monetary policy function of maintaining price stability. The risk that the independence of the central bank could be compromised could be greater the more powers and responsibilities the central bank has in micro-prudential supervision.

The experience with the crisis, however, has highlighted some advantages in ensuring central bank involvement in micro supervision. From the perspective of macro-prudential supervision, there is no better way to eliminate the mismatch between the institution responsible for coming up with a macro-prudential recommendation and that responsible for implementing the recommendation than

[2] The Central Bank of Cyprus implemented such a tightening of lending conditions to control a boom in real estate lending in the Summer of 2007 and contained the associated risks (see Central Bank of Cyprus, 2010). It was possible to employ a restriction of the loan-to-value ratio as a macro-prudential tool because micro supervision and regulation of banks was a function of the central bank.

ensuring that they are one and the same institution. Thus, crisis prevention could be more effective if the central bank were involved in micro-prudential supervision.

Another reason to seek central bank involvement in micro supervision, at least for banks, is to reap the benefits from the information synergies that can be of critical importance for efficient crisis management. A central bank has a special relationship with a depository institution regarding the provision of liquidity upon the presentation of suitable collateral while the supervisor assesses the bank's capitalisation and potential solvency risks. In crisis situations, when potential shortfalls in capital or liquidity may become blurred, the sharing of information and analysis on liquidity and solvency becomes critical. In theory, the information sharing and joint analysis needed can be achieved even if the micro-supervisor is an institution other than the central bank. In theory, all parties involved can meet and sit around the table in the same room as needed and deal with the problem. Experience, including examples from the current crisis, however, suggests this does not always work in practice. During a crisis it may not be that easy to get all involved in the same room to share and analyse information as much as needed. It is much easier when all involved are in the same organisation, and ideally in the same building! This will make it more likely that a crisis episode will be resolved quickly, perhaps over one weekend, which is often the most efficient way to deal with such situations.

One of the strongest lessons from the crisis is that we should not let bank regulation and supervision be distanced from central banks, as was the case in many countries before the crisis. Where this has not already happened, I believe we need to bring them back closer together. In a sense this is not a new lesson but rather a lesson re-learned. When it comes to financial stability, the crisis has influenced perceptions of the role of central banking, taking us back to an earlier epoch, when the role of central banks was much closer to the objective of ensuring financial stability, regulating banks and dealing with banking crises much more frequently than had been the case in recent decades.

2.4. Monetary Policy and Economic Governance

The next topic I want to cover, and this is a painful topic to cover in Europe today, is the interaction of monetary policy and economic governance in a monetary union like the euro area. The central bank's task of maintaining stability is more complicated in a monetary union when the member states pursue independent fiscal policies unless some minimum coordination and strict budgetary rules are adhered to. This is an area where the necessity of adhering to a proper design of the economic and monetary union (EMU) was advocated by central banks before

the crisis. However, the risks posed by weak economic governance of the EMU were arguably underappreciated by euro area governments. Even worse, a delayed and inadequate management of the difficulties identified during the early stages of the crisis has led to a severe worsening of the crisis in the euro area overall. At present, lack of sufficient progress regarding economic governance, including clarity on crisis management, has become a grave source of instability for the system.

It is well understood that sound fiscal policy is a prerequisite for stability in any economy. We all know that when the creditworthiness of a sovereign is endangered it can be disastrous for its economy and render the preservation of stability impossible. But during good times, governments do not always appreciate that in their fiscal plans they should take into account the possibility that after the next recession they may be faced with a difficult situation with a large deficit and a large debt. The crisis revealed that in a number of states in the developed world, government policies prior to the crisis tolerated structural deficits and debt levels that put the economy at risk when the crisis hit. Following the onset of the crisis we have seen downward revisions in the growth prospect of many economies, for example virtually all the EU economies. For a number of governments this has resulted in limited fiscal space that has reduced their ability to implement countercyclical measures without risking worsening long-term stability prospects. The underlying weakness has been inadequate adherence to sound long-term fiscal planning, made worse in many states by looming demographic problems over the next few decades.

Fiscal problems of this nature, if unchecked, can be magnified in a monetary union. In the euro area the crisis has mutated into a sovereign debt crisis, a crisis of the governance of the euro area. These developments have complicated tremendously the stability-oriented efforts of the European Central Bank (ECB) that has the mandate to set a single monetary policy for the euro area as a whole.

In a monetary union, strong economic governance is a prerequisite for maintaining stability in all states of the union. In the case of the euro area, the Stability and Growth Pact (SGP) provided a framework meant to ensure sound fiscal policy by all member states. Indeed, in theory at least, adherence to the SGP should have ensured sound public finances so well that it was viewed as unnecessary to put in place a crisis management framework for dealing with potential deficit and debt crises. But that was the theory. The crisis revealed significant gaps in monitoring and enforcement and insufficient respect for the rules by euro area governments. Unfortunately, the SGP did not work as intended. Sadly, some of the weaknesses in enforcement were recognised even before the onset of the crisis but at

the time there was no consensus among governments about the risks posed by failing to respect the SGP and the need to strengthen governance[3].

In some member states, insufficient budgetary discipline allowed the accumulation of large imbalances whose extent was not sufficiently appreciated before the crisis. In the case of Greece, in particular, the imbalances were partly hidden as a result of questionable statistical reporting (see Orphanides, 2010b). Despite concerns being expressed from time to time, euro area governments collectively allowed this to occur through ineffective oversight. These imbalances could no longer be hidden once the crisis hit and the fiscal deficits became larger and more problematic. Doubts about some governments regarding their debt obligations has led to a sovereign debt crisis in the euro area – the crisis we are observing right now – and in the absence of a clear crisis management framework this has become a major source of instability.

Figure 7 (p. 32) illustrates some of the resulting complications for the functioning of the euro area and the transmission of the single monetary policy. The figure compares the yields on ten-year government bonds in several euro area member states. It includes Germany, as a benchmark, and a number of member states whose sovereigns have experienced some pressure during the crisis. The latter includes Greece, Ireland and Portugal, three member states where the situation deteriorated so much that they lost the ability to refinance their debt in the markets and were forced to seek support from their EU partners and the IMF.

As can be seen, prior to the crisis, the costs of financing of member states in the euro area did not differ substantially from each other and co-moved over time. This reflected the perception in markets that euro area sovereign debt presented minimal credit risk, as should be the case if the SGP were fully respected. Since 2009, however, and especially since 2010, government yields have varied substantially among member states, reflecting the opening of significant credit spreads in some states. Recognising that the cost of financing for banks, and consequently for businesses and households, in each member state is materially influenced by the cost of financing for the government of the member state, the divergence in government yields has meant that financing conditions for the real economy have diverged across the euro area. As a result, the single monetary policy of the euro area does not correspond to similar monetary conditions throughout the euro area. This is the essence of the impairment of the monetary policy transmission experienced at present. Although we use the same currency everywhere in the euro area and despite the single monetary policy, lending rates faced by two households or two businesses with fundamentally similar characteristics can vary tremendously simply because they are located in different member states. As a

[3] The ECB had repeatedly expressed concerns about potential problems associated with weakened adherence to the SGP prior to the crisis (see *e.g.* European Central Bank, 2005a,b).

result of the sovereign crisis, the economic integration sought in the EMU is being seriously challenged.

The dispersion in government financing costs reflected in the figure has another detrimental effect on the euro area. This is the large increase in the overall costs of financing sovereigns in the euro area as a whole due to significant increases in credit spreads for sovereign issues. As a result of the crisis, euro area governments have collectively made most euro area sovereigns much less attractive to investors outside the euro area. With few exceptions, this implies euro area governments need to compensate investors much more to refinance their debt than would have been the case if the sovereign crisis were contained. Not all member states are immediately affected but this cannot obscure the collective inefficiency created by raising the collective costs to all euro area governments. At the end of the day, all citizens in the euro area are collectively paying the cost of this inefficiency. As a result of our failure to tackle the underlying problem, we are becoming poorer.

What is to be done? How can economic governance in the euro area be strengthened to remove the costly inefficiency we observe at the moment? The key weakness that must be corrected is the failure of the existing governance structure to ensure adequate fiscal discipline in all member states. In a changing environment, this requires checks that avoid the building up of fiscal imbalances. Positive shocks that improve fiscal finances are easy to take care of in our societies. Raising spending or reducing taxation is easy to do. But adverse shocks, such as a slowdown of growth prospects, are more painful to address.

The key is to prevent irresponsible fiscal behaviour by making it difficult to postpone necessary fiscal consolidation when it is determined that such consolidation is needed to ensure long-term stability. In a democracy, it cannot be ruled out that from time to time an elected government may not be predisposed to behave as responsibly as circumstances demand and instead be tempted to behave myopically, for instance by postponing decisions about painful adjustment until after the next election. The perennial problem is that the social cost of postponement can sometimes be hidden from the electorate until after the next election. When unchecked for a time, such behaviour can lead to the accumulated imbalances that can be so problematic, especially in a monetary union. This may be seen as an unavoidable cost of a democratic society, but it can be limited by strengthening governance. The issue then is to improve the governance of our democratic societies, putting checks in place that would protect the citizens of all states in the euro area from the potential of irresponsible behaviour of this kind. I am confident that citizens in every euro area state would support improvements in this area.

The preceding discussion may appear abstract but concrete steps are being contemplated that move the euro area in the right direction. We need to return to the

drawing board and reinforce the SGP in a manner that would allow its credible implementation. Some specific elements include improving the reliability of statistical reporting, enhancing the monitoring of budget plans and introducing debt breaks in national legislation. Indeed, these are elements that are included in legislation currently under consideration by the European Parliament[4].

The progress under way in this area, however, may prove insufficient to ensure lasting stability. To ensure the framework works in practice, the proper incentive structure must be put in place to discourage future governments from ignoring the common rules. As has been observed in the past, a government may be tempted not to behave prudently in the future. To discourage this, meaningful and prompt sanctions must be enacted. They must be meaningful in order to serve as proper deterrents and they must be prompt in order to be effective. Political discretion to delay the imposition of sanctions should be avoided. It would certainly not help the citizens of a member state that happened to have an irresponsible government if the EU imposed sanctions five years after that government's indiscretions. Nor would such a delayed process provide an incentive to an irresponsible government to behave differently as by then that government might not even be in power. That is why we need automatic, prompt and meaningful sanctions. Unfortunately, the discussions that have taken place so far in the euro area have not taken us far enough in this direction.

In addition to the necessity of improving the governance of the euro area, the ongoing turbulence has also made clear that a crisis management mechanism must be put in place to ensure stability. This is urgently needed. It is not enough to pronounce that such a mechanism will be eventually put in place. The framework that will be operational in the future must be clarified at present to prevent further deterioration of the ongoing crisis. Why the urgency? Why do central banks seem so anxious to have solutions in place as soon as possible? Again, the answer is stability. Because financial markets are forward looking, clarity about how the framework will work tomorrow would have a beneficial effect today. In contrast, the continuing uncertainty created by lack of clarity about euro area governance and crisis resolution and the continuing delay in committing to an operational framework in the future has an adverse impact on the euro area today.

2.5. Concluding Remarks

Let me conclude by reiterating a few key points. First, what is the paradigm of central banking? Stability, stability, stability. This has been the key throughout the history of central banking and remains so. As regards monetary policy, I do

[4] The legislation was enacted by the European Parliament on 28 September 2011 (European Parliament, 2011).

not think that the crisis has materially shifted views. The basic strategy remains a forward looking policy orientation that maintains well-anchored inflation expectations in line with a numerical definition of price stability. But as a result of the crisis, it appears that greater emphasis on financial stability is warranted than was appreciated before the crisis, in addition to price stability. To that end, the role of central banks in macro-prudential supervision must be strengthened. Furthermore, the balance of arguments has shifted towards central banks having more direct involvement in micro-supervision of the banking sector. Lastly, the crisis has reaffirmed with great force that strong economic governance is a prerequisite for stability in a monetary union. Sadly, despite having experienced tremendous costs stemming from the sovereign crisis in the euro area, lack of sufficient progress in strengthening economic governance going forward, including clarity on crisis management, has become a grave source of instability in the euro area.

References

Central Bank of Cyprus, 2010, "The use of the loan-to-value ratio as a macroprudential policy tool: the case of Cyprus 2007-2008", *Economic Bulletin*, December.

de Larosière, J., 2009, *Report of the High-Level Group on Financial Supervision in the EU*, 25 February.

European Central Bank, 2005a, *Statement of the Governing Council on the ECOFIN Council report on improving the implementation of the Stability and Growth Pact*, 21 March.

European Central Bank, 2005b, "The reform of the Stability and Growth Pact", *Monthly Bulletin*, August.

European Parliament, 2011, "Text Adopted at the Sitting of Wednesday, 28 September 2011", Provisional Edition 473.469, 0421-0426.

Friedman, M., 1960, *A Program for Monetary Stability*, New York, Fordham University Press.

Orphanides, A., 2010a, "Monetary policy lessons from the crisis", Central Bank of Cyprus Working Paper 2010-1.

Orphanides, A., 2010b, "Strengthening economic governance in the euro area", remarks at the Goethe-Universitat Frankfurt conference on "Macroeconomic Modelling and Policy Analysis After the Global Financial Crisis", Frankfurt, 15 December.

Orphanides, A. and Williams, J.C., 2002, "Robust monetary policy rules with unknown natural rates", *Brookings Papers on Economic Activity*, 2:63-118.

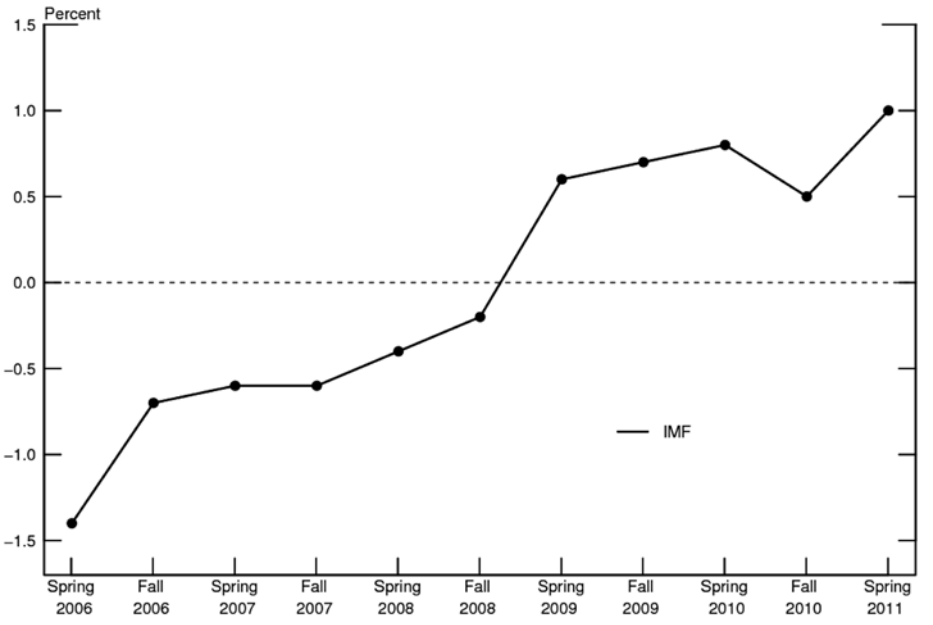
ORPHANIDES, A. and WILLIAMS, J.C., 2010, "Monetary policy mistakes and the evolution of inflation expectations", Central Bank of Cyprus Working Paper 2010-2.

WICKSELL, K., 1898, *Interest and Prices*, London, Macmillan for the Royal Economic Society (translated by Richard Kahn), 1936.

Figure 1: Real-time vs Retrospective Output Gap Estimates

Notes: IMF spring WEO estimates

Figure 2: Evolution of Output Gap Estimates for 2006

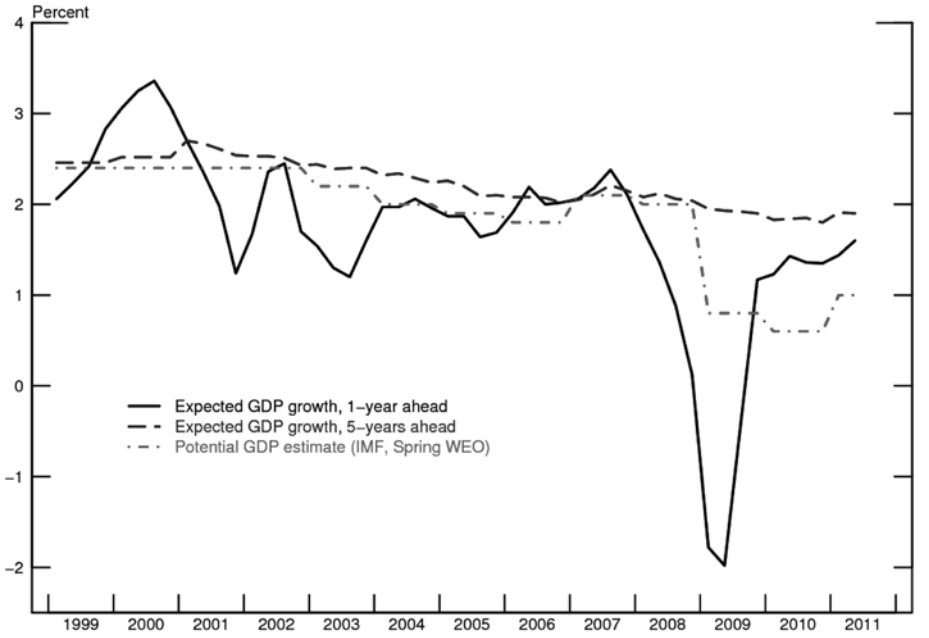


Notes: IMF estimates as updated in the spring and fall of each year.

Figure 3: Outlook for Inflation: One-year Ahead

Notes: ECB SPF average of individual responses.

Figure 4: Outlook for GDP Growth: One-year Ahead and Trend



Notes: ECB SPF average of individual responses. IMF real-time spring WEO.

Figure 5: Policy Rate and Simple Rule Prescription: Quarterly Change

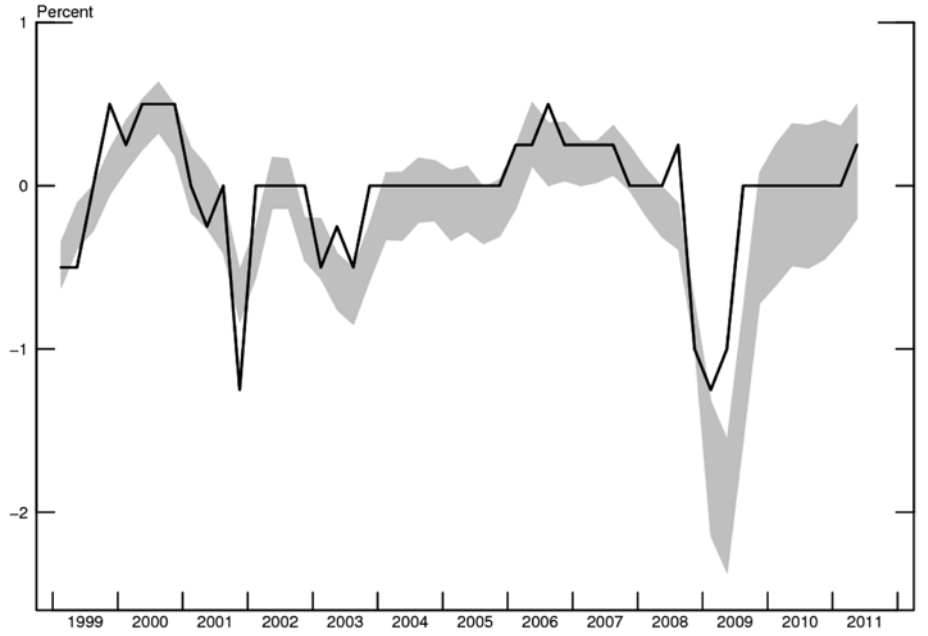


Figure 6: Policy Rate and Simple Rule Prescription

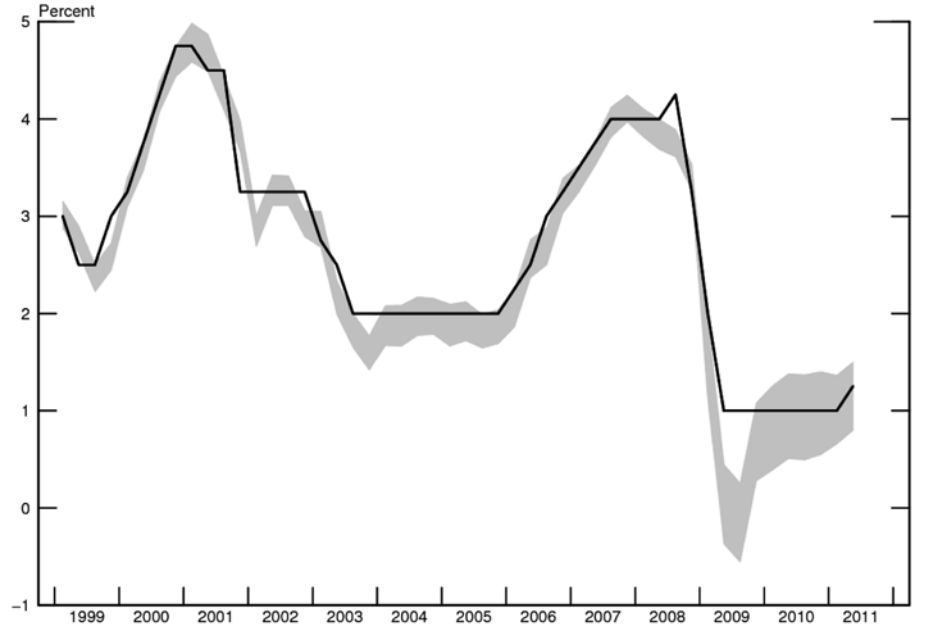
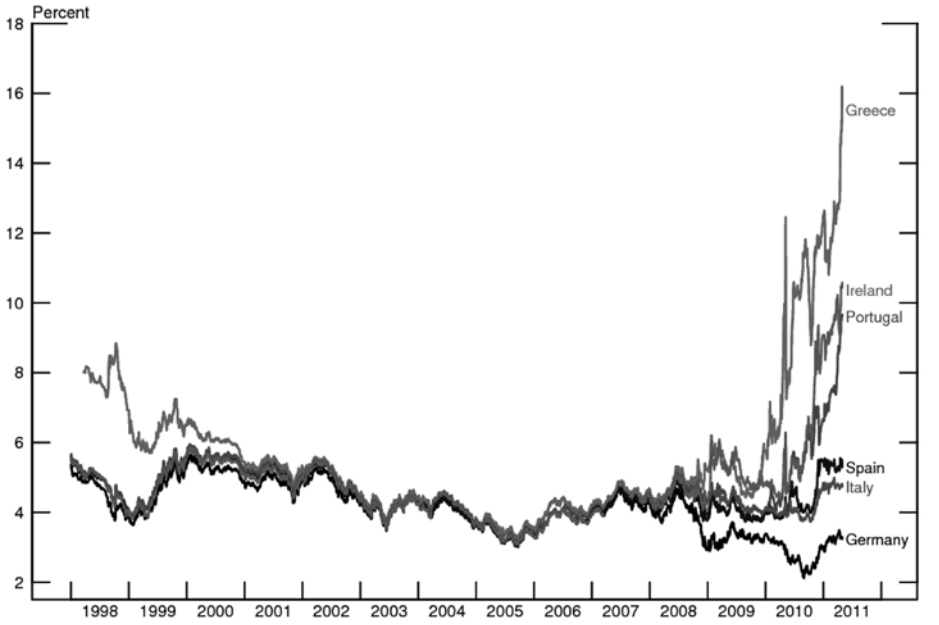


Figure 7: Yields on 10-year Government Bonds



3. CHALLENGES FOR EURO AREA MONETARY POLICY GOING FORWARD

Luc Coene

This week marks the *first 'anniversary' – if I may say so – of the sovereign debt crisis*. Indeed, the first week of May last year was characterised by extreme turmoil on financial markets and on the markets for public debt of some European countries in particular. That forced the Eurosystem to announce a set of measures on Monday 10th May 2010, including a programme to intervene on markets for debt instruments. One year after that very turbulent period, I think it is a good time to take a look at what challenges are ahead of us. I will focus my remarks on monetary policy in the euro area, and in particular on the challenges posed by the current macroeconomic outlook and how the sovereign debt turmoil has an impact on euro area monetary policy decisions.

Let's first go back to the early days of *May 2010*. What we witnessed those days, was a full-blown panic on financial markets after tensions on some government debt markets had been mounting since the fall of 2009 as investors increasingly cast doubts on the capacity of Greece to repay its public debts. The turmoil in May not only led to very high spreads on Greek paper, but also affected other countries' sovereign debt markets, led to extremely volatile equity and foreign exchange markets and brought about a new freeze in interbank trading as banks again became reluctant to lend each other in a context of uncertainties regarding exposure to the countries concerned. Therefore, the Governing Council of the Eurosystem decided on a *package of measures*. First, a programme to intervene on the secondary markets for private and public debt securities was set up in order to restore the smooth functioning of securities markets, a key link in the monetary transmission chain. Second, it was decided to organise again all Eurosystem liquidity providing operations as fixed-rate full allotment tenders, which allows banks to obtain all liquidity they need at a fixed rate, of course against the pledge of appropriate collateral. Finally, banks could again obtain US dollar liquidity through a swap line with the US Federal Reserve.

Since these early May days one year ago, the *economic outlook has improved*, both on the global level and at the euro area level. Yet, in my view, the economic environment is characterised by some *divergences*. I see two types of divergences. At the *global level*, we currently experience what the IMF in its latest World Economic Outlook calls a two-speed recovery. Indeed, the recovery is led in particular by the emerging market economies while the advanced economies are still characterised by rather low growth and excess capacity. The resource-intensive

growth of the emerging economies does put severe upward pressure on commodity prices, which are now standing at levels close to those seen before the financial crisis erupted in 2008. Of course, not only the fast economic growth in emerging economies pushed up commodity prices, also tensions in the Middle East and North Africa and the Japanese disaster led to higher prices. At the *euro area level* too, we see divergences. The rather solid recovery for the euro area as a whole does, indeed, hide significant heterogeneity as the so-called 'core countries' are posting nice growth numbers while the countries most affected by the sovereign and banking crisis are lagging behind.

This all means that, when doing our job – which is to maintain price stability –, the *Governing Council faces a number of challenges*. First and foremost, the Governing Council identifies clear *upside risks to price stability* which do require close monitoring. At the same time, I must admit that the *sovereign debt crisis* and – in some cases mutually related to that – the still *fragile euro area banking sector* do complicate the Governing Council's task as it threatens the good functioning of the monetary transmission mechanism. I will look at each challenge in turn.

Risks to the inflation outlook have shifted to the upside: the euro area recovery is now gaining a good footing and commodity prices have posted large gains. These higher prices push up inflation: according to Eurostat's flash estimate, headline inflation stood at 2.8% in April, clearly above the ECB's quantitative definition of price stability. On top, we see a lot of price pressures in the pipeline which implies that the risk of second-round effects is non-negligible today, in the context of a continuing recovery and given the likely persistent nature of the raw materials price increases. Therefore, the Governing Council decided to *raise the key ECB interest rate in April to 1.25%*, up from the 1%-level at which it stood since May 2009. That interest rate rise – which was widely anticipated by financial markets – indeed aims at avoiding that the first-round effects of higher commodity prices which we see in today's inflation figures translate into second-round effects and would hence entail a prolonged period of high inflation. The higher commodity prices – which, as I said earlier, mainly reflect the good performance of emerging economies and are therefore, at least in that sense, a blessing – are a *real* impoverishment for the euro area economy which cannot be avoided. Higher wage claims or price increases seeking compensation for such a deterioration in the terms of trade only postpone necessary adjustments and only lead to a longer period of higher inflation without any longer-run *real* benefits. Therefore, a solid anchoring of inflation expectations is essential and the Governing Council will do whatever is necessary to maintain price stability over the medium term.

The Governing Council acknowledged that the current monetary policy stance does remain accommodative. *"Is this increase the first in a series of interest rate rises?"*, is therefore a question which observers have often raised over the past month. As you all know, the Governing Council never pre-commits but at the same time, I think our strategy is very clear and markets and observers alike do realise that we will do whatever is necessary to ensure price stability will be maintained. Markets currently anticipate a *gradual* withdrawal of monetary accommodation and I personally think that is no unreasonable assumption, given the clear upside risks to price stability I mentioned earlier. Needless to say, it is incoming data and our assessment of the economic outlook that will ultimately determine our course of action and the pace at which monetary accommodation will be withdrawn.

Another question people often raise is how such an increase in interest rates squares to the *ongoing sovereign debt turmoil*, which brings me the second challenge I want to discuss. I see two ways in which the sovereign debt turmoil enters our discussion. First, the turmoil does have important bearings on the *transmission of monetary policy*. Indeed, that was the very motivation for setting-up the Securities Market Programme in May 2010 and for re-introducing the regime of fixed-rate full allotment for longer-term operations, which is still in place at the current juncture. It will be maintained for as long as necessary, and at least until July 2011. That should avoid that banks in need of short-term funds are being cut-off from liquidity in case banks with excess funds are no longer willing to lend to them because of uncertainty on counterparties' exposure to sovereign debt.

At the current juncture, *we deem these non-standard measures an essential part of our monetary policy toolkit as they help to maintain financial stability and hence a good functioning of the monetary transmission mechanism, an essential condition for being able to deliver price stability.* At the same time, I would like to stress that these measures are temporary in nature. Indeed, they are not without drawbacks. The regime of fixed-rate full allotment discourages interbank trading because the Eurosystem in fact puts itself between banks with excess liquidity and those in need of liquidity. That is not a sustainable situation and it does not fit in the ECB's view of a market-oriented implementation of monetary policy. Moreover, the non-standard measures may lessen the incentive for banks to regain access to market funding, for instance through recapitalisation – possibly with the help of public funds –, balance sheet restructuring or a change in their business model. These are the only structural and long-run solutions for the banks concerned. The current non-standard measures – which will be phased-out when appropriate – help to make the transition as smooth as possible but are no substitute for concrete actions on the part of the banks.

Another way through which the *sovereign debt problems* enter our discussion is through their *impact on the economic outlook and the outlook for price stability in particular.* The considerable fiscal consolidation efforts already undertaken and those still to come, are of course indispensable to secure sustainable public finances over the longer term, but they do weigh on domestic demand in the short-run. Moreover, we continue to see the sovereign debt turmoil and its possible fall-out to the financial sector and the real economy as a downside risk to the economic outlook. These developments are therefore duly taken into account when deciding on monetary policy in the months ahead.

To conclude, I would like to touch upon two issues which often raise questions with observers. The first concerns the role of heterogeneity in the euro area and the second concerns today's policy constellation in which we raise interest rates but maintain very flexible liquidity provision policies.

As regards *heterogeneity across euro area countries*, I do not consider this as such a phenomenon which greatly complicates our task. It is the outlook for the euro area as a whole that determines the course of our actions: there simply is no other option with a single monetary policy. Moreover, I tend to see the current heterogeneity as being part of a necessary – but, admittedly, painful – process of adjustment through which some countries have to go in order to regain competitiveness and to repair their balance sheets. Besides, being part of a monetary union will help them – rather than make it more difficult – to do so, because the greater trade links they have, allow them to benefit from faster growth in well performing member countries. Although monetary policy cannot be tailored towards the needs of specific countries or regions, national developments are to some extent taken into account when deciding on monetary policy measures. That is, for instance, the case when the Governing Council decides on its non-standard measures. Indeed, the monetary transmission impairments we observe are located mostly in those countries most affected by the sovereign and banking crisis. It is therefore no coincidence that we kept these measures in place, although we raised interest rates.

In that respect, some people ask me *whether I see any conflict between raising interest rates and maintaining such flexibility in liquidity allotment modes*. The answer is "No": both conceptually and technically, I see no problems in raising rates while at the same continuing to provide banks with unlimited liquidity.

From a conceptual point of view I want to underscore that these *two types of measures are geared towards different, but complementary, goals*. The monetary policy stance is signaled by our key interest rates and is set as a function of the outlook for price stability. The non-standard measures, in contrast, are designed to ensure that the transmission of the monetary policy stance to the rest of the economy happens as smooth as possible, which should in turn allow the Govern-

ing Council to deliver price stability over the medium term. Hence, these measures are complementary to each other, rather than conflicting.

Let me *conclude*. The Governing Council has shown it will do whatever is necessary to deliver price stability, which means taking the necessary measures to avoid a 'Great Depression'-scenario as we did in 2008, but also to raise interest rates if upside risks to price stability threaten to materialise. We do have the will and the tools – including non-standard ones – to cope with the challenges in front of us. The flexibility of our framework should, however, be no excuse to postpone necessary adjustments, both in the financial and non-financial sector. And although we see encouraging signs – for instance in terms of competitive adjustment in some countries –, I think there is still a lot of work to do.

Thank you for your attention.

4. The Short Long

Andrew G. Haldane and Richard Davies[1]

4.1. Introduction

Is the world becoming short-sighted? As individuals, it sometimes feels that way. Information is streamed in ever greater volumes and at ever rising velocities. Timelines for decision-making appear to have been compressed. Pressures to deliver immediate results seem to have intensified. Tenure patterns for some of our most important life choices (marriage, jobs, money) are in secular decline[2]. Some have called this the era of 'quarterly capitalism'[3].

These forces may be altering not just the way we act, but also the way we think. Neurologically, our brains are adapting to increasing volumes and velocities of information by shortening attention spans. Technological innovation, such as the world wide web, may have caused a permanent neurological rewiring, as did previous technological revolutions such as the printing press and typewriter[4]. Like a transistor radio, our brains may be permanently retuning to a shorter wavelength.

If these forces are real, they might be expected to be particularly important in capital markets. These are a key conduit for choice over time. An efficient capital market transfers savings today into investment tomorrow and growth the day after. In that way, it boosts welfare. Short-termism in capital markets could interrupt this transfer. If promised returns the day after tomorrow fail to induce saving today, there will be no investment tomorrow. If so, long-term growth and welfare would be the casualty.

Yet, despite its potential importance for long-term growth, studies of short-termism in capital markets are relatively thin on the ground. There is a sharp disconnect between popular perception of rising myopia, driven by technology and neurology, and empirical evidence[5]. This paper aims to provide some evidence on short-termism drawing on equity market experience. It is planned as follows.

---

1 The views are not necessarily those of the Bank of England or the interim Financial Policy Committee. We are grateful to Nicola Anderson, Sarah Allen, Kath Begley, Antony Ford, Priya Kothari, David Miles, Mette Nielsen, Peter Richardson, Iain de Weymarn and Laura Wightman for comments and contributions.

2 Haldane (2010).

3 Barton (2011).

4 Carr (2008).

5 A recent interim report on short-termism by a UK government department concludes thus: "Overall, respondents believe that short-termism exists in equity markets, but provided little evidence to demonstrate the scale of the consequences for companies and investors" (Department for Business, Innovation and Skills (2011)).

Section 4.2. reviews existing evidence on short-termism. Section 4.3. describes the theory underlying our test of short-termism and its adverse implications for investment choice. Section 4.4. presents the empirical results, drawing on cross-sectional and time-series data. Section 4.5. draws out the investment implications of the results and sets out a potential menu of policy options.

Our evidence suggests short-termism is both statistically and economically significant in capital markets. It appears also to be rising. In the UK and US, cash-flows 5 years ahead are discounted at rates more appropriate 8 or more years hence; 10 year ahead cash-flows are valued as if 16 or more years ahead; and cash-flows more than 30 years ahead are scarcely valued at all. The long is short. Investment choice, like other life choices, is being re-tuned to a shorter wave-length. Public policy intervention might be needed to correct this capital market myopia.

4.2. The Short-Termism Debate

The short-termism debate is not new. Excess discounting of future outcomes was a familiar theme among Classical economists. For Jevons, "the untutored savage, like the child, is wholly occupied with the pleasures and troubles of the moment; the morrow is dimly felt; the limit of his horizon is but a few days off"[6]. For Marshall, people acted like "children who pick the plums out of their pudding to eat them at once"[7]. For Pigou, it demonstrated a 'defective telescopic faculty' such that "we see future pleasures on a diminished scale"[8].

And nowhere were these problems more acute than in financial markets. Keynes, himself part-time speculator, was well-aware of the perils of short-termism in investment choice, both moral and financial: "It is from time to time the duty of a serious investor to accept the depreciation of his holdings with equanimity without reproaching himself. Any other policy is anti-social, destructive of confidence and incompatible with the working of the economic system"[9].

In the US, these sentiments were echoed in the immediate post-war era by Benjamin Graham, the original 'value investor' and yesteryear investment guru to today's investment guru, Warren Buffett: "A serious investor is not likely to believe that the day-to-day or even month-to-month fluctuations of the stock market make him richer or poorer"[10]. And, famously, "in the short run, the market is a voting machine but in the long run, it is a weighing machine". Whether an untutored savage, defective telescope or anti-social voting machine, something sounded amiss.

6 Jevons (1871).
7 Marshall (1890).
8 Pigou (1920).
9 Keynes (1938).
10 Graham (1949).

Thus far, however, this evidence was largely anecdotal. It was not until the 1960s that the short-termism hypothesis was first tested empirically. This drew on survey evidence from investing firms. It found that investors typically expected full pay-back on an investment within 3 to 5 years. At the time, the average life of plant and equipment was often 10 times that[11]. Firms played short even when they desired long.

The first quantitative evidence that discount rates might be high began to appear in the early 1970s. For example, King (1972) examined investment in plant and machinery in the UK. Empirical estimates suggested the internal discount rate implied by firms' corporate investment decisions may be up to 25%[12].

This literature failed to catch fire. Starting in the mid-1970s, it was doused by a torrent of papers testing – and typically failing to reject – the efficient markets hypothesis.

This new wave swamped empirical finance for the better part of a decade. In the late 1970s and early 1980s, the efficient markets paradigm appeared all-conquering as a description of asset price movements in practice[13]. Research on the inefficiencies of capital markets became something of a backwater. The voting machine appeared to be delivering outcomes both democratic and socially beneficial.

But beginning in the 1980s, a whole sequence of 'puzzles' in empirical finance began to emerge. These were puzzles only in the sense of being deviations from efficient markets. For Mr Keynes and the Classicists, they would have been anything but[14]. For example, an early set of papers found 'excess volatility' in asset prices relative to future dividends and earnings[15]. Investor myopia was one interpretation, with too great a weight on near-term dividends causing even transitory changes to affect valuation[16].

Using an augmented version of this basic asset pricing framework, Miles (1993) tested formally for excessive discounting of future cash-flows using company level equity price data from the UK between 1980 and 1988, finding evidence of short-termism over this period. Similar approaches applied to longer time-series across a range of countries reached broadly similar conclusions[17].

11 Neild (1964) and the National Economic Development Office (1965) used questionnaire-based evidence. A large proportion of firms in the sample claimed to use a pay-back criterion and of these the modal pay-back period was 3-5 years. Census evidence from this period indicated that the average useful lifespan of machines was over 15 years. The distribution of plant and equipment lives in Dean and Irwin (1964) implied a mean economic life of 34 years.

12 Sumner (1974) reaches similar conclusions.

13 Fama (1970) provides a survey of the early papers.

14 Hicks (1937).

15 The important papers are LeRoy and Porter (1981), Shiller (1981) and Campbell and Shiller (1988).

16 Several other of the empirical finance 'puzzles', including the dividend smoothing and serial correlation puzzles, can also potentially be attributed to myopia (Haldane (2010)).

17 Cuthbertson, Hayes and Nitzsche (1997), Black and Fraser (2002).

Yet, latterly, the quantitative evidence appears, as in the mid-1970s, to have dried up. This time the efficient markets hypothesis cannot be held responsible, for it has come under increasingly critical scrutiny. Instead we have seen scraps of evidence drawn from the types of surveys familiar from the 1960s. For example, among asset managers, a 2004 MORI survey of members of the Investment Managers Association (IMA) and the National Association of Pension Funds (NAPF) asked if investment mandates created short-termism. A third of NAPF members and two-thirds of IMA members agreed.

In 2006, a CFA (Chartered Financial Analyst) symposium of financial institutions concluded "the obsession with short-term results by investors, asset management firms, and corporate managers collectively leads to the unintended consequences of destroying long-term value, decreasing market efficiency, reducing investment returns, and impeding efforts to strengthen corporate governance". Echoes, here, of Graham's anti-social voting machine.

Short-termist behaviour among investors appears to have rubbed-off on companies. Poterba and Summers (1995) surveyed Chief Executive Officers (CEOs) at Fortune-1000 firms. They found that the discount rates applied to future cash-flows were around 12%, much higher than either equity holders' average rate of return or the return on debt. This excessive discounting implied that some firms were rejecting positive net present value (NPV) projects. Echoes, here, of Pigou's defective telescope.

Graham, Harvey and Rajgopal (2005) surveyed 401 executives. They found three striking results. First, managers would reject a positive-NPV project if that lowered earnings below quarterly consensus expectations. Second, over 75% of the sample would give up economic value in order to smooth earnings. Third, managers said that this was driven by the desire to satisfy investors. Echoes, here, of Marshall's plum pudding problem.

Most recently, in 2011 PricewaterhouseCoopers conducted a survey of FTSE-100 and 250 executives, the majority of which chose a low return option sooner (£250,000 tomorrow) rather than a high return later (£450,000 in 3 years). This suggested annual discount rates of over 20%. Recently, Matthew Rose, CEO of Burlington Northern Santa Fe (America's second biggest rail company), expressed frustration at the focus on quarterly earnings when locomotives lasted for 20 years and tracks for 30 to 40 years. Echoes, here, of 'quarterly capitalism'.

This evidence – anecdotal, survey, quantitative – is broadly consistent with popular perceptions. Capital market myopia is real. It may be rising. For at least some of the jury, however, it remains inconclusive. In 2010, Richard Saunders (Chief Executive of the IMA) summed it up thus: "Now red lights start flashing for me when people talk about short-termism, particularly when shareholders feature in

the same sentence. What do people mean when they claim that shareholders behave in a short-term fashion? And what evidence do they have for it? I have yet to hear a convincing answer to either question".

4.3. Testing for Short-Termism

In the quest for some concrete, quantitative evidence, our test of short-termism uses the forward-looking asset price framework of Miles (1993). A simple example illustrates the basic approach to testing myopia and its implications for project choice.

(a) A Simple Example

Consider an investment project costing \$60. This investment is riskless and pays \$10 at the end of each of 10 years. The present value of the project is simply the sum of the cash-flows discounted by the risk-free rate, r:

$$PV_{rational} = \frac{\$10}{(1+r)} + \frac{\$10}{(1+r)^2} + \ldots + \frac{\$10}{(1+r)^{10}} \quad (1)$$

With a discount rate of 9%, the project's cash-flows are worth \$65 today and its NPV is \$5. A firm or investor offered this project should rationally undertake the investment.

Short-termism implies that agents may discount "excessively" future cash-flows, over and above the risk-free rate. Denote that short-termism parameter, x. The present value under myopic discounting then becomes:

$$PV_{myopic} = \frac{\$10x}{(1+r)} + \frac{\$10x^2}{(1+r)^2} + \ldots + \frac{\$10x^{10}}{(1+r)^{10}} \quad (2)$$

If x is less that unity, then the project's cash-flows are discounted too heavily. For example, assume x = 0.95 so that one period ahead cash-flows are underestimated by 5%. Even with this modest degree of myopia, NPV calculations are affected significantly. A \$10 return received at the end of year 5 should be worth \$6.65 today. With myopia, it is worth \$5.14. Discounted cash-flows on the project are now worth \$52, meaning that the NPV of the project is negative. A myopic investor would walk away from this NPV-worthy project.

Imagine instead that an investor were making choices based on average payback periods, rather than NPV. Under rational discounting, the project has a payback period of 9 years. Under myopic discounting, the payback period rises to 15 years. An investor might now think twice before investing their money, for their money is committed for almost twice as long.

So short-termism implies that projects with positive returns, or a relatively short payback, may be misperceived as being negative return or having a relatively lengthy payback. These projects would fail to receive financing. Investment and, ultimately, growth would be lower than optimal. In fact, the potential capital misallocation problem is greater still. To see that, consider the three projects summarised in Table 1.

Table 1: Short-termism and capital planning

Project	A	B	C
Cash-flows (CF)	$28 pa in years 6-10	$10 pa every year	$16 pa in years 1-5
Cumulative CF	$140	$100	$80
NPV (rational)	$73	$66	$63
Ranking (rational)	1	2	3
NPV (myopia)	$49	$52	$55
Ranking (myopia)	3	2	1

In the absence of short-termism, project A is selected. Its payouts are back-loaded but significant; it generates a net excess return of 22%[18]. Short-termism hits such long duration projects hardest. The impatient investor chooses project C. This project delivers lower cash-flows but these are front-loaded. In NPV terms, the project selected is the worst on offer, whereas the rationally optimal project ranks last. Capital allocation is not just sub-optimally low; it is also skewed towards sub-optimally short-duration projects.

(b) Asset Pricing

Consider now a formal model of multi-period equity price determination. Finance theory typically assumes that investors care about both the level and uncertainty of their wealth and are risk averse. In this world, agents require a premium to invest in a company. More formally, the expected return can be written as the sum of the risk free rate and a company-specific risk premium for company j[19]:

$$E_t(R_{jt}) = R_{ft} + \pi_{jt} \tag{3}$$

The actual return on an investment is the sum of the capital gain and the dividend yield:

[18] The return is $73 - $60 = $13, divided by the cost of investment.

[19] This is the case with the capital asset pricing model (CAPM) (Lintner (1965), Sharpe (1964)) and arbitrage pricing theory (Ross (1976)). Under the CAPM, for example, the company specific risk premium is equal to the company specific beta multiplied by the market risk premium $\pi_{jt} = (R_{mt} - R_{ft})$. This means $E_t(R_{jt}) = R_{ft} + \beta_{jt}(R_{mt} - R_{ft})$.

$$R_{jt} = \frac{P_{jt+1} - P_{jt}}{P_{jt}} + \frac{D_{jt+1}}{P_{jt}} \tag{4}$$

Assuming an efficient market, actual returns differ only from expected returns due to a forecast error which is uncorrelated with expected returns[20]. Using this assumption, we can substitute (4) into (3) to give an equation for the equity price.

$$P_{jt} = \frac{E_t(P_{jt+1} + D_{jt+1})}{R_{ft} + \pi_{jt} + 1} \tag{5}$$

So the price of the security is simply the expected price and dividend in the next period, discounted by the sum of the risk-free rate and the company-specific risk premium.

By repeated substitution, this asset pricing equation can be written as a generalised form of (1):

$$P_{jt} = \frac{\sum_{i=1}^{N} E_t(D_{jt+i})}{(1 + \gamma_{t1,\,t+i} + \pi_{jt})^i} + \frac{E_t(P_{jt+N})}{(1 + \gamma_{t1,\,t+N} + \pi_{jt})^N} \tag{6}$$

The current share price is a function of future discounted dividend streams and a discounted terminal share price, where we have used:

$$E_t(\pi_{jt+k}) = \pi_{jt}, \forall k \tag{7}$$

$$E_t(R_{ft+k}) = \gamma_{t1,\,t+k}, \forall k \tag{8}$$

Equation (7) says that the expected company-specific risk premium is constant and pre-determined based on period t information. Equation (8) says that expectations of future risk-free rates are defined by the path of the risk-free forward rate curve observed at time t.

Equation (6) can be modified with a myopia coefficient to give a generalised version of (2):

$$P_{jt} = \frac{\sum_{i=1}^{N} E_t(D_{jt+i})x^i}{(1 + \gamma_{t1,\,t+i} + \pi_{jt})^i} + \frac{E_t(P_{jt+N})x^N}{(1 + \gamma_{t1,\,t+N} + \pi_{jt})^N} \tag{9}$$

[20] That is, we assume that $R_{jt} = E_t(R_{jt}) + \varepsilon_{jt}$.

The null hypothesis – no short-termism – implies $x = 1$. Drawing on evidence across time and industrial sectors, it is this restriction we now test.

4.4. Testing for Short-Termism

The data comprises a panel of 624 firms listed on the UK FTSE and US S&P indices over the period 1980-2009[21]. These span a broad range of industrial sectors, as shown in Table 2.

Table 2: Number of firm level observations in each industry segment

Index	Consumer	Energy & Utilities	Financials	Health	IT	Industrials	Materials	Total
S&P	117	65	78	47	73	47	23	**450**
FTSE	52	14	42	5	34	18	9	**174**

The core inputs to the analysis are firm-level measures of dividends and equity prices. The average dividend-price ratio in each industry segment is shown in Table 3. The mean dividend-price ratio across the panel is 2.6%. But there is a fairly significant degree of cross-sectoral and time-series dispersion. For example, dividend-price ratios are almost twice as high in the energy and utilities sector as the health and pharmaceuticals sector. And mean dividend-price ratios were two thirds third higher in the 1990s compared to the 1980s.

Table 3: Mean dividend-price ratio for firms in each industry segment

	Consumer	Energy & Utilities	Financials	Health	IT	Industrials	Materials
S&P	1.94	2.82	3.19	1.87	1.69	2.55	2.22
FTSE	4.12	3.96	2.63	1.38	2.92	3.81	3.16

To estimate (9), we require a selection of quantitative inputs. Taking these in turn:

(a) Company-Specific Risk Premium

Following Miles (1993), the company risk premium is modelled based on firm-specific characteristics, in particular the company beta and the level of gearing:

$$\pi_{jt} = \alpha_1 \beta_{jt} + \alpha_2 Z_{jt} \tag{10}$$

where $Z = \frac{D}{E}$[22]. Betas are estimated using daily return data for firms listed on the

[21] Data are from Thomson Reuters Datastream.

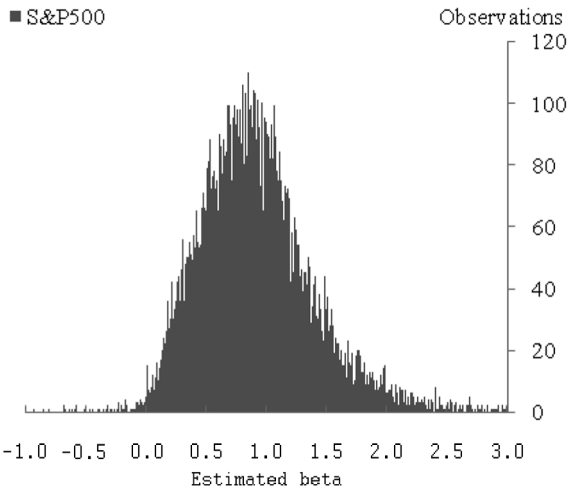
[22] Because a firm's beta ought also to be a function of its business and financing decisions, we also estimate a restricted version of (10): $\pi_{jt} = \alpha_1 \beta_{jt}$.

S&P 500 and FTSE, together with daily data for the indices themselves[23]. Mean estimated betas are shown in Table 4. These average below one for both UK and US firms. As Charts 1 and 2 (p. 48) illustrate, however, the distribution of betas is fairly wide, with over a third of US firms and almost a fifth of UK firms having a beta in excess of unity.

Table 4: Estimated betas

Index	Number of firms	Number of observations	Mean	Median	S.D
S&P	401	10,140	0.91	0.86	0.49
FTSE	168	3,765	0.63	0.62	0.45

Chart 1: Distribution of betas – US



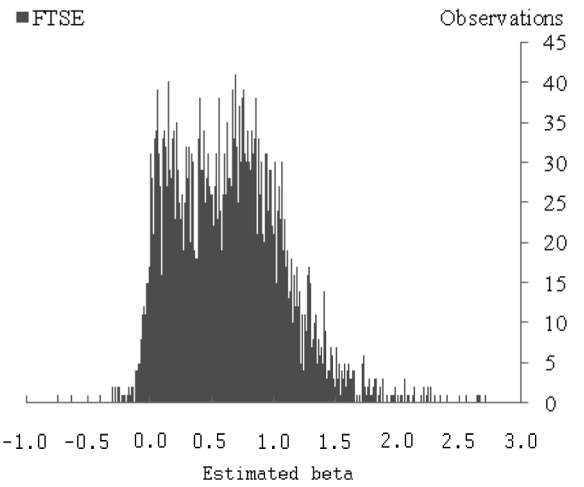
Sources: Thomson Reuters Datastream and Bank calculations.
Notes: Shows estimated betas for the US firms. The chart is drawn for betas lying between -1 and 3 with 400 bins.

The second component of the firm-specific discount factor is company gearing. This was constructed using annual Thomson Reuters Datastream data for book value per share, the number of shares outstanding and debt outstanding. Other things equal, higher gearing would suggest a higher company-specific discount factor[24]. The final element in the firm-level discount factor calculation is the risk-free rate. The yield on government securities was used, based on data from the Federal Reserve and Bank of England.

[23] We exclude observations where the estimated beta is greater than 5 in absolute value, which in practice is only 7 firms.

[24] The gearing variable is of poorer quality than others in the data, leading to negative gearing observations for some firms. Any firm-year observations with negative gearing are excluded from the analysis (a total of 37 observations).

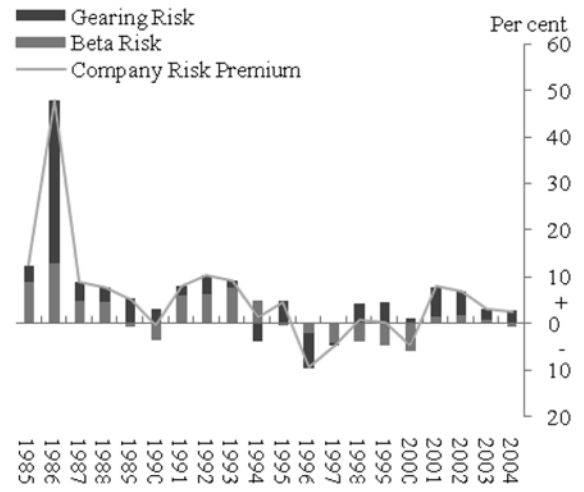
Chart 2: Distribution of betas – UK



Sources: Thomson Reuters Datastream and Bank calculations.
Notes: As for Chart 1 but for UK firms.

Having estimated (10) using pooled US and UK regressions over 20 years, a firm-specific risk premium can be calculated. The average premium across the sample is 5.9%. As Chart 3 shows, both gearing and beta contribute to the company risk premium estimates.

Chart 3: Estimates of company risk premium



(b) Expected dividends and prices

The right-hand-side of equation (9) defines the stream of future dividends and terminal prices. To generate these, consider a simplified version of (9) which abstracts from discount rates, company-specific risk premia and dividends:

$$P_{jt} = E_t(P_{jt+N})x^N \tag{11}$$

Following Wickens (1982), the rational expectation t+N periods ahead are formed on the basis of information available at time t. For each company j, these expectations differ from the realised values by a forecast error (U_{jt+N}) unpredictable at time t:

$$E_t(P_{jt+N}) = P_{jt+N} + U_{jt+N} \tag{12}$$

Adding and subtracting the average forecast error across all companies ($\overline{U}_{jt+N}$) gives:

$$P_{jt} = E_t(P_{jt+N})x^N = P_{jt+N}x^N - \overline{U}_{jt+N}x^N - (U_{jt+N} - \overline{U}_{jt+N})x^N \tag{13}$$

Actual prices cannot be used in the estimation of (13) as these are not known at time t and are correlated with the error term $((U_{jt+N} - \overline{U}_{jt+N})$. But consistent estimation of (13) is possible using a set of instruments correlated with P_{jt+N} but which are independent of the company-specific excess forecasting errors. In the estimation, lagged share prices, lagged dividends per share and lagged earnings per share are used as instruments for future dividends and equity prices. These are known at time t but are uncorrelated with the error term. Five lags of each variable (price, dividends, earnings) are used as instruments.

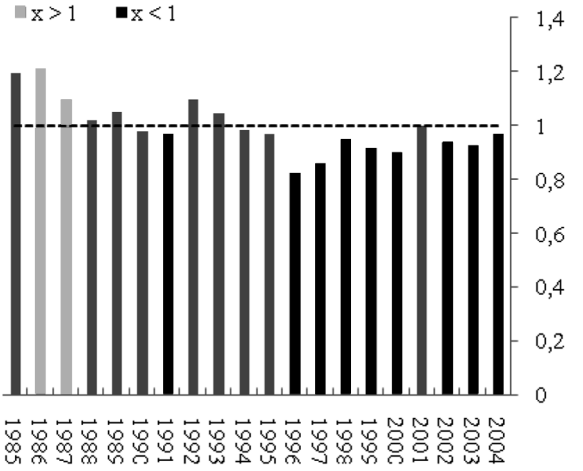
(c) Generating estimates of short-termism

Given estimates of company beta and gearing, risk-free rates and the instrumented variables, equation (9) can be estimated to generate estimates of the short-termism parameter, x. This was achieved using non-linear least squares on a set of cross-sectional regressions for each of the years 1985 to 2004[25].

Chart 4 (p. 50) shows point estimates of x for each of these years. Short-termism estimates which are statistically significantly below unity (at the 5% confidence level) are shown in red. The simple average of x across the 20-year period is very close to one (0.9935). On the face of it, this does not suggest that short-termism has been a particular problem among this cross-section of firms.

[25] Because the estimation expected values up to five periods ahead, the estimates only run to 2004.

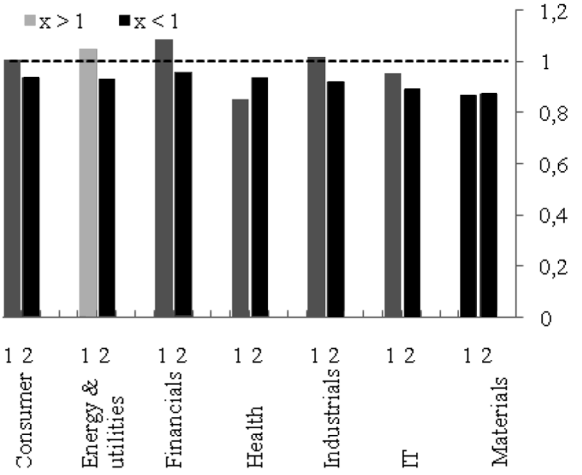
Chart 4: Short termism estimates over time



Source: Bank of England.

Notes: Bars show the estimated x parameter for regressions for the UK and US pooled data. Estimates where the 95% confidence interval spans 1 are coloured grey.

Chart 5: Industry estimates



Source: Bank of England.

Notes: Bars show the industry estimates for the sample split into (1) 1985-1994, and (2) 1995-2004 for each industry. S&P and FTSE industry classifications were used. Bars are coloured based on the significance of the estimates at the 5% level.

But this masks some important within-period variation. In 13 of the 20 years, x is lower than 1. And in 9 of these years, x is statistically significantly below unity. Moreover, there is evidence of a rising tide of myopia: 8 of these 9 years occur in the final decade of the sample.

To illustrate, Table 5 shows point estimates of x over two decadal sub-samples (1985-1994 and 1995-2004) and over the full sample. Estimates are significantly below unity in the second sub-sample, but not the first. The point estimate of x over the second sub-sample is 0.94[26].

Table 5: Short-termism estimates for the US and UK

Year	x	Standard error	Evidence of short-termism?
Full sample (1985-2004)	0.937	(0.004)	Yes
1985-1994	1.001	(0.008)	No
1995-2004	0.938	(0.005)	Yes

Notes: The significance column refers to a test of x<1 at the 5% confidence level.

Table 6 shows estimates of x over the same three samples on a sectoral basis. It echoes the message from Table 5. There is statistically significant evidence of short-termism in the second half of the sample for all seven industrial sectors. And in all of these sectors except health and materials, x is lower in the second half of the sample than the first – in those two sectors x is below unity throughout the sample.

Although short-termism appears to be a consistent theme across industrial sectors, there are nonetheless some interesting patterns in the degree of short-termism across sectors. For example, the financial sector does not appear especially short-termist over the full sample. By contrast, the health and materials sectors exhibit short-termism throughout.

Table 6: Sectoral short-termism estimates for the US and UK

	Full Sample 1985-2004		1985-1994		1995-2004	
Industry	x	Significant?	x	Significant?	x	Significant?
Consumer	0.939	Yes	1.007	No	0.94	Yes
Energy and Utilities	0.939	Yes	1.05	No	0.934	Yes
Financials	0.965	Yes	1.087	No	0.963	Yes
Health	0.940	Yes	0.857	No	0.940	Yes
IT	0.902	Yes	0.957	No	0.892	Yes
Industrials	0.926	Yes	1.018	No	0.925	Yes
Materials	0.875	Yes	0.871	Yes	0.874	Yes

Notes: The significance columns refer to a test of x<1 at the 5% confidence level.

[26] Various robustness checks were conducted. These included dropping gearing from the estimation of the risk premium and varying the effects of taxes. These did not alter significantly the empirical estimates.

4.5. Short-Termism and Public Policy

These tests of short-termism point to two key conclusions. First, there is statistically significant evidence of short-termism in the pricing of companies' equities. This is true across all industrial sectors. Moreover, there is evidence of short termism having increased over the recent past. Myopia is mounting.

Second, estimates of short-termism are economically as well as statistically significant. Empirical evidence points to excess discounting of between 5% and 10% per year. To illustrate the impact of this on investment choice, consider the earlier project with an annual income stream of $10.

Chart 6 (p. 53) shows the present value of those income streams under three counter-factual assumptions: rational discounting; myopic discounting – lower bound (5%); and myopic discounting – upper bound (10%). The cumulative impact is fairly dramatic. Ten-year ahead cash-flows under rational discounting are valued similarly to between six-year (lower bound) and four-year (upper bound) ahead cash-flows under myopic discounting. The long is shortened.

Table 7: Point in future at which residual discounted cash-flow falls below (years)

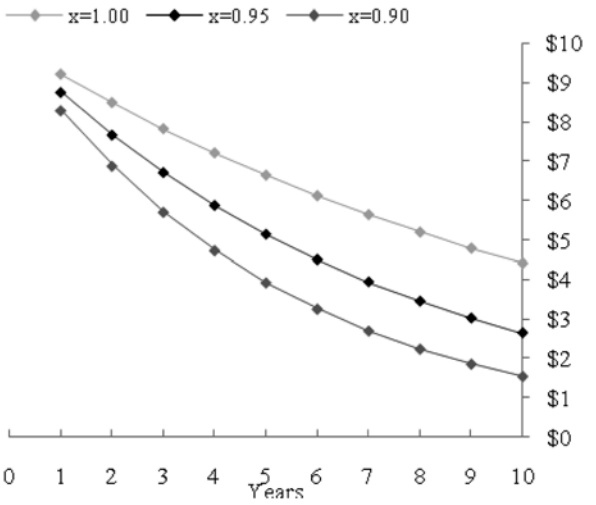
	10%	1%	0.1%
Rational (x=1)	29	57	85
Mild myopia (x=0.95)	18	35	52
Strong myopia (x=0.90)	13	25	37

Notes: The number in the table refers to the first year that a $10 cash-flow falls below 10%, 1% and 0.1% of its actual value in present value terms. The rational discount uses an average risk free rate from our cross sectional data sample (1.085).

This is illustrated even more clearly if we consider payback periods. Under rational discounting, payback occurs in 9 years (Chart 7). Under upper bound myopic discounting, the investor today would erroneously assume that payback would never be made. These differences have the potential to alter radically project choice. The net present value of this project evaluated over 50 years falls from $56 under rational discounting to a loss of $11 under extreme myopia. In other words, a NPV-positive project would be resoundingly rejected.

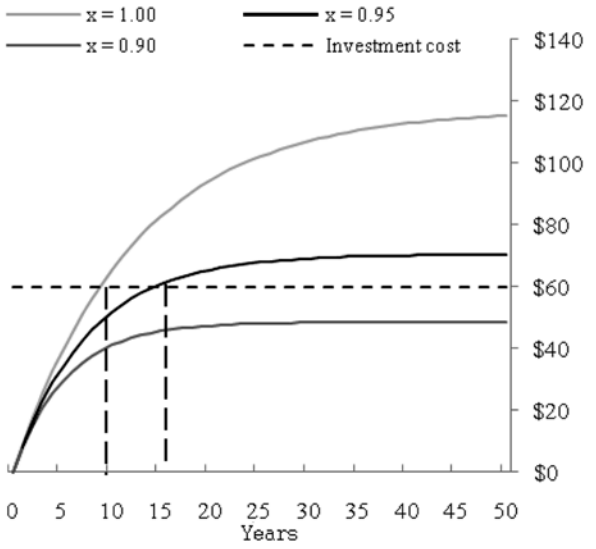
To put the point more starkly, Table 7 asks at what point in the future the residual value of a future cash-flow hits a level of 10%, 1% and 0.1% of its face value, under rational and myopic discounting. Under rational discounting, cash-flows even 50 years ahead retain more than 1% of their face value. Under strong myopic discounting, this residual threshold is reached after 25 years. Virtually zero weight – less than 1000^{th} of the face value of the cash-flow – is placed on projects with income streams much beyond 35 years. The long is dramatically shortened.

Chart 6: Present value of future cash-flows



Notes: The chart assumes $10 is paid at the end of each year. The rational discount rate used is 1.085.

Chart 7: Cumulative present value of future cash-flows



Notes: The cumulative NPV of $10 cash-flows rises to $61 in year 9 under rational discounting. With mild myopia (x=0.95) it only passes $60 at year 15. With severe myopia (x=0.90) the investor calculates that payback is not achieved.

This is a market failure. It would tend to result in investment being too low and in long-duration projects suffering disproportionately. This might include projects with high build or sunk costs, including infrastructure and high-tech

investments. These projects are often felt to yield the highest long-term (private and social) returns and hence offer the biggest boost to future growth. That makes short-termism a public policy issue.

But what would be an appropriate public policy response to this capital market failure? A number of proposals have been suggested by various authors. These include:

(a) *Transparency:* The lightest touch approach would be to require greater disclosures by financial and non-financial firms of their long-term intentions – for example, their long-term performance, strategy and compensation practices[27]. For financial firms, this might include metrics of portfolio churn. This could be accompanied by a programme of educating managers, investors and advisors of their fiduciary responsibilities.

(b) *Governance:* A more intensive approach would involve acting directly on shareholder incentives through their voting rights. For example, fiduciary duties could be expanded to recognise explicitly long-term objectives[28]. More concretely, shareholder rights could be enhanced for long-term investors, perhaps with a duration-dependent sliding scale of voting rights[29].

(c) *Contract Design:* There have been various attempts over the past few years to make compensation contracts more sensitive to long-term performance and risk. This includes employment contracts conditioned on long-term performance, or with deferral or clawback. Changes in the compensation instrument can also help – for example, remunerating in equity is better than in cash and remunerating in junior or convertible debt might be better than either[30].

(d) *Taxation / Subsidies:* Authors have suggested a variety of ways in which government could penalise short-duration holdings of securities, or incentivise long-duration holdings, using tax and / or subsidy measures. These measures differ in detail, but the underlying principle is to link them to the duration of an investor's holdings or the length or nature of a company's investment[31].

Some of these initiatives have been tried and tested in differing degrees, at different times and in different countries. They have not obviously arrested the short termism trend. It might be time to increase the level of policy ambition if the telescope is to be corrected, the voting machine socialised, the savage civilised. Public policy could help keep the plums in the pudding. Without intervention, the long could become shorter still.

27 Aspen Institute (2009), CFA (2006).
28 Duruigbo (2011).
29 Securities and Exchange Commission (2010), Aspen Institute (2009).
30 Haldane (2011).
31 Aspen Institute (*o.c.*), Poterba and Summers (1995).

References

ASPEN INSTITUTE, 2009, "Overcoming Short-termism: A Call for a More Responsible Approach to Investment and Business Management", *The Aspen Institute Business and Society Program*, September 9.

BARTON, D., 2011, "Capitalism for the Long Term", *Harvard Business Review*, March.

BLACK, A. and FRASER, P., 2002, "Stock Market Short-termism – An International Perspective", *Journal of Multinational Financial Management*, Vol. 12, pp. 135-158.

CAMPBELL, J. and SHILLER, R., 1988, "Stock Prices, Earnings, and Expected Dividends", *The Journal of Finance*, Vol. 43 (3), pp. 661-676.

CARR, N., 2008, "Is Google Making Us Stupid? What the Internet is doing to our brains", *Atlantic Magazine,* July-August 2008.

CHARTERED FINANCIAL ANALYST INSTITUTE, 2006, "Breaking the Short Term Cycle. Discussion and Recommendations on How Corporate Leaders, Asset Managers, Investors, and Analysts Can Refocus on Long-term Value", *CFA Centre for Financial Market Integrity/Business Roundtable Institute for Corporate Ethics*.

CUTHBERTSON, K., HAYES, S. and NITZSCHE, D., 1997, "The Behaviour of UK Stock Prices and Returns: Is the Market Efficient?", *The Economic Journal,* Vol. 107 (443), pp. 986-1008.

DEAN, G. and IRWIN, J.O., 1964, "The stock of fixed capital in the UK in 1961", *Journal of the Royal Statistical Society*, Vol. 3, pp. 327-358.

DEPARTMENT FOR BUSINESS INNOVATION AND SKILLS, 2011, *A Long-term Focus for Corporate Britain, Summary of Responses*, March.

DURUIGBO, E., 2011, *Tackling Shareholder Short-termism and Managerial Myopia*.

FAMA, E.F., 1970, "Efficient Capital Markets: A Review of Theory and Empirical Work", *The Journal of Finance,* Vol. 25 (2), pp. 383-417.

FINANCIAL TIMES, 2011, *BNSF chief hits at short-termism*, 12th February.

GRAHAM, B., 1949, "The Intelligent Investor", *HarperCollins*.

GRAHAM, J.R., HARVEY, C.R. and RAJGOPAL, S., 2005, "The Economic Implications of Corporate Financial Reporting", *Journal of Accounting and Economics*, 2005.

HALDANE, A.G., 2011, "Capital Discipline", *Remarks based on a speech given at the American Economic Association, Denver,* available at www.bankofengland.co.uk/publications/speeches/2011/speech484.pdf.

HALDANE, A.G., 2010, "Patience and Finance", *Speech given at the Oxford China Business Forum, Beijing,* available at www.bankofengland.co.uk/publications/speeches/2010/speech445.pdf.

HICKS, J.R., 1937, "Mr. Keynes and the 'Classics'; A Suggested Interpretation", *Econometrica,* Vol. 5 (2), pp. 147-159.

JEVONS, W.S., 1871, "The Theory of Political Economy", *Macmillan and Company.*

KEYNES, J.M., 1938, JMK letter to Francis Curzon, 18th March 1938 in SKIDELSKY, R., 2000, "John Maynard Keynes: Vol. 3 Fighting for Britain 1937-1946", *Macmillan.*

KING, M.A., 1972, "Taxation and Investment Incentives in a Vintage Investment Model", *Journal of Public Economics*, Vol. 1 (1), pp. 121-148.

LEROY, S.F. and PORTER, R.D., 1981, "The Present Value Relation: Tests Based on Variance Bounds", *Econometrica*, Vol. 49, pp. 555-574.

LINTNER, J., 1965, "The Valuation of Risk Assets and the Selection of Risky Investments in Stock Portfolios and Capital Budgets", *Review of Economics and Statistics*, Vol. 47 (1), pp. 13-37.

MARSHALL, A., 1890, "Principles of Economics", *Macmillan and Company Ltd.*

MILES, D., 1993, "Testing for Short Termism in the UK Stock Market", *Economic Journal,* Vol. 103 (421), pp. 1379-1396.

MORI, 2004, *NAPF/IMA Short-termism Study Report.*

NATIONAL ECONOMIC DEVELOPMENT OFFICE, 1965, "Investment in Machines Tools", *HMSO.*

NEILD, P.R., 1964, "Replacement Policy", *National Institute Economic Review.*

PIGOU, A.C., 1920, "The Economics of Welfare", *Macmillan and Company Ltd.*

POTERBA, J. and SUMMERS, L.H., 1995, "A CEO Survey of U.S. Companies' Time Horizons and Hurdle Rates", *Sloan Management Review,* Fall.

PWC, 2011, "PwC Valuation Index, Tracking the Market to Understand Value", *PwC.*

ROSS, S.A., 1976, "The Arbitrage Theory of Capital Asset Pricing", *Journal of Economic Theory,* Vol. 13, pp. 341-60.

SECURITIES AND EXCHANGE COMMISSION, 2010, *Facilitating Shareholder Director Nominations.*

SHARPE, W.F., 1964, "Capital Asset Prices: A Theory of Market Equilibrium under Conditions of Risk", *Journal of Finance*, Vol. 19 (3), pp. 425-442.

SHILLER, R.J., 1981, "Do Stock Prices Move Too Much to be Justified by Subsequent Changes in Dividends?", *The American Economic Review*, Vol. 71 (3), pp. 421-436.

SUMNER, M.T., 1974, "Taxation and Investment Incentives in a Vintage Investment Model: Comment", *Journal of Public Economics*, Vol. 3 (2), pp. 185-194.

WICKENS, R.M., 1982, "The Efficient Estimation of Econometric Models with Rational Expectations", *The Review of Economic Studies*, Vol. 49 (1), pp. 55-67.

5. Inflation targeting and exchange rate pass-through in emerging countries

Dramane Coulibaly and Hubert Kempf

Abstract

This paper empirically examines the impact of inflation targeting on the exchange rate pass-through to prices in emerging countries. This empirical study is conducted using a panel VAR approach on data from twenty-seven emerging countries. The results show that inflation targeting has contributed to reduce the pass-through to domestic prices in emerging countries. The variance decomposition also shows that the contribution of exchange rate shocks to price fluctuations decline after inflation targeting.

JEL Classification: E31, E52, F41.

Keywords: Inflation Targeting, Exchange Rate Pass-Through, panel VAR.

5.1. Introduction

After New Zealand initiated inflation targeting in 1990, a large number of industrial and emerging countries have explicitly adopted an inflation target as their nominal anchor. In the last two decades, ten industrial economies and twenty emerging economies[1] have adopted the full-fledged inflation targeting system for managing monetary policy. Many other emerging countries intend to adopt this monetary framework in the near future. Given the vulnerability of emerging countries to exchange rate shocks, a key element for the success of this strategy depends on its ability to reduce the exchange rate pass-through. Various studies have shown a decrease in exchange rate pass-through in the last two decades: is it related to inflation targeting? Many studies have provided some evidence that adoption of inflation targeting is associated with an improvement in overall economic performance (Bernanke and Mishkin (1997); Svensson (1997); Bernanke *et al.*(1999) among others). Ball and Sheridan (2005), one of the few empirical papers critical of inflation targeting, argue that the implementation of inflation targeting appears to have been irrelevant in industrial countries. Based on OLS cross-section estimation, their results indicate that the reduction in the level and the volatility of inflation in inflation targeting countries simply reflects regression

[1] The ten industrial countries targeters are Australia, Canada, Finland, New Zealand, Norway, Spain, Sweden, Switzerland and United Kingdom. Finland and Spain are now in euro area. The twenty emerging countries targeters are Brazil, Chile, Colombia, Czech Republic, Ghana, Guatemala, Hungary, Indonesia, Israel, Korea, Mexico, Peru, Philippines, Poland, Romania, Serbia, Slovakia, South Africa, Thailand and Turkey. Slovakia ceased inflation targeting in January 2009 with its ERM II entry.

toward the mean, *i.e.*, inflation will fall faster in countries that start with high inflation than in countries with an initial low inflation. Since countries having implemented inflation targeting had generally an initial high level of inflation, the bigger drop in inflation for those countries simply reflects a tendency for this variable to revert to its mean. But their study focused solely on industrial countries and therefore cannot address this issue for emerging countries targeting inflation. Gonçalves and Salles (2008) extended Ball and Sheridan's analysis for a subset of 36 emerging economies and found that, for those countries, results are different. Specifically, emerging countries which have adopted inflation targeting have experienced greater reductions in inflation and in growth volatility, even after controlling for mean reversion.

The present paper contributes to this literature on inflation targeting by analyzing the effect of inflation targeting on exchange rate pass-through in emerging countries. It is based on the hypothesis in Taylor (2000) that argues that exchange rate pass-though is lower in low-inflation environment. More precisely Taylor's argument is that in low-inflation environment firms expect a deviation of inflation to be less persistent and would therefore pass on less of an exchange rate-induced increase in the price of imported inputs to its selling prices. This hypothesis has been supported by empirical evidence based on the consumer price index (CPI), both for industrialized and emerging countries (see for example Gagnon and Ihrig, 2001, or Choudhri and Hakura, 2006). Since Gonçalves and Salles (2008) show that inflation targeting has helped to reduce inflation in emerging countries, it is interesting to analyze whether the adoption of inflation targeting has lead to a decrease in exchange rate pass-through[2]. This paper tackles this issue using a subset of twenty-seven emerging economies (fifteen targeters and twelve nontargeters)[3]. After a first VAR analysis by including the consumer prices (CPI) as the only price, we conduct a second VAR analysis by including two other prices: import prices (IMP) and producer prices (PPI). The use of these two prices in the VAR allows us to directly answer to the Taylor's hypothesis. A decrease in pass-through effect to import prices means that after the adoption of inflation targeting a retailing firm that imports goods from abroad absorbs a larger fraction of

[2] This idea was explored by Mishkin and Schmidt-Hebbel (2007). Mishkin and Schmidt-Hebbel (2007) empirically study the link between inflation targeting and some measures of economic performance including exchange rate pass-through to consumer prices. Using data on twenty-one industrial and emerging inflation-targeting countries (targeters) and thirteen industrial countries without inflation targeting (nontargeters) they employ panel VAR techniques. To test for differences, they adopt the before-and-after approach by comparing impulse response functions in different country samples, depending on whether a country has inflation targeting in place. The results of this analysis show that pass-through effect to consumer prices has been close to zero in industrial inflation targeters before and after inflation targeting and in nontargeters. In emerging inflation targeters, the exchange rate pass-through to consumer prices fell after the countries achieved a stationary target, but remained significantly different from zero. However, these results in Mishkin and Schmidt-Hebbel (2007) suffer from selection bias as there are no emerging inflation nontargeters in the control group.

[3] In the sequel, 'targeters' refers to emerging countries targeting inflation, and 'nontargeters' to emerging countries not targeting inflation.

an exchange rate shock through a smaller variation in its selling prices. A decrease in pass-through effect to producer prices means that after the adoption of inflation targeting, a firm that imports its inputs from abroad absorbs a larger fraction of an exchange rate shock through a smaller variation in the prices of its final products.

Even though impulse responses give information about the size of exchange rate pass-through to domestic prices, they do not show how important exchange rate shocks are in explaining domestic price fluctuations. Since implementation of inflation targeting requires flexible exchange rate regime, inflation targeting can lead to a great volatility in exchange rate. Thus, even if inflation targeting leads to a decline in exchange pass through to domestic prices, it can lead to mitigate effect on the contribution of exchange rate shocks to domestic prices fluctuations. Hence, to assess the contribution of exchange rate shocks to domestic prices fluctuations, we also perform a variance decomposition of domestic prices.

The main results of this paper are the following. The adoption of inflation targeting in emerging countries has helped to reduce the pass-through to consumer prices from a initial higher level to a new level that, however, remains significantly different from zero. For emerging nontargeters however, the pass-through to consumer prices has not been significantly different from zero before 1999 and has significantly become positive after 1999. By comparing emerging inflation targeters after adopting inflation targeting to emerging nontargeters after 1999, the pass-through effects to consumer prices are not significantly different among the two groups of emerging targeters and nontargeters. The decline in pass-through to consumer prices in emerging inflation targeters is attributable to the decline in pass-through effect along the prices chain. Pass-through effects to both import and producer prices fell significantly in emerging inflation targeters after adopting inflation targeting framework. These results are corroborated by the variance decomposition analysis. The variance decomposition analysis shows that exchange rate shocks explain an important part of prices fluctuations in targeters countries, while the contribution of exchange rate shocks to the fluctuations in prices in nontargeters countries is insignificant. The variance decomposition analysis also shows that the contribution of exchange rate shocks to prices fluctuations in targeting countries declines after the adoption of inflation targeting.

The remainder of the paper is organized as follows. Section 5.2. presents methodology and data. Section 3 presents the empirical results and theirs interpretations. Section 5.4. concludes the study.

5.2. Methodology and Data

Our quarterly dataset consists of twenty-seven emerging economies (fifteen targeters and twelve nontargeters), covering the 1989Q1-2009Q1 period. Using the panel VAR before-and-after strategy already employed by Mishkin and Schmidt-Hebbel (2007), we investigate whether inflation targeting has helped to reduce the exchange rate pass-through to domestic prices in emerging countries. We use panel VAR techniques to estimate the impulse response functions.

The use of panel VAR techniques has two main advantages. First, the VAR approach addresses the endogeneity problem by allowing endogenous interactions between the variables in the system. Second, the asymptotic results are easier to derive for panel data.

The econometric model takes the following reduced form:

$$Y_{it} = \Gamma(L)Y_{it} + u_i + \varepsilon_{it}$$

where Y_{it} is a vector of stationary variables, $\Gamma(L)$ is a matrix polynomial in the lag operator with $\Gamma(L) = \Gamma_1 L^1 + \Gamma_2 L^2 + \ldots + \Gamma_p L^p$, u_i is a country specific effects and ε_{it} is a vector of idiosyncratic errors.

An issue in estimating this model concerns the presence of fixed effects. As fixed effects are correlated with the regressors, due to lags of the dependent variable, we use forward mean differencing (the Helmert procedure), following Love and Zicchino (2006). This transformation is an orthogonal deviation, in which each observation is expressed as a deviation from average future observations. Each observation is weighed so as to standardize the variance. If the original errors are not autocorrelated and are characterized by a constant variance, the transformed errors should exhibit similar properties. Thus, this transformation preserves homoscedasticity and does not induce serial correlation (Arelano and Bover, 1995). Additionally, this technique allows to use the lagged values of regressors as instruments and estimate the coefficients by the generalized method of moment (GMM).

Once all coefficients of the panel VAR are estimated, we compute the impulse response functions (IRFs)[4]. In order to compute the IRFs we use Cholesky decomposition. The assumption behind Cholesky decomposition is that series listed earlier in the VAR order impact the others variables contemporaneously, while series listed later in the VAR order impact those listed earlier only with lag. Consequently, variables listed earlier in the VAR order are considered to be more exogenous. We apply bootstrap methods to construct the confidence intervals of the

[4] The panel VAR is estimated by using the package provided by Inessa Love. This package is a Stata programs for Love (2001) and it is used in Love and Zicchino (2006).

IRFs. Since we cannot assume independence among the various samples, we also employ bootstrap methods to construct confidence intervals for differences in IRFs rather than simply taking their differences[5].

Following Ito and Sato (2007, 2008)[6], we begin by setting up a 5-variable VAR model, $Y_{it} = (\Delta oil_{it}, gap_{it}, \Delta m_{it}, \Delta ner_{it}, \Delta cpi_{it})$, where oil denotes the natural log of world oil prices; gap the output gap; m the natural log of money supply; ner that of the nominal exchange rate; cpi that of the consumer price index (CPI); and Δ represents the first difference operator. The change in oil prices is included to identify the supply shock. We include the output gap to capture the demand side. The money supply is included in the VAR to allow for the effect of monetary policy in response to a large fluctuation in exchange rate or devaluation.

To answer directly the Taylor conjecture, we also conduct an additional estimation with 7-variable VAR model by including two other price indexes: the producer price index (PPI) and the import price index (IMP). As mentioned above, a decrease in the pass-through effect on import prices will mean that retail firms that import their commodities pass through a lower fraction of an exchange rate shock into their selling prices; and, a decrease in the pass-through effect on producer prices will mean that firms that import their inputs pass though a lower fraction on such a shock into the final goods prices. According to Burstein, Eichenbaum and Rebelo (2002, 2005), the extent of CPI inflation after a large changes in exchange rate depends on the relative importance of imported inputs being used for domestic production and the presence of distribution costs. The production or distribution channels can dampen the effect of exchange rate changes and account for a low pass-through to consumer prices. Then, the 7-variable VAR model allows us to examine the exchange rate pass-through along the pricing chain. In other words, it allows us to examine whether inflation targeting could have negatively impacted on the pass-through to consumer prices by lowering pass-through to imported and/or producer prices.

As discussed above, the order of endogenous variables is central to the identification of structural shocks. The change in oil prices included to identify the supply shock is ordered first in the VAR. The output gap is placed second. The demand and supply shocks that affect the output gap are assumed to be predetermined. The money supply is ordered third and before the nominal exchange rate and the price variables. Then, for the 5-variable VAR the ordering is: Δoil_{it}, gap_{it}, Δm_{it}, Δner_{it}, Δcpi_{it}. In 7-variable VAR it seems appropriated to place import prices ahead of producer and consumer prices and to place consumer prices last in the

[5] If we assume sample independence, the confidence intervals for differences in IRFs would be narrower.

[6] Ito and Sato (2007) used VAR technique to compare the exchange rate pass-through effects of East Asia and Latin American Countries, while Ito and Sato (2008) applied VAR analysis to exchange rate pass-through in East Asian countries.

ordering. Thus, for the 7-variable VAR the ordering is: Δoil_{it}, gap_{it}, Δm_{it}, Δner_{it}, Δimp_{it}, Δcpi_{it}.

5.3. Empirical Results

This section presents the results of the impulse response function analysis. The details of the data for empirical estimation are presented in the appendix. Before conducting the VAR estimation, we tested for stationarity. Since the oil price is a variable that does not depend on countries, the stationarity test on this variable is conducted by using the standard Augmented Dickey-Fuller unit root test. For the other variables, we use Maddala and Wu (1999) panel unit root test. The tests results (see Table 1, p. 65) show that the oil price, three types of domestic prices, the money supply and the nominal exchange rate are non-stationary in level but stationary in first-differences for all countries. The output gap is found to be stationary in level. Previous studies (for example Ito and Sato 2007, 2008, Mishkin and Schmidt-Hebbel, 2007) suggest to include in a VAR the output gap in level together with other variables in first-difference. We follow this methodology in our VAR analysis. The model yields similar IRFs when we include more than three lags for targeters sample. For nontargeters sample, more than three lags are not accepted for estimating IRFs owing to nearly singular matrix determinants. Hence, we selected a lag order of three for reasons of parsimony.

We start by discussing the impulse responses of CPI to an exchange rate shock in the 5-variable VAR model for targeters and nontargeters. We also discuss the impulse responses of all prices (CPI, PPI and IMP) to an exchange rate shock in the 7-variable VAR model for targeters.

5.3.1. Exchange Pass-Through to Domestic Prices in Emerging Targeters: Before and After Inflation Targeting

In this subsection we discuss the impulse responses of domestic prices to an exchange rate shock using data on fifteen emerging inflation targeters. The impulse responses for the different samples are reported in Figures 1 and 2 (p. 66). Each figure reports before-and-after comparisons: before and after adopting inflation targeting. In these figures the third cell reports the difference between the two preceding responses (the response in the second cell minus the response in the first cell).

Figure 1 reports the dynamic response of CPI inflation to an exchange rate shock using the 5-variable VAR. Figure 1 shows a positive significant exchange rate pass-through to consumer prices in inflation targeting countries that decreases after they adopted inflation targeting. As reflected by the confidence intervals in third cell, the decrease in exchange rate pass-through to consumer prices is statis-

Table 1: Unit Root test

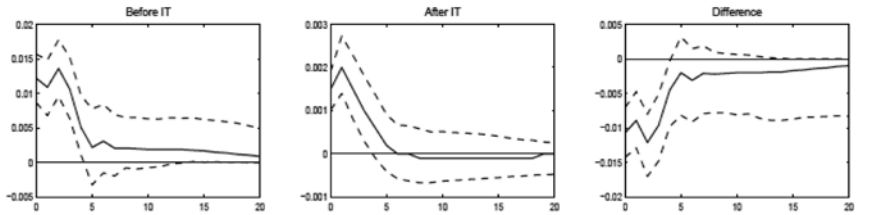
Variables	Test Statistic
oil	–2.225
Δoil	–4.532***
g	238.9443***
m	63.4918
Δm	203.5607***
ner	38.3284
Δner	199.9251***
cpi	42.3842
Δcpi	104.0440***
imp	52.8330
Δimp	160.7035***
ppi	58.7423
Δppi	93.6602***

Note: The unit root test for oil and Δoil is Dickey-Fuller Generalized Least Square (DFGLS) test since these variables do not depend on countries. The null hypothesis of the DFGLS test is that the variable is non-stationary. For other variables, the unit root test is the panel unit root test developed by Maddala and Wu (1999) with the null hypothesis that all series are non-stationary against the alternative that at least one series in the panel is stationary. No lag is used for g. The lag length used in the panel tests is the maximum lag length of individual tests that are chosen based on Schwarz information criterion. 1 (3) lags are used for oil (Δoil). 10 (5), 10 (6), 10 (11), 7 (8), and 10 (10) lags are used for m (Δm), ner (Δner), cpi (Δcpi), imp (Δimp) and ppi (Δppi), respectively. Using a lag length higher, the results were still found to be the same. For the level of variables (expected g), constant and time trend are included. For the first-difference of variables, only constant is included. ***, **, * denote the significance at 1, 5 and 10% respectively.

tically different from zero. This evidence suggest that the adoption of inflation targeting in emerging countries has helped to reduce the pass-through from a higher level, and the pass-through effect remains significantly different from zero.

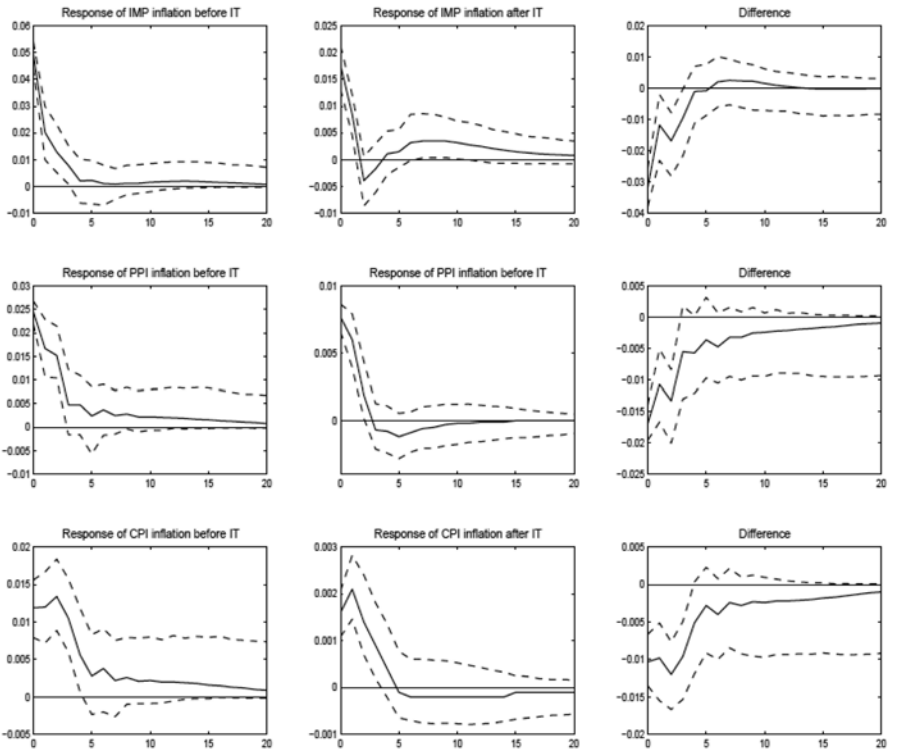
As discussed above, the response of consumer prices to changes in exchange rate depends on the extent of imported inputs being used for domestic production and the presence of distribution costs. The production or distribution channels can dampen the effect of exchange rate changes on consumer prices and account for a low exchange rate pass-through to consumer prices. In order to take into account the production and distribution channels we estimate a 7-variable VAR that includes two other price indexes: the producer price index (PPI) and the import price index (IMP). This estimation helps us to directly check the hypothesis made by Taylor who argues that in a low-inflation environment firms expect a deviation of inflation to be less persistent and would therefore less adjust its selling prices in response to an exchange rate-induced increase in the price of imported inputs. Figure 2 reports the dynamic response of the three prices index (CPI, IMP, PPI) inflation to an exchange rate shock using the 7-variable VAR. Figure 2 shows that the decline in pass-through to consumer prices in emerging inflation targeters is attributable to the decline in pass-through effect along the price chain. The pass-through effects to all the three prices significantly falls in emerging inflation targeters after adopting inflation targeting to levels that are significantly different from zero.

Figure 1: Response of CPI inflation in inflation targeters countries to an exchange rate shock (5-variable VAR)



Note: "IT" denotes inflation targeting. The solid line shows the impulse response to an exchange rate shock. The dashed lines indicate five standard error confidence band around the estimate. Error are generated by Monte-Carlo with 500 repetitions.

Figure 2: Response of prices in inflation targeters countries to an exchange rate shock (7-variable VAR)



Note: "IT" denotes inflation targeting. The solid line shows the impulse response to an exchange rate shock. The dashed lines indicate five standard error confidence band around the estimate. Error are generated by Monte-Carlo with 500 repetitions.

By comparing the exchange rate pass-through along the price chain, the results show that the response is the largest in import prices, then in producer prices, and the least in consumer prices. This finding is consistent with those of previous

results such as McCarthy (2000), Hahn (2003), Faruque (2006) and Ito and Sato (2007, 2008).

In summary, we have obtained evidence that the adoption of inflation targeting has helped to reduce the pass-through to all three price indexes from a higher level to a new level that remains significantly different from zero. Our evidence confirms the view that when initial credibility of emerging markets' central banks is low, practicing inflation targeting makes their monetary policy more credible, and thus leads to a lower inflation environment. More specifically, in accordance with the argument made by Taylor, inflation targeting by implementing low inflation environment in emerging countries induces input-importing firms as well as retailing firms to pass through less of the exchange rate depreciation in the form of higher prices (producer prices and import prices). Hence exchange rate fluctuations lead to smaller exchange rate pass-through to domestic producer and import prices.

5.3.2. Comparison between Inflation Targeters and Inflation Nontargeters

In the previous subsection, we have obtained evidence that inflation targeting has helped to decrease the exchange rate pass-through to all the three price indexes (CPI, IMP, PPI). A comparison with emerging nontargeters over the same period conveys interesting additional information. Data for twelve nontargeters are used to conduct this comparative analysis. To perform before-and-after comparison for nontargeters, the demarcation period for nontargeters is set at year 1999[7] that is around the average of the adoption date of inflation targeting in emerging countries.

Figure 3 and 4 (p. 68) report before-and-after comparisons for inflation nontargeters before and after 1999. Figures 3 displays the response of the CPI inflation to an exchange rate shock using the 5-variable VAR, while Figure 4 displays the response of the three indexes to an exchange rate shock using the 7-variable VAR[8].

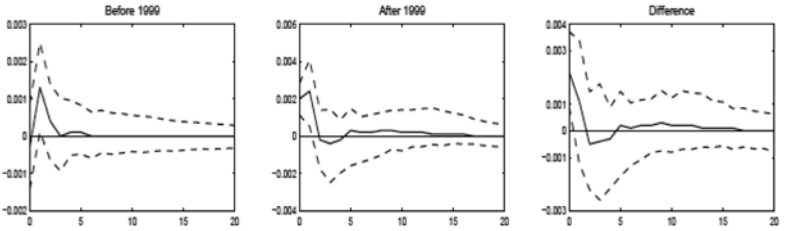
Figure 3 shows that for nontargeters the exchange rate pass-through to CPI has not been significantly different from zero before 1999 and has become significantly positive after 1999. Figure 4 shows that, before 1999, pass-through effects to the three indexes in nontargeters are not significantly different from zero, while after 1999 these effects are significantly positive.

To compare targeters to nontargeters, Figure 5 and 6 (p. 70) reports comparisons across the two samples of countries: inflation targeters after adopting inflation

[7] We also ran estimations using, 1998, and 2000 as the demarcation periods. These changes did not substantially affect our results.

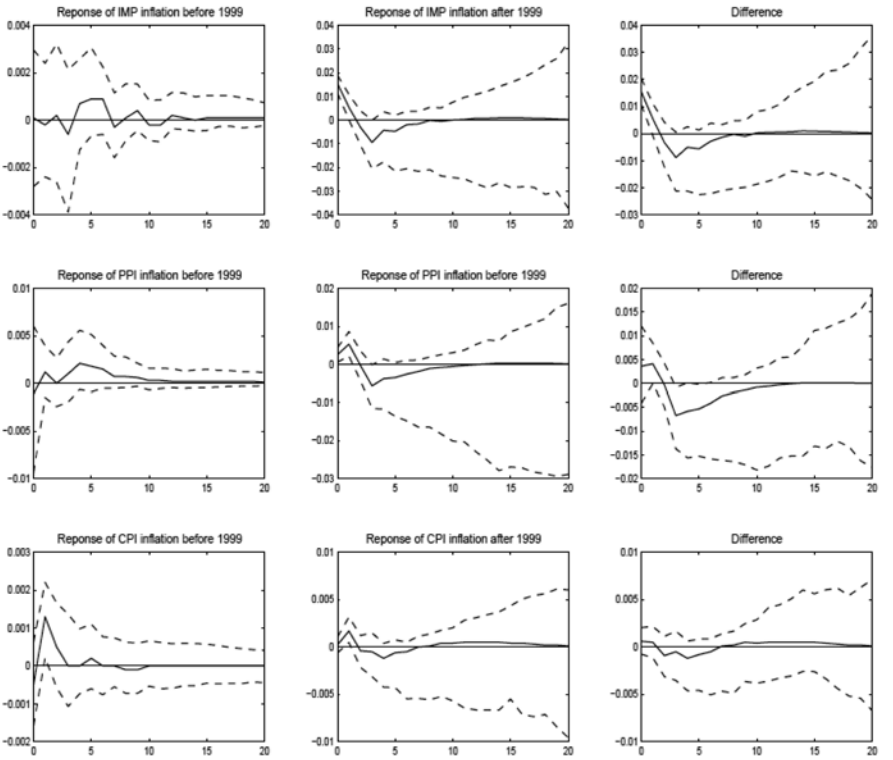
[8] China and Uruguay are not included in the 7-variable VAR as no data on import and producer prices are available for these countries.

Figure 3: Response of CPI inflation in inflation nontargeters to an exchange rate shock (5-variable VAR)



Note: The solid line shows the impulse response to an exchange rate shock. The dashed lines indicate five standard error confidence band around the estimate. Error are generated by Monte-Carlo with 500 repetitions.

Figure 4: Response of prices in inflation nontargeters countries to an exchange rate shock (7-variable VAR)



Note: The solid line shows the impulse response to an exchange rate shock. The dashed lines indicate five standard error confidence band around the estimate. Error are generated by Monte-Carlo with 500 repetitions.

targeting are compared to nontargeters after 1999. Figures 5 compares the response of the CPI inflation to an exchange rate shock using the 5-variable VAR, while Figure 6 compares the response of the three indexes to an exchange rate

shock using the 7-variable VAR. Figure 5 shows that the exchange pass-through to consumer prices is the same for targeters after inflation targeting and nontargeters after 1999. However Figure 6 qualifies this result. The impulse response functions in Figure 6 indicate that the exchange pass-through to consumer and import prices in inflation targeting countries after adopting inflation targeting is slightly higher than that in nontargeters after 1999, while the exchange pass-through to producer prices in targeters after inflation targeting is not significantly different than that in nontargeters after 1999.

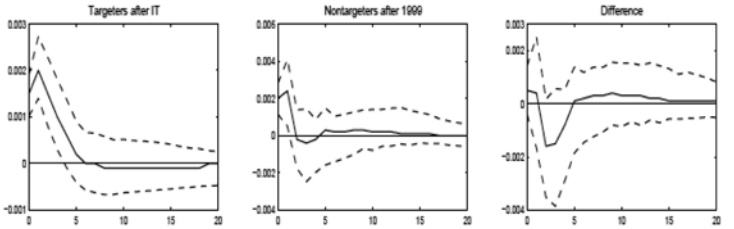
We can infer two claims from these comparisons. First, for emerging nontargeters, the pass-through has not been significantly different from zero before 1999 and becomes significantly positive after 1999. Second, by comparing inflation targeters after adopting inflation targeting to nontargeters after 1999, the pass-through effects are rather close among the two groups of targeters and nontargeters. This evidence suggests that countries experiencing high exchange rate pass-through are more prone to adopt inflation targeting in order to gain credibility, than countries with low pass-through.

5.4. Variance Decomposition

Even though impulse responses give information about the size of exchange rate pass-through to domestic prices, they do not show how important exchange rate shocks are in explaining domestic price fluctuations. To assess the importance of exchange rate shocks for domestic prices fluctuations, we perform variance decomposition for domestic price indexes. We begin by examining the importance of exchange rate shocks for consumer prices by using the 5-variable VAR (Table 2, p. 71). Table 2 indicates that exchange rate shocks are more important in explaining CPI fluctuations in targeters countries. The results contained in Table 2 also show that the contribution of exchange rate shocks to consumer price fluctuation decreases in targeting countries after they adopted inflation targeting, while it increases in nontargeting countries after 1999. Exchange rate shocks explain (after 20 quarters) 19.21% of consumer price forecast variance for targeting countries before they adopted inflation targeting. This percentage declines to 11.82% after the adoption of inflation targeting. In nontargeting countries, exchange rate shocks explain (after 20 quarters) 0.92% of consumer prices variability before 1999, and, this percentage is 3.72% after 1999.

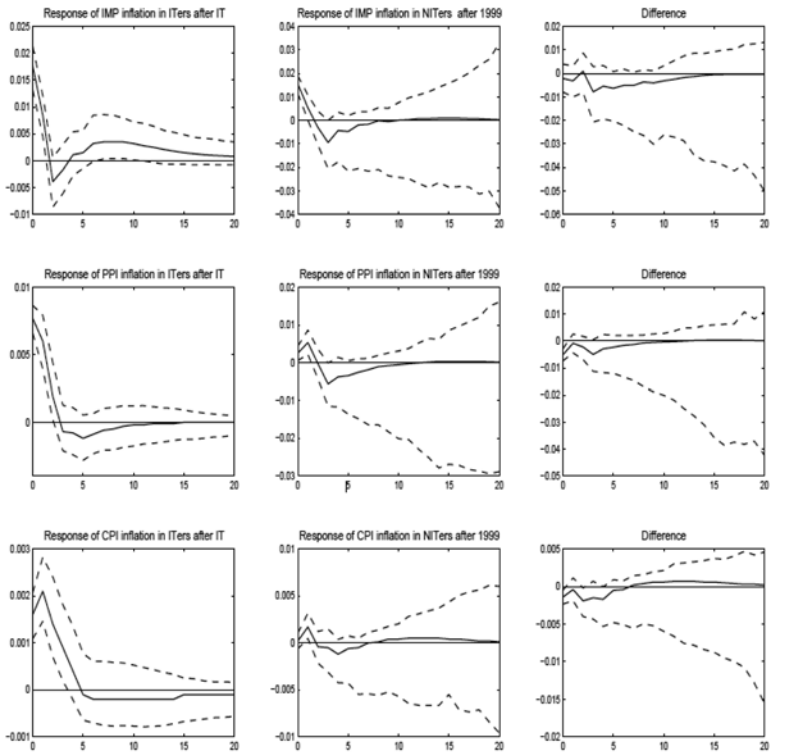
Table 3 (p. 71) displays the contribution of exchange rate shocks in explaining the fluctuations of all three price indexes using the 7-variable VAR. The results in Table 3 indicate that exchange rate shocks are more important to explain the fluctuations of all three indexes in targeters countries, while the contribution of exchange rate shock to the fluctuations in price indexes in nontargeters countries

Figure 5: Response of CPI inflation to an exchange rate shock: Inflation targeters (ITers) versus Inflation nontargeters (NITers) (5-variable VAR)



Note: The solid line shows the impulse response to an exchange rate shock. The dashed lines indicate five standard error confidence band around the estimate. Error are generated by Monte-Carlo with 500 repetitions.

Figure 6: Response of prices to an exchange rate shock: Inflation targeters (ITers) versus Inflation nontargeters (NITers) (7-variable VAR)



Note: The solid line shows the impulse response to an exchange rate shock. The dashed lines indicate five standard error confidence band around the estimate. Error are generated by Monte-Carlo with 500 repetitions.

is insignificant. The percentage of price forecast variance attributed to exchange rate shocks declines in targeting countries after they adopted inflation targeting, while it slightly increases in nontargeters after 1999. In targeters before they

Table 2: Percentage of CPI inflation forecast variance attributed to exchange rate shocks (5-variable VAR)

	Inflation targeteres		Inflation nontargeters	
Horizon	Before IT	After IT	Before 1999	After 1999
1	9.05	5.62	0.07	3.72
2	14.69	11.19	1.20	5.46
4	22.58	12.91	1.03	4.25
8	20.19	12.06	0.86	3.76
12	19.28	11.86	0.81	3.61
20	19.21	11.82	0.78	3.61

Note: "IT" denotes inflation targeting

Table 3: Percentage of prices forecast variance attributed to exchange rate shocks in inflation targerters (7-variable VAR)

	Inflation targeteres		Inflation nontargeters	
Horizon	Before IT	After IT	Before 1999	After 1999
	Import prices		Import prices	
1	52.09	11.38	0.00	7.11
2	53.25	12.24	0.00	5.17
4	50.83	11.51	0.05	5.62
8	45.30	11.43	0.28	5.68
12	43.76	12.20	0.31	5.46
20	43.47	12.54	0.31	5.31
	Producer prices		Producer prices	
1	52.09	22.59	0.03	1.05
2	60.34	28.02	0.06	2.14
4	56.44	25.27	0.09	2.84
8	47.48	23.68	0.32	3.66
12	44.60	23.33	0.34	3.65
20	43.70	23.30	0.35	3.56
	Consumer prices		Consumer prices	
1	8.80	6.31	0.28	0.05
2	15.38	12.48	1.87	1.63
4	22.95	14.21	1.66	1.32
8	20.70	13.69	1.46	1.73
12	19.83	13.74	1.38	1.59
20	19.76	13.89	1.32	1.73

Note: "IT" denotes inflation targeting

adopted inflation targeting exchange shocks explain (after 20 quarters) 43.47%, 43.70% and 19.76% of the variance of import prices, producer prices and consumer prices, respectively. After the adoption of inflation targeting, these percent-

ages fall to 12.54%, 23.30% and 13.89%, respectively. In nontargeters before 1999, exchange rate shocks explain (after 20 quarters) 0.31%, 0.35% and 1.32% of the variance of import prices, producer prices and consumer prices, respectively. After 1999, these contributions are 5.31%, 3.56% and 1.73%, respectively. In summary, the variance decomposition analysis indicates that exchange rate shocks explain an important part of price fluctuations in emerging countries targeting inflation, while the contribution of exchange rate shocks to the fluctuations in prices in nontargeters countries is insignificant. The variance decomposition analysis also shows that the contribution of exchange rate shocks to price fluctuations in targeting countries declines after the adoption of inflation targeting. Hence the variance decomposition analysis corroborates the decline in exchange rate pass-through in targeting countries after adopting inflation targeting.

5.5. Conclusion

In this paper, we have empirically examined the effect of the adoption of an inflation targeting strategy on the exchange rate pass-through to prices in emerging countries. To conduct this empirical study, we used panel VAR techniques using data on twenty-seven emerging countries (fifteen inflation 17 targeters and twelve inflation nontargeters). We have adopted the before-and- after approach by comparing impulse response functions in different country subsamples, depending on the adoption of inflation targeting. The adoption of inflation targeting modifies the pricing decisions in emerging countries in a way which is consistent with the credibility view. The adoption of inflation targeting has helped to reduce the pass-through to all three price indexes that we considered (import prices, producer prices and consumer prices) in targeting countries from a higher level to a new level that remains significantly different from zero. For nontargeting countries exchange pass-through to all three price indexes is not significantly different zero before 1999, while after 1999 exchange rate pass-through to all the three prices is significantly different from zero. By comparing targeters after inflation targeting to nontargeters after 1999, our evidence suggests that exchange rate pass-through to prices in targeters after inflation targeting is close to that in nontargeters after 1999. The variance decomposition corroborates these results. The variance decomposition analysis indicates that the contribution of exchange rate shocks to price fluctuations in targeting countries is important, while the contribution of exchange rate shocks to prices fluctuations in nontargeters countries is insignificant. The variance decomposition analysis also shows that the contribution of exchange rate shocks to price fluctuations in targeting countries declines after the adoption of inflation targeting. Finally, our evidence suggests that countries experiencing high exchange rate pass-through were more prone to adopt

inflation targeting in order to gain credibility, than countries with low pass-through.

References

ARELANO, J. and BOVER, O., 1995, "Another look at the instrumental variable estimation of error-components model", *Journal of Econometrics* 68, pp. 29-51.

BALL, L. and SHERIDAN, N., 2003, "Does inflation targeting matter?" in B.S. BERNANKE and M. WOODFORD (Ed.), *The Inflation-Targeting Debate*, University of Chicago Press (2005).

BERNANKE, B. and MISHKIN, F., 1997, "Inflation targeting: a new framework of monetary policy?", *Journal of Economic Perspectives* 11, pp. 97-116.

MISHKIN, F. and SCHMIDT-HEBBEL, K., 2007, *Does inflation targeting make a difference?*, NBER Working Paper 12876, National Bureau of Economic Research.

BURSTEIN, A., EICHENBAUM, M. and REBELO, S., 2002, *Why Are Rates of Inflation So Low After Large Devaluations?*, NBER Working Paper 8748, National Bureau of Economic Research.

BURSTEIN, A., EICHENBAUM, M. and REBELO, S., 2005, "Large Devaluation and the Real Exchange Rate", *Journal of Political Economy* 113, pp. 742-784.

CHOUDRHI, E.U. and HAKURA, D.S., 2006, "Exchange Rate Pass-Through to Domestic Prices: Does inflationary Environment matter?", *Journal of International Money and Finance* 25, pp. 614-639.

FARUQEE, H., 2006, *Exchange Rate Pass-Through in the Euro area*, IMF Staff Papers 53(1), pp. 63-88.

GAGNON, J.E. and IHRIG, J., 2004, *Monetary Policy and Exchange Rate Pass-through*, International Finance Discussion Papers No. 704, Board of Governors of Federal Reserve System.

GONÇALVES, C.E.S. and SALLES, J.M., 2008, "Inflation targeting in emerging economies: What do the data say?", *Journal of Development Economics* 85, pp. 312-318.

HAHN, E., 2003, *Pass-Through of External Shocks to Euro Area Inflation*, European Central Bank Working Paper No. 243.

ITO, T. and SATO, K., 2007, *Exchange Rate Pass-Through and Domestic Inflation: A comparison between East Asia and Latin American Countries*, Research institute of Economy, Trade and Industry, RIETI Discussion Papers No. 07040.

–, 2008, "Exchange Rate Changes and Inflation in Post-Crisis Asian Economics: VAR Analysis of Exchange Rate Pass-Through", *Journal of Money, Banking and Credit* 40 (7), pp. 1407-1438.

LOVE, I., 2001, *Estimating Panel-Data Autoregressions, Package of Programs for Stata*, Columbia University, Mimeo.

LOVE, I. and ZICCHINO, L., 2006, "Financial development and dynamic investment behavior: Evidence from a panel VAR", *Quarterly Review of Economics and Finance* 46, pp. 190-210.

MADDALA, G.S. and WU, S., 1999, "A Comparative Study of Unit Root Tests With Panel Data and A New Simple Test", *Oxford Bulletin of Economics and Statistics* 61, pp. 631-652.

MCCARTHY, J., 2000, "Pass-Through of Exchange Rates and Import Prices to Domestic Inflation in Some Industrialized Economies", *Federal Reserve Bank of New York Staff Reports* No. 111.

SVENSSON, L.E., 1997, "Inflation forecast targeting: implementing and monitoring inflation targets", *European Economic Review* 41, pp. 111-146.

TAYLOR, J., 2000, "Low Inflation, Pass-Through, and the Pricing Power of Firms", *European Economic Review* 44, pp. 1389-1408.

Appendix

Countries in the sample

Emerging inflation targeters and adoption date of inflation targeting: Brazil (1999:Q2), Chile (1991:Q1), Colombia (1999:Q4), Czech Republic (1997:Q4), Hungary (2001:Q2, Indonesia (2005:Q3), Israel (1991:Q4), Mexico (1998:Q4), Peru (1999:Q3), Philippines (1999:Q3), Poland (1998:Q3), South Africa (2001:Q1), South Korea (1997:Q4), Thailand (2000:Q2) and Turkey (2006:Q1).

Emerging inflation nontargeters: Argentina, Bulgaria, China, Estonia, India, Latvia, Lithuania, Malaysia, Singapore, Taiwan, Uruguay, and Venezuela.

Variable and their sources

World oil price: The US dollar-basis oil price index that is an average of the three spot price index of Texas, U.K. Brent and Dubai. The world oil price is seasonally adjusted using the Census X12 method. Data source: IMF, International Financial Statistics (henceforth, IFS).

Output gap: The output gap is generated by applying the Hodrick-Prescott (HP) filter to eliminate a strong trend in the seasonally adjusted real gross domestic product (GDP). If the original GDP series is not adjusted, series is seasonally

adjusted using the Census X-12 method. The quarterly data are collected using Datastream. The data sources depending on the countries are the following:
Argentina: GDP volume index (2000=100), IMF's International Financial Statistics (IFS)
Brazil: GDP volume index (1995=100) (seasonally adjusted), Instituto Brasileiro de Geografia e Estatistica (IBGE) (Brazil).
Bulgaria: GDP volume index, IFS.
Chile: GDP at 2003 prices (seasonally adjusted) Banco Central de Chile
China: GDP at current price (from IFS) divided by CPI.
Colombia: GDP at 2000 prices (seasonally adjusted), National Administrative Department of Statistics (Colombia).
Czech Republic: GDP at 2000 prices, (seasonally adjusted), Organization of Economic Co-operation and Development (OECD).
Estonia: GDP at 2000 prices, Estonia Statistics (Estonia).
Hungary: GDP volume index (2000=100)(seasonally adjusted),OECD.
India: GDP Volume index (2005=100) (seasonally adjusted), OECD.
Indonesia: GDP at 2000 prices (seasonally adjusted), OECD.
Israel: GDP at 2005 prices (adjusted series), Central Bureau of Statistics (Israel).
Latvia: GDP at 2000 prices, Central Statistics Bureau of Latvia (Latvia).
Lithuania: GDP at 2000 prices (seasonally adjusted), Statistics Lithuania (Lithuania).
Malaysia: GDP volume index (2000=100), IFS.
Mexico: GDP volume index (2000=100), IFS.
Peru: GDP volume index (2000=100), IFS.
Philippines: GDP at 1985 prices (seasonally adjusted), National Statistical Coordination Board (NSCB) (Philippines).
Poland: GDP at 2000 prices (seasonally adjusted), OECD.
Singapore: GDP volume index (2000=100), IFS.
South Africa: GDP at 2000 prices, (seasonally adjusted),IFS.
South Korea: GDP at 2000 prices (seasonally adjusted), OECD, (Quarterly National Accounts).
Taiwan: GDP at 2001 prices, Directorate General of Budget, Accounting and Statistics (DGBAS).
Thailand: GDP at 1988 prices (seasonally adjusted), Office of National Economic and Social Development Board (Thailand).
Turkey: GDP at 1995 prices, Eurostat.
Uruguay: GDP volume index (2005=100) (seasonally adjusted), Banco Central de Uruguay (Uruguay).
Venezuela: GDP at 1997 prices (seasonally adjusted), Banco Central de Venezuela (Venezuela).

Money supply: The data is collected using Datastream. For some countries, base money is used. For others, M1 is used. If the original series is not adjusted, series is seasonally adjusted using the Census X-12 method. The data sources depending on countries are the following:
Argentina: Base money, IFS.
Brazil: Base money, (seasonally adjusted), IFS.
Bulgaria: Money M1 (Banking Survey), IFS.
Chile: Money M1, IFS.
China: Money Supply, People Bank of China.
Colombia: Money M1 (Banking Survey), IFS.
Czech Republic: Money M1 (Banking Survey), IFS.
Estonia: Money M1 (Banking Survey),(seasonally adjusted), IFS.
Hungary: Monetary Base, IFS.
India: Money M1 (Banking Survey), IFS.
Indonesia: Money M1 (Banking Survey) (seasonally adjusted), IFS.
Israel: Money M1 (seasonally adjusted), IFS.
Latvia: Money M1 (Banking Survey) (seasonally adjusted), IFS.
Lithuania: Money M1 (Banking Survey) (seasonally adjusted), IFS.
Malaysia:Money M1, (seasonally adjusted), IFS.
Mexico: Money M1 (Banking Survey) (seasonally adjusted), IFS.
Peru: Money supply, IFS.
Philippines: Money M1 (Banking Survey) (seasonally adjusted), IFS.
Poland: Money M1, IMF, International Financial Statistics (IFS).
Romania: Money M1 (Banking Survey) (seasonally adjusted), IFS.
Singapore: Money M1 (Banking Survey) (seasonally adjusted), IFS.
South Africa: Money M1, IFS.
South Korea: Money M1 (seasonally adjusted), IFS.
Taiwan: Money supply, Bank Central of China.
Thailand: Money M1 (Banking Survey), IFS.
Turkey: Money M1 (Banking Survey) (seasonally adjusted), IFS.
Uruguay: Money M1 (Banking Survey)(seasonally adjusted), IFS.
Venezuela: Money M1 (Banking Survey)(seasonally adjusted), IFS.

Exchange rate: The data is collected using Datastream. The period average bilateral nominal exchange rate vis-à-vis the US dollar are used. For all countries, except Taiwan, the data is taken from IMF's IFS. For Taiwan the data is taken from IFO World Economic Survey (WES).

Consumer Price Index: The data is collected using Datastream. For all countries except China the consumer price index (2000=100) is taken from IMF, International Financial Statistics (IFS). For china, the monthly CPI taken from EOCD is used to construct the quarterly CPI. All series are seasonally adjusted using the Census X-12 method.

Import Price Index: The data is collected using Datastream. The import prices index are expressed in home currency. All series are seasonally adjusted using the Census X-12 method. The data sources depending on countries are the following:
Argentina: The import price index is the import unit value in US dollar (2000=100) taken from IFS multiplied by the exchange rate.
Brazil: The import price index is the import unit value in US dollar (2000=100) taken from IFS multiplied by the exchange rate.
Bulgaria: The quarterly series of import price index is constructed by dividing the total import value by the total import volume (1995 prices). The import value and the import volume are taken from National Statistics Institute (Bulgaria) and Eurostat, respectively.
Chile: Import Price Index (2003=100), Banco Central de Chile (Chile).
Colombia: The import price index is the import unit value in US dollar (2000=100) taken from IFS multiplied by the exchange rate.
Czech Republic: Import Price Index (2005=100), Czech Statistical of Office.
Estonia: The quarterly series of import price index is constructed by dividing the total import value by the total import volume (2000 prices) Statistics Estonia. The data are taken from Statistics Estonia (Estonia).
Hungary: The import price index is the import unit value in US dollar (2000=100) taken from IFS multiplied by the exchange rate.
India: The quarterly series of import price index is constructed by dividing the total import value by the total import volume (1990 prices). Data are taken from OECD.
Indonesia: The quarterly series of import price index is constructed by dividing the total import value by the total import volume (2000 prices). Data are taken from EOCD.
Israel: The import price index is the import unit value in US dollar (2000=100) taken from IFS multiplied by the exchange rate.
Latvia: The import price index is the import unit value in US dollar (2000=100) taken from IFS multiplied by the exchange rate.
Lithuania: The quarterly series of import price index is constructed by dividing the total import value by the total import volume (2000 prices). The data are taken from Statistics Lithuania.
Malaysia: The quarterly series of import price index is constructed by dividing the total import value by the total import volume (2000 prices). The data are from Department of Statistics (Malaysia).
Mexico: The quarterly import price index is constructed by the monthly import price index (1980=100) taken from Banco de Mexico (Mexico).
Peru: The quarterly import price index is constructed by the average monthly import price index (1994=100) taken from Banco Central Reserva (Peru).
Philippines: The import price index is the import unit value in USdollar (2000=100) taken from IFS multiplied by the exchange rate.

Poland: The import price index is the import unit value in US dollar (2000=100) taken from IFS multiplied by the exchange rate.
Singapore: The import price index is the import unit value in US dollar (2000=100) taken from IFS multiplied by the exchange rate.
South Africa: The import price index is the import prices index in US dollar (2000=100) taken from IFS multiplied by the exchange rate.
South Korea: The import price index is the import unit value in US dollar (2000=100) taken from IFS multiplied by the exchange rate.
Taiwan: The quarterly import price index is constructed by the average monthly import price index (manufactruing goods) (2001=100) taken from Directorate General of Budget, Accounting and Statistics (DGBAS).
Thailand: The import price index is the import unit value in US dollar (2000=100) taken from IFS multiplied by the exchange rate.
Turkey: The import price index is the import unit value in US dollar (2000=100) taken from IFS multiplied by the exchange rate.
Venezuela: The import price index is the import unit value in US dollar (2000=100) taken from IFS multiplied by the exchange rate.

Producer Price Index: The data is collected using Datastream. For all countries except Taiwan and Turkey, the producer prices index are taken form IFS. For Taiwan the quarterly producer prices index are the average monthly output prices index (2006=100) taken from Taiwans Directorate General of Budget, Accounting and Statistics. For Turkey the quarterly data are taken from Turkeys National Institute of Statistics.

6. The Monetary Policy Transmission Mechanism in an Open Emerging-Market Economy: The Case of South Africa

N. Brink and M.A. Kock[1]

Abstract

The monetary policy transmission mechanism describes the different ways in which the economy is affected by monetary policy. This process is conditioned by the monetary policy framework, financial system and the real economy. The dynamic nature of the economy and financial markets, institutional changes in the credit market and the monetary policy approach contribute to changes in the transmission mechanism and the effectiveness thereof. This paper assesses the channels of monetary policy transmission in the South African context, and how these may have changed or become more complex in a globalised environment. A pragmatic approach is followed for such an analysis, starting with issues related to bank credit and followed by the issues relating to the broader credit markets, the exchange rate and asset prices.

JEL classification: E5, E43, E44

Keywords: Monetary policy transmission mechanism

6.1. Introduction

South Africa is an open emerging-market economy with a relatively well-developed financial system and liquid financial markets. The South African Reserve Bank (SARB) adopted a flexible, forward looking inflation-targeting monetary policy framework in 2000, according to which monetary policy should keep inflation within a target band of 3 to 6 per cent, with due consideration of prevailing financial stability and real economic developments.

In terms of monetary policy implementation, the SARB follows a classical shortage-based system, with the money-market shortage being refinanced at the repurchase rate (the policy rate) in transactions with a one-week maturity. In pursuit of price stability, the policy rate is determined by the Monetary Policy Committee (MPC), and influences aggregate demand through various channels.

[1] The views expressed are those of the author(s) and do not necessarily represent those of the South African Reserve Bank or Reserve Bank policy. While every precaution is taken to ensure the accuracy of information, the South African Reserve Bank shall not be liable to any person for inaccurate information or opinions contained herein.

This paper assesses the channels of monetary policy transmission in the South African context, and how these may have changed or become more complex in a globalised environment.

6.2. Theory on the Transmission Mechanism

Monetary policy is a powerful tool, at least in the short-term, for the stabilisation of output and inflation (Bernanke and Gertler, 1995:27). Monetary policy that anchors inflation expectations should constrain a rise in expected inflation through appropriate interaction with the output gap (Mishkin, 2007).

Policymakers have to understand the process through which monetary policy affects an economy, including the timing of these effects (Mishkin, 1995:3). Individual real economic variables respond with diverse lags and durations to monetary policy changes (Bernanke and Gertler, 1995:33-34). An understanding of the transmission mechanism facilitates an evaluation of the monetary policy stance (Boivin, Kiley and Mishkin, 2010:1) and the effectiveness of monetary policy in achieving its objectives. The type and scale of policy measures influence the magnitude of the effect on real economic activity.

Most analyses seem to argue that monetary policy is primarily transmitted through the asset-price and credit channels, with secondary integrated expectations, risk-taking and international-transactions channels. Within the asset price channel, interest rates are both a monetary policy instrument and a reactive variable (with the later primarily referring to the effect on the prices of and yields on debt instruments). Within the asset-price channel, exchange rates, equities and house prices are affected by interest rates. The credit channel enhances the interest rate channel and also affects asset prices. (See the annexure for an expanded schematic presentation of the various channels and elements of the transmission mechanism).

The monetary policy transmission mechanism describes the different ways through which monetary policy affects an economy. This process is conditioned by the monetary policy framework, financial system and the real economy (Mohanty and Turner, 2008:2). The dynamic nature of the economy and financial markets, institutional changes in the credit market, and the monetary policy approach may alter the transmission mechanism and the effectiveness thereof. Therefore, a practical analysis of the transmission mechanism has to be country-specific. A pragmatic approach is followed for such an analysis in the South African context, starting with issues related to bank credit and followed by issues relating to the broader credit markets, the exchange rate and asset prices.

6.3. Issues Related to Bank Credit

6.3.1. An Inverted Bank Credit Channel: No Exogenous Limit on Supply

The traditional bank lending channel states that expansionary monetary policy, by increasing bank reserves and bank deposits, determines the amount of loans that banks can make available (Mishkin, 1996:9). In terms of this conventional view, deposits represent the supply of loanable funds and determine the amount that banks can lend[2]. The proposition is that cash reserves drain deposits and reduce loanable funds through the money multiplier mechanism. If banks have less deposits they could possibly replace such deposits with other types of liabilities, but at a higher marginal cost of funding. A change in the policy rate also affects deposits through a re-allocation of depositors' assets. Thus, bank lending is determined by quantitative changes in bank liabilities and relative funding cost. The traditional theoretical view is that, within the bank lending channel, changes in deposits drive changes in the amount of credit.

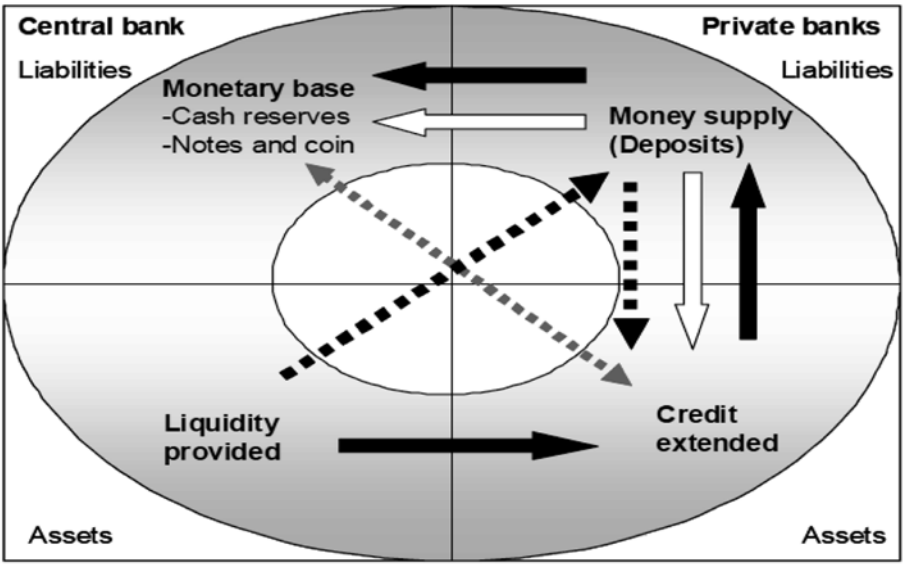
However, there is an alternative and opposing view in terms of the causality between deposits and loans, according to which the amount of bank credit drives the amount of deposits. This view, as put forward by Disyatat (2010) contends that bank loans to non-bank borrowers endogenously drive the amount of deposits in the monetary sector[3]. When a bank grants a loan, a new bank deposit liability is created in the name of the borrower. In the South African context, Brink and Kock (2010) furthermore argue that any marginal shortfall of funding is provided by the central bank, in essence removing the exogenous limit on the amount of credit in the banking system and enabling a self-enforcing cycle of credit growth. The two opposing views on the causality between deposits and loans, and their linkages to the central bank balance sheet, are illustrated in Figure 1 overleaf on p. 82.

For the transmission mechanism the key implication is that with new loans funded through new deposits, credit extension is only limited by capital requirements and interest rates (Disyatat, 2010:17). The notion that loans drive deposits implies that the money-multiplier concept is flawed, that the cash reserve requirement is irrelevant as a quantitative brake on credit growth, and that the transmission of the policy rate is through credit and not through money supply. Mostly, borrowers are quantity setters and price takers, while lenders are price setters and quantity takers.

[2] Disyatat (2010:2), "A central proposition… in the transmission mechanism is that monetary policy imparts a direct impact on deposits, and that deposits, insofar as they constitute the supply of loanable funds, act as the driving force of bank lending".

[3] Disyatat (2010:17), "The supply of deposits (inside money), rather than being exogenous is determined endogenously by the quantity of credit that firms demand…".

Figure 1. The casualty between deposits and loans[a]



Source: Brink and Kock (2010)

a. The white arrows represent the conventional cash reserve requirement and multiplier effects: Banks source a certain amount of deposits enabling them to extend credit. However, the amount of credit is constrained by the cash reserve requirement. The black arrows represent the alternative view that causality is in the opposite direction. In this direction, the cash reserve requirement and deposit funding does not constrain credit extension.

6.3.2. The Pricing of Bank Credit

6.3.2.1. The Policy Rate and Real Market Lending Rates

Changes in the policy rate are intended to change the price and consequently the quantity of credit demanded in the economy, thereby affecting aggregate demand and output. The pricing of credit is, therefore, a key element in the transmission mechanism.

Monetary policy is primarily conducted through changes in the short-term nominal policy rate. However, due to a combination of sticky prices and rational expectations, changes in the nominal rate affect the real rate in the short term and, through the term structure, longer-term rates (Mishkin, 1995:4, 1996:34; Bernanke and Gertler, 1995:27-28,33). Through the interest rate channel, banks' funding costs increase (decrease) in line with the central bank's policy rate. Banks transfer these changes to customers' lending rates by changing their risk-adjusted price of credit.

The SARB and the Banking Association of South Africa (BASA) in 2009 conducted a review of the links between the SARB's policy (repo) rate and banks'

prime lending rates (South African Reserve Bank and Banking Association of South Africa, 2010). This review confirmed that banks' nominal lending rates (and in the short-term their real lending rates) are determined by three main factors: their cost of funding, the financial position of the client (credit risk profile) and the degree of risk appetite of the bank itself, which includes not only appetite for credit risk but also for liquidity and interest rate risk. An analysis of the transmission mechanism should consider all factors that have an impact on banks' cost of funding.

6.3.2.2. The Effect of Liquidity Conditions

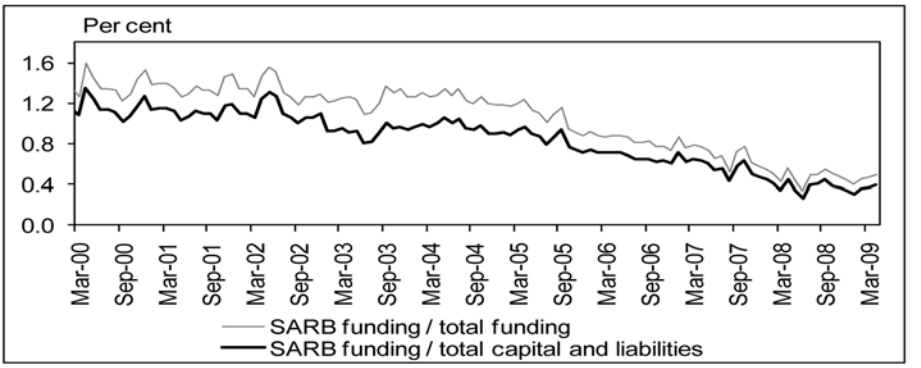
The literature on the transmission mechanism focuses on the level of interest rates, with little reference to the influence that the quantity of money in the system has on its price, *i.e.* the influence that the central bank balance sheet policy has on the amount of money-market liquidity available. This effect partly depends on the monetary policy implementation framework that is applied within a specific jurisdiction. The liquidity effect of the central bank's balance sheet represents the 'broad portfolio balance sheet channel' described by Borio and Disyatat (2009:13), in terms of which changes in the relative supply of liquidity brought about by central bank operations materially affect the composition of private sector assets and liabilities and alter their behaviour.

The SARB's current monetary policy implementation framework represents a classical cash reserve system. The SARB uses a number of instruments, mainly reflected on the liability side of its balance sheet, to ensure that the money market remains in a liquidity-deficit position. The liquidity shortage in the banking sector is funded by the SARB at the main repurchase auctions against prescribed collateral. There is no limit on the amount of liquidity provided to individual banks, within reasonable parameters, but the price of this funding (the policy rate) is determined by the MPC. It is by accommodating or refinancing this shortage that the SARB seeks to acquire control over short-term interest rates, from where it should cascade to the rest of the banking sector, the financial markets and the economy as a whole (Brink and Kock, 2010).

However, since 2002, the SARB has managed its balance sheet in such a way that the liquidity shortage has remained fairly constant in nominal terms, and has shrunk in real terms and relative to the size of commercial banks' balance sheets. The main reason for this relative decline in the liquidity requirement was the substantial amount of liquidity that was injected into the money market in the SARB's reserves accumulation interventions, which had not been fully sterilised. By maintaining the liquidity shortage at a constant nominal level, banks' reliance on central bank funding through the refinancing system was reduced. The liquidity shortage fluctuated around 1,5 per cent of banks' total funding liabilities

between 2000 and 2002, but subsequently declined to around 0,5 per cent by 2010 (Figure 2). The small size of the money-market shortage relative to banks' balance sheets implies that the SARB has little direct effect on banks' cost of funding, although there is still an indirect impact through the influence that the repo rate has on the money-market yield curve and fixed linkages to some lending rates (Brink and Kock, 2010).

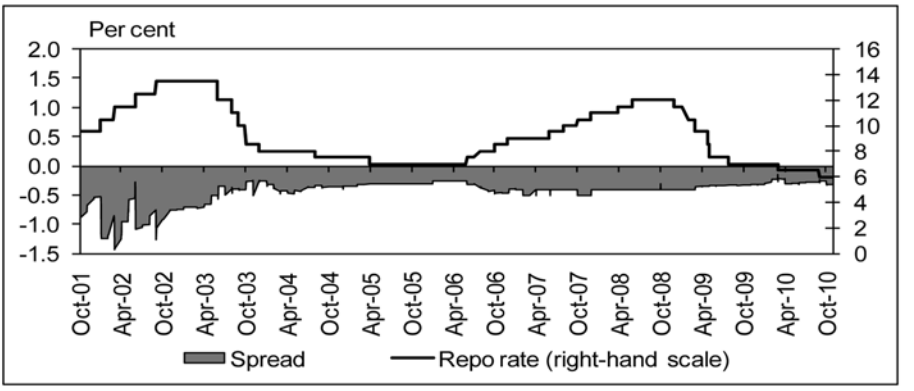
Figure 2: The money-market shortage as percentage of bank funding



Source: South African Reserve Bank

Figure 3 shows that the Rand Overnight Deposit Rate (RODR)[4] has consistently been below the SARB's repo rate, irrespective of whether the repo rate was high or low. This is indicative of a situation of surplus money-market liquidity.

Figure 3: The repo rate and its spread to overnight market rates



Source: South African Reserve Bank

[4] The RODR is the weighted average of the overnight call deposit rates paid by A1-rated local and F1-rated foreign financial institutions where Safex places its daily margin deposits received by members. It is regarded as a benchmark for overnight deposit rates for large clients.

In the Eurozone, on which the SARB's monetary policy implementation framework has to a large extent been modeled, the European Central Bank's (ECB) Eonia rate in normal circumstances fluctuates around the policy rate – both above and below, depending on liquidity conditions. In the South African case, banks consistently pay less on overnight deposits than on central bank funding. Furthermore, the spread tends to widen when the repo rate is relatively high. These tendencies reflect a situation of little funding pressure on banks.

The main implication for the transmission mechanism is that the balance sheet policy of a central bank (*i.e.* the amount of liquidity that it injects into or drains from the money market) can either enforce or dilute its interest rate policy.

6.3.2.3. The Role of the External Financing Premium

The credit channel theory states that an exogenous change in the policy rate[5] is enhanced and emitted through endogenous changes in the external financing premium. The external financing premium[6] is the difference between the cost of funding raised in the capital markets (equities and debt) and the opportunity cost of internal retained earnings. The external financing premium is inversely related to a borrower's financial position[7] (Bernanke, 2007), but tends to change in the same direction as the policy rate. The policy rate influences the size of the premium, but the latter also reflects credit market imperfections. This additional effect of the policy rate on borrowing cost magnifies its real economic impact (Bernanke and Gertler, 1995:28,35).

In the absence of undue government intervention, the credit channel can enhance the interest rate channel and its impact on the external financing premium (Bernanke and Gertler, 1995:29). The credit channel consists of a balance sheet channel, where informational friction affects bank clients' financing premium and consequently their credit demand, and a bank lending channel, where banks themselves face a financing premium that affects their cost of funding.

In South Africa, banks' weighted average cost of funding[8] is not directly determined by the level of the repo rate, but by market forces[9], money-market liquidity and their own financial positions. The repo rate should not be seen as a proxy for banks' average cost of funding. In practice, banks' funding cost, as derived from the money market yield curve, is at a premium or discount relative to repo, as

[5] This assumes that the central bank is able to set the risk-free short-term interest rate at the required level (Bernanke and Gertler, 1995:28).

[6] The external financing premium is usually positive. External finance is more expensive because of the cost of evaluating borrowers (Bernanke, 2007).

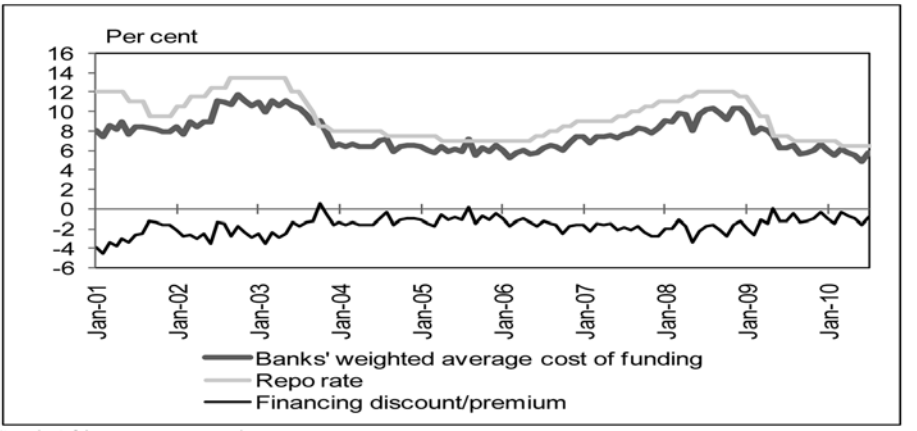
[7] Bernanke (2007), "This inverse relationship… creates a channel through which otherwise short-lived economic shocks may have long lasting effects."

[8] Banks' total cost of funding is determined by rand-denominated deposit rate, cost of foreign funding and cost of capital.

[9] Disayat (2010), states that riskier banks pay a premium on uninsured deposits.

shown in Figure 4. (In South Africa, banks generally fund themselves at a discount to the policy rate.) This is in line with the view of Disyatat (2010:8) that policy-induced variations are reflected in banks' external financing premiums, as determined by their perceived financial position, which, in turn, depends on their own profitability and balance sheet strength as well as general economic and financial conditions.

Figure 4: Banks' funding cost relative to the repo rate



Source: South African Reserve Bank

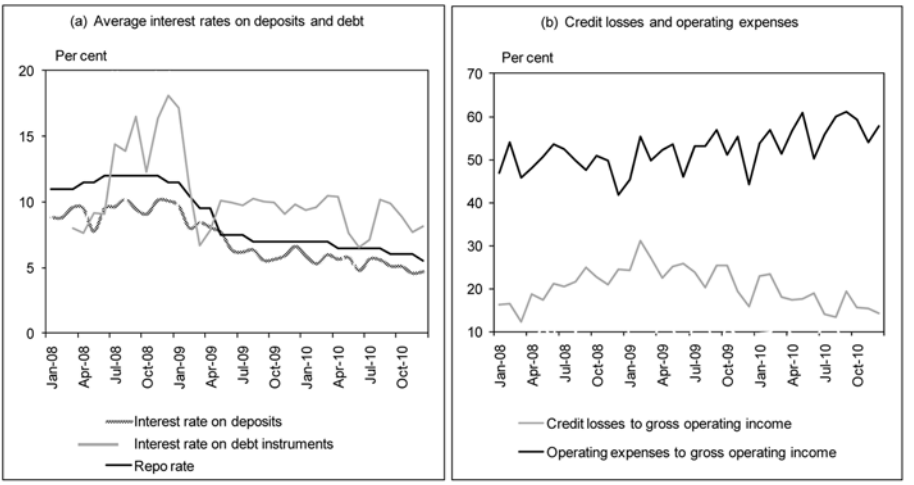
Figure 5(a) below shows South African banks' average cost of deposit funding and the cost of funding through issuing debt instruments, compared to the repo rate. It shows how banks' external financing premium (as represented by the cost of debt instrument funding) increased significantly in the last part of 2008 (Lehman episode) and the first part of 2010 (Greece episode). However, these increases also reflect a deterioration in banks' own financial positions, brought about by rising credit losses during the economic downturn of 2008/09 combined with rising operating expenses (Figure 5(b), p. 87).

The implication for monetary policy transmission in South Africa is that banks mostly fund themselves in the market at rates below the repo rate, in particular with regard to deposits. This once again reflects the effects of surplus liquidity within a relatively stable banking system referred to in section 6.3.2.2.

6.3.2.4. Procyclical Trends in the Cost and Amount of Credit

Banks' lending rates are mostly driven by three factors: the weighted average cost of funding, the financial position (risk profile) of clients, and the banks' risk appetite (SARB and BASA, 2010). All three these elements have strong procyclical tendencies. In an economic downturn, clients become less creditworthy as unem-

Figure 5: Funding costs and financial position of banks



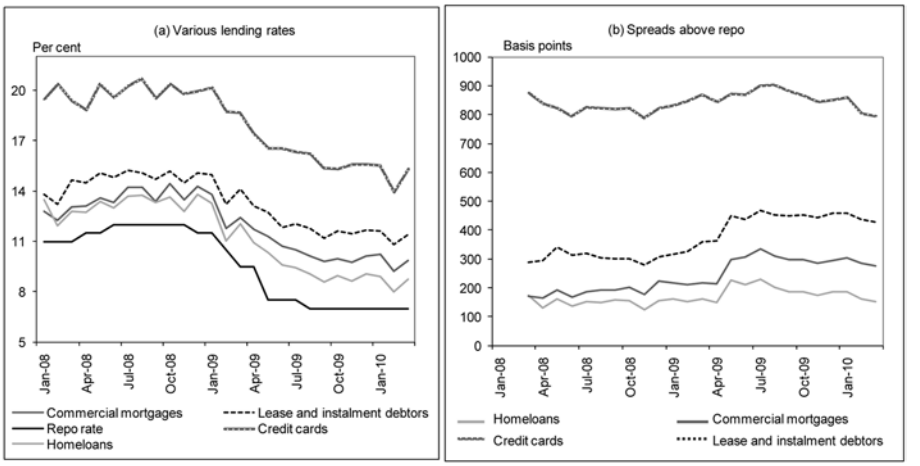
Source: South African Reserve Bank

ployment increases, corporate profits decline and the values of loan collateral fall. The external financing premium of banks rises as banks' own financial positions deteriorate, and banks themselves become more risk averse, consequently increasing the pricing of their loans. Figure 6(a) shows how the interest rates on various categories of lending (existing and new loans) in South Africa declined as the repo rate was reduced from the end of November 2008. However, Figure 6(b) shows how the spreads of these rates above repo nevertheless widened as banks increased the pricing of their loans relative to repo, especially on loan categories applicable to the corporate sector (commercial mortgages, leases and instalment sales) (see Figure 6, p. 88).

It is not only the pricing of credit that is procyclical, but also the quantity. Despite an accommodative monetary policy stance since the end of 2008, banks in South Africa (like elsewhere in the world) tightened their lending criteria, and contained the growth in their lending books. This trend partly negated the potential stimulatory effect of low interest rates on demand and output.

The implication for the transmission of monetary policy is that policymakers have to consider the economic cycle in their interest rate policies, and take into account the procyclical nature of the pricing as well as the quantity of credit. This may in some circumstances justify an over- or undershooting in the policy rate to achieve the desired outcome.

Figure 6: Lending rates relative to the repo rate



Source: South African Reserve Bank

6.3.2.5. The Effect of Expectations

Expectations significantly influence the effectiveness of all the channels of monetary policy. According to Mohanty and Turner (2008:20), the effectiveness of the expectations channel depends on the degree of central bank credibility, predictability of policy responses and commitment to policy objectives.

As an inflation-targeting central bank the SARB adjusts its policy rate based on its inflation forecast over a two-year period, taking cognisance of the domestic and international economic environment. The variables that feed into future inflation are known to both the SARB and the market. In addition, the SARB in its two-monthly monetary policy statements, as well as in its six-monthly *Monetary Policy Review*, sets out the rationale for its decisions on interest rates. This is in line with the general global trend towards greater policy transparency of central banks. As a result, market participants are able to predict the course of monetary policy fairly accurately, except in the event of sudden shocks.

Expectations surveys[10] are an indicator of the credibility of monetary policy. According to Wesso and Kock (2003) the credibility of monetary policy in South Africa has increased since the introduction of an inflation-targeting monetary policy framework. This is supported by regular surveys on inflation expectations conducted by the Bureau for Economic Research (BER) in South Africa.

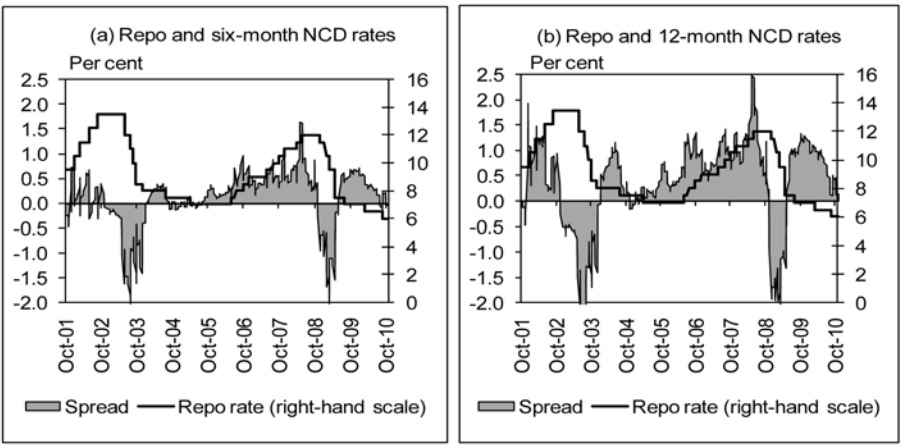
The implication of expectations in the transmission mechanism is that banks' funding cost leads, rather than follows, the policy rate. The major South African

[10] The Bureau for Economic Research (BER) has been contracted by the Bank to conduct an independent quarterly inflation expectations survey.

banks' average term of funding is between six and 12 months, making these rates more relevant to their cost of funding than overnight rates. Figure 7 illustrates how rates on six-month and 12-month Negotiable Certificates of Deposit (NCDs) consistently led changes in the repo rate by three to five months. Banks experience some margin squeeze (widening) on existing loans linked to prime, which is only relieved once the SARB adjusts its repo rate.

However, Figure 7 also shows how market expectations can overshoot policy reaction (*e.g.* at the peak of the interest rate cycle in mid-2008), as well as how market conditions can at times overshadow the effect of interest rate expectations (*e.g.* since mid-2009 when higher financing premiums kept NCD rates high relative to the repo rate).

Figure 7: The repo rate and longer-term funding rates of banks



Source: South African Reserve Bank

6.4. Issues Related to the Broad Credit Market

6.4.1. The Concepts of Narrow and Broad Credit[11]

The policy interest rate affects the flow of credit to the domestic private sector through the transmission mechanism. There are various measures of credit. The narrowest measure is borrowing and lending activity between the domestic private sector and the domestic monetary sector (*i.e.* lending by banks only). The broadest measure[12] also includes lending by non-bank financial institutions, as published by the International Monetary Fund (IMF) in the *International Financial Statistics Yearbook (IFS)*. This concept broadly corresponds to that of Men-

[11] See, Kock (2010) for a detailed analysis for South Africa.

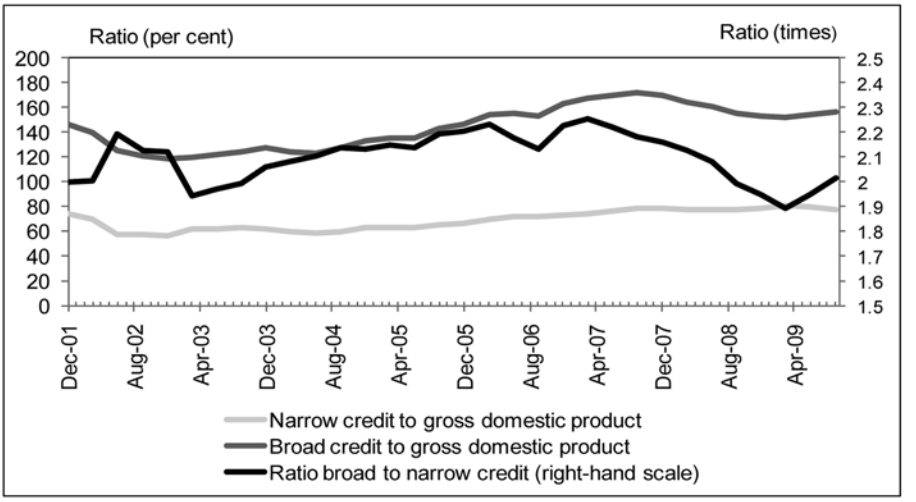
[12] Broad credit is the exchange of bank deposits among the non-bank domestic private sector creating an additional flow of credit outside the banking sector.

doza and Terrones (2008:7), who use credit from the financial sector to the private non-financial sector from the IFS, *i.e.* the sum of the claims of banks and other financial institutions on the private sector. It is also aligned to the views of Adrian and Shin (2008) about the increased importance of non-bank financial institutions and capital markets in the supply of credit.

An analysis of statistics in the latest available financial survey for South Africa published in the IFS reveals the following structural characteristics of credit:

i. Claims on the private sector account for most (about 92 per cent) of total credit.
ii. About 55 per cent of credit is extended by banks and 45 per cent by non-bank financial intermediaries (Figure 8), showing the significance of monitoring a broad credit concept. Broad credit is on average twice as much as narrow credit. The changes in the ratio between broad and narrow credit partly reflects dis- and re-intermediation, as well as some revaluation effects.
iii. Mortgage advances are by far the most important type of bank credit, accounting for 48 per cent of banking survey claims on the private sector (narrow credit extension that creates deposits). Households source about 13 per cent of their credit from non-banks (representing an exchange of existing deposits).

Figure 8: Narrow and broad credit in South Africa



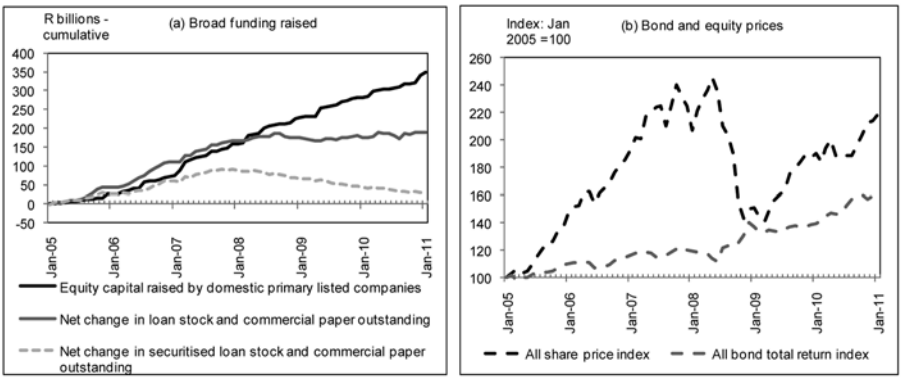
Sources: South African Reserve Bank; IMF International Financial Statistics Yearbook.

The significance of broad credit for the transmission mechanism is that the price of non-bank credit does not necessarily follow the central bank's policy rate to the same extent as bank credit. In South Africa, most mortgages have variable

interest rates that are linked to the prime rate, which is in turn linked at a fixed margin to the repo rate[13]. These formal linkages ensure the effective transmission of the repo rate to the most important component of bank credit, and therefore an immediate impact on household disposable income after mortgage payments. Even non-linked bank loans normally adjust to a change in the repo rate, albeit not necessarily with the same magnitude.

However, the cost of non-bank financing, such as the issuance of loan securities, is to a larger extent influenced by the general market climate, risk appetite of investors, the size of the issuance, demand and supply and the risk profile of the issuer. Figure 9 shows how bond issuance declined from 2009 as bond yields increased due to risk aversion, despite an accommodative monetary policy stance. Funding in the equity market continued to increase as share prices increased, partly supported by the low interest rate environment. This illustrates the looser relationship between the repo rate and the cost of funding in the capital markets.

Figure 9: Trends in broad funding raised



Source: JSE Limited

Policymakers should be cognisant of both narrow and broad credit. The most immediate and direct impact of changes in the policy rate is on households through their mortgage loans, and banks as providers of these loans. Most of the other types of bank credit also have variable interest rates and are similarly influenced by changes in the policy rate.

6.4.2. A Credit-Demand Channel: the Role of the Borrower's Margin

According to the traditional interest rate channel, a lower (higher) real short-term rate leads to declines (increases) in longer-term rates through the term structure of interest rates, which in turn increases (decreases) various types of demand,

[13] Not fixed by regulation or law, but by convention.

namely business fixed investment, residential housing investment, consumer durable expenditure and inventory investment (Mishkin, 1996:3). However, according to investment theory it is not only the cost of funding that drives investment demand, in particular, but also the expected rate of return on an investment. Putting this in context of the transmission mechanism implies that it is not the absolute level of real interest rates that affects the demand for credit as a source of funding, but the level of funding rates relative to the expected return of the borrower. For example, a borrower may be more willing to borrow at a 10 per cent interest rate in expectation of a 15 per cent return than to borrow at 4 per cent in expectation of a 5 per cent return. The concept of a 'borrower's margin'[14], representing the difference between funding rates and expected return, has an impact on the transmission mechanism.

The cost of finance (*i.e.* banks' lending rates) differs among borrowers, depending on their creditworthiness. Given the difficulties in determining the external financing premium for funding raised in the capital markets, as well as the difficulty of determining the opportunity cost of internally-generated retained earnings, this paper proposes the following: It is assumed that lending rates offered to borrowers encapsulate all financing premiums and are at competitive levels relative to the cost of funds that can be raised externally in the capital market as well as to the opportunity cost of internal funding. It is proposed that the demand for credit is a function of the borrower's assessment of the margin between the expected risk-adjusted return on investment[15] (or utility from goods and services in the case of consumer credit) and the cost of finance. This links up with the idea that monetary policy is transmitted through "changes in required rates of return rather than changes in the quantity of deposits" (Disyatat, 2010:9). The linkages between interest rates are shown in Box 1 (p. 93).

If borrowers can earn a positive margin, the quantity of credit demanded will increase. The supply of credit will increase as long as it is within the amount allowed by banks' capital adequacy requirements and supply constraints in the capital markets[16]. However, the risk associated with lending is likely to increase as the amount borrowed increases. This increases the cost of finance for borrowers and reduces their margin, eventually leading to a decline in credit demand and supply.

In terms of such a credit demand channel, the important factor that limits or encourages credit demand is the borrower's margin. Incorporating this variable into policy formulation requires a way to measure the private sector borrower's

[14] See, Kock (2010) for a complete discussion of the concept and calculation of the borrower's margin for South Africa.

[15] In the case of firms, the capacity utilisation of the existing plant or operation is an important determinant of the expected risk-adjusted return on investment.

[16] Disyatat (2010:16), "… firms decide how much to borrow given the loan rate" … "once a loan is granted, a deposit is created in the name of the firm".

Box 1: Linkages between interest rates[a]

Monetary policy:

Central bank sets the monetary policy interest rate (repo rate) = risk free rate

Transmission mechanism:

Credit supply

Banks' weighted average cost of funding = repo rate -/+ financing discount/ premium

Banks' lending rate[b] = banks' weighted average funding cost + premium

Credit demand

Borrowers' cost of finance = Banks' lending rate

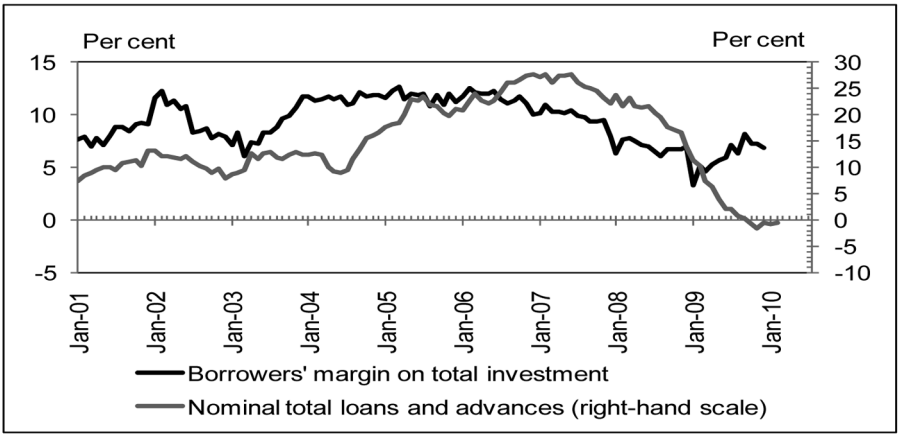
Borrowers' margin = borrower's return on investment – cost of finance

a. This box can be populated with data that is either readily available or derived from national accounts information for the economy in aggregate, to obtain an indication of whether credit demand should be increasing or decreasing.

b. In this analysis banks can be replaced by all financial intermediaries as "at the margin, all financial intermediaries (including commercial banks) have to borrow in the capital markets, since deposits are insufficiently responsive to funding needs" (Adrian and Shin, 2008).

return on investment[17]. Figure 10 shows the relationship between a calculated borrower's margin on investment in South Africa and growth in credit extension, and suggests that the borrower's margin tends to lead the credit cycle.

Figure 10: The private sector borrowers' margin



Source: South African Reserve Bank

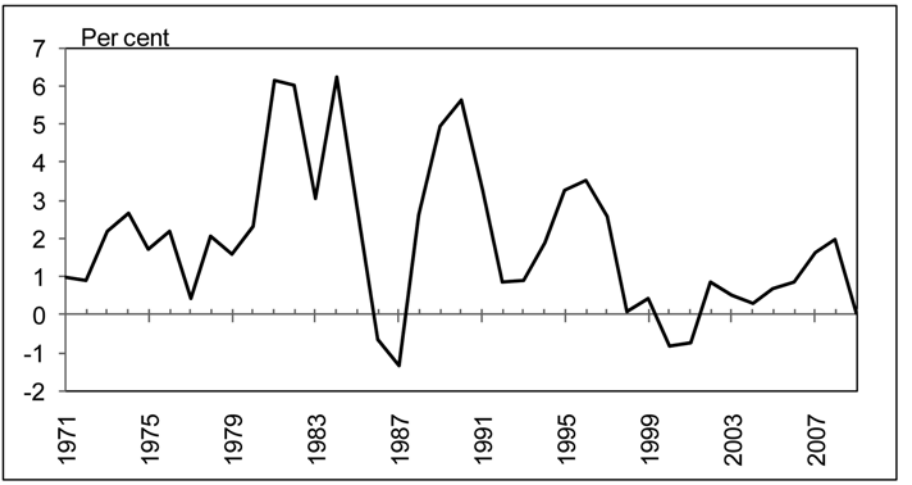
17 The borrower's return on investment can be calculated from national accounts data by adjustments to fixed capital stock at market value and historical cost and gross operating surplus to provide for depreciation, taxes and net interest payments.

The implication for the transmission mechanism is that the concept of the borrower's margin is a key determinant of demand for credit. This is particularly relevant to investment by businesses in the productive capacity of the economy, as well as in the funding of real-estate. Borrowers are not only sensitive to the level of interest rates, but also to their margin of return. This may at times call for supplementary policy instruments to support the policy rate.

6.4.3. Household Credit and Spending[18]

According to the transmission mechanism a change in interest rates affects household durable consumer spending and aggregate demand through the credit channel. In South Africa, the stock of bank credit not related to real-estate funding accounts for a relatively smaller portion of household credit. The change in the stock of non-mortgage credit, as well as the churn within this credit, provides finance for household spending, as shown in Figure 11.

Figure 11: Household non-mortgage credit as a percentage of household spending



Source: South African Reserve Bank

The implication for monetary policy is that, in South Africa, a major impact of the policy rate on household spending occurs through its effect on disposable income (net of mortgages) and on wealth effects, rather than only through direct effects on consumer credit demand to fund expenditure on durable and non-durable consumer goods and services. This reiterates the importance of credit for investment and for funding the acquisition of real-estate.

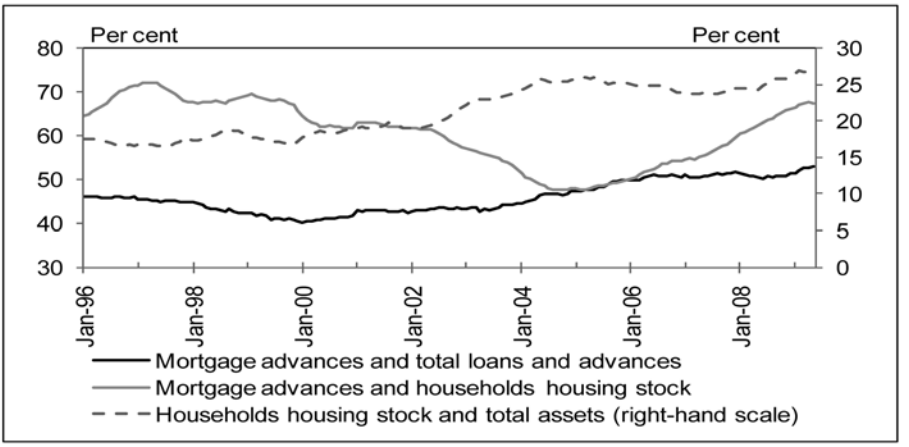
[18] See, Kock (2010) for a detailed discussion and calculations for South Africa.

6.4.4. Household Balance Sheet Effects

A major portion of the household sector's assets and liabilities are tied up in residential real estate and the financing thereof. Similarly, banks' assets are largely tied up in mortgage finance and exposed to changes in the value of collateral as house prices change.

For households, real estate assets represent both utility and an avenue to accumulate wealth by capturing price appreciation. The impact of monetary policy on both households and banks through the real-estate market is embedded in the contribution of mortgage loans to total loans and advances, the ratio of mortgage loans to households' housing stock, and the ratio of households' housing stock to total household assets. Figure 12 shows how all of these ratios increased during the upward credit cycle that started in 2004. Banks' exposure to mortgages increased, households' homeowners equity decreased as their indebtedness increased, and houses became an even larger portion of total household assets.

Figure 12: Ratios of house prices and balance sheet effects[a]



Source: South African Reserve Bank

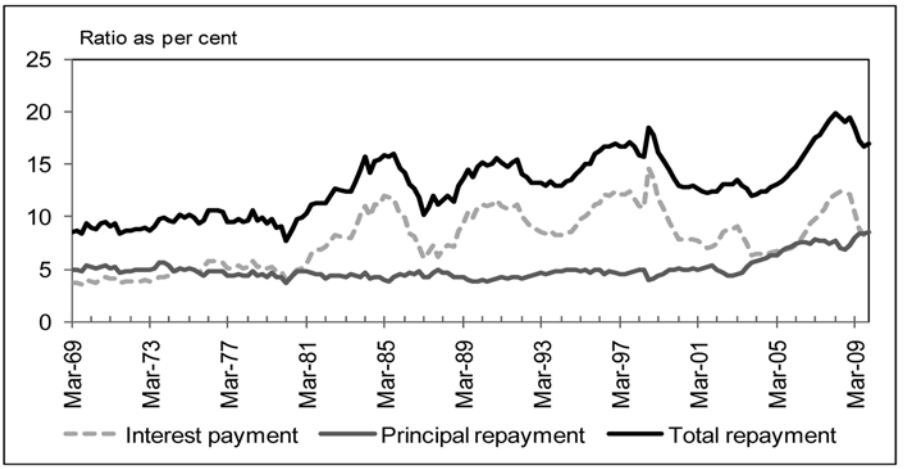
a. This analysis is based on seasonally adjusted normal stock values.

The provision of credit by banks is based on an assessment of the borrower's ability to service and repay the debt, which depends on the borrower's current and future income expectations, interest rates and the existing level of debt. Between 1999 and 2010 the ratio of household debt to disposable income in South Africa increased from 50 per cent to about 80 per cent.

While monetary policy can decrease or increase interest payments, it has no direct effect on principal repayments. As is shown in Figure 13, the increase in the level of debt in South Africa has had a marked impact on required principal repay-

ments. The transmission mechanism is affected by the overall debt level to the extent that overall indebtedness constrains borrowers' ability to take on new debt.

Figure 13: Amortisation payments on household debt to disposable income



Source: South African Reserve Bank

The implications for the transmission mechanism is that the sensitivity of household balance sheets to interest rates has increased, firstly because of the predominance of mortgage loans and, secondly, because of the high level of indebtedness. However, at high levels of indebtedness, households' commitments to repay principal dilute (magnify) the effect of a reduction (increase) in the policy rate on disposable income.

6.5. A Broadened Exchange Rate Channel

6.5.1. The Conventional Paradigm

The exchange rate channel is conventionally regarded as a subcomponent of the asset price channel. An inherent feature of this channel is the reaction of the exchange rate to changes in interest rates and their effect on interest rate differentials between currencies. In an international economic landscape characterised by globalisation, flexible exchange rates and capital flows, the interest rate effect is transmitted to the nominal exchange rate and relative prices in international markets, which directly affects net exports, aggregate demand and output, with an indirect effect through the balance sheets of both financial and non-financial firms (Mishkin, 1996:5; 2001:7).

In a very simplified way, the direct effects can be summarised as follows: An increase (decrease) in domestic interest rates results in wider (narrower) interest rate differentials relative to other countries, which in turn encourages (discourages) capital inflows. The effect is a relative appreciation (depreciation) of the currency. As a consequence, domestic goods become more expensive (cheaper) and foreign goods cheaper (expensive), causing a decrease (increase) in net exports and aggregate output (Mishkin, 1996:35).

The exchange rate also has an indirect effect through the balance sheets of financial institutions. The relative[19] amount of domestic debt denominated in foreign currency determines the balance sheet effect of changes in the exchange rate. In cases where banks have substantial amounts of foreign debt on their balance sheets, a currency depreciation causes bank and non-bank financial intermediaries' balance sheets to deteriorate as it increases their funding liabilities denominated in foreign currency. This weakens the net worth and capital base of lenders, which in turn leads to a decline in lending, investment and economic activity. The effects are aggravated if non-bank clients of banks also experience deteriorating balance sheet effects as a result of the rising values of their foreign debt (Mishkin, 2001:7-8).

6.5.2. A Capital Flows Channel

The conventional exchange rate channel is based on the notion that the exchange rate reacts in a predictable way to changes in interest rate differentials, *i.e.* when the domestic interest rate differential widens, the domestic currency nominal exchange rate should appreciate. However, the effects of a change in the policy rate may be very different for an open emerging-market economy, particularly if portfolio flows are not necessarily driven only by interest rate differentials. South Africa has been recording a deficit on its current account since 2003, which has consistently been financed mostly by portfolio investment inflows and some direct investment. For example, in 2009 net exports amounted to -R97,1 billion (*i.e.* a net import position equivalent to about US$11,5 billion at the average 2009 exchange rate). This was funded by a positive balance of R113,2 billion on the financial account (about US$13,4 billion), of which 83 per cent comprised net portfolio investment flows. The magnitude of portfolio flows in the South African economy make these flows at least as important as net exports in the exchange rate channel.

In addition to interest rate differentials, portfolio investment is determined by various other factors, which complicate an assessment of the reaction of the

[19] This channel becomes more relevant if an economy has a substantial amount of foreign-currency denominated debt. This is a lesser issue in South Africa because of moderate foreign debt levels. The impacts are reversed if the economy does not have foreign-currency-denominated assets.

exchange rate in an open emerging-market country to changes in the policy rate, and which also make the effect in the transmission mechanism more unpredictable. These factors include:

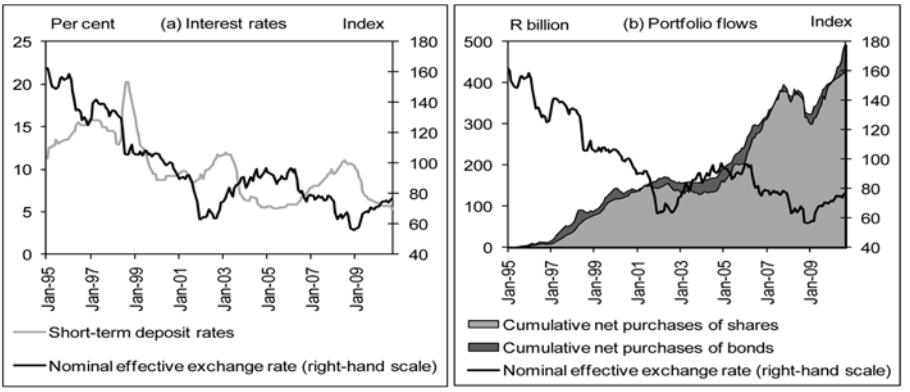
- growth expectations, which normally improve if real interest rates decline and which attract foreign investment into the domestic equity market, thereby lending a strengthening bias to the exchange rate;
- interest rate expectations: Expectations of lower nominal interest rates (and corresponding declines in bond yields) tends to drive demand for domestic bonds in order to benefit from the potential capital gains as yields decline, thereby lending a strengthening bias to the exchange rate. This bias is in contrast to the interest-rate-differential-based incentives for portfolio investment;
- exchange rate expectations: Portfolio investment is also driven by expected capital gains or losses as a result of exchange rate changes. If the domestic exchange rate is expected to appreciate (depreciate), foreign investors stand to gain (lose), irrespective of the level of interest rate differentials at that particular time;
- relative interest rate differentials: Even though domestic interest rates may be relatively low (or high) by historical domestic standards, they may be higher (lower) relative to those of other countries, thereby resulting in a relatively higher (lower) demand for interest-bearing portfolio assets. Capital flows are mainly determined by global economic conditions, and are largely exogenous to an open emerging-market economy;
- global risk appetite: Changes in the risk appetite of global investors have an influence on their pricing of risk. Excessive search for yield and risk appetite are typically accompanied by a general under-pricing of risk and high demand for emerging-market assets. Conversely, a flight to safe-haven assets is generally accompanied by an over-pricing of risk and selling of emerging-market assets, irrespective of whether domestic conditions in emerging markets have changed or not. These changes in investor sentiment have significant effects on exchange rates, irrespective of domestic monetary policy.

In a recent paper, Batini and Dowling (2011) found that during the financial crisis the depreciation phases in selected emerging-market currencies were largely dominated by safe-haven effects rather than carry trade activity or other return considerations. Subsequently, the appreciation phase that began at the end of 2008 seems to be largely driven by carry trade considerations, mostly induced by the US Federal Reserve's commitment to prolonged easing and the lowering of the Fed funds rate to near zero.

The various factors that affect the exchange rate work in various directions and complicate the exchange rate channel of the transmission mechanism. The effect of changes in the policy rate on the exchange rate becomes even more unpredictable because the composition of portfolio flows into an emerging-market country, and the relative importance of various factors that drive these flows, change continuously. This unpredictable relationship between interest rates and the nominal effective exchange rate of the rand is illustrated in Figure 14(a). The relationship varies between a negative and positive correlation, depending on prevailing circumstances. With expectations also playing a significant role in these trends, causality becomes even more blurred and often circular.

Likewise, Figure 14(b) suggests an inconsistent correlation between cumulative portfolio investment holdings and the exchange rate. However, it shows that in the South African context equity flows play a much more important role than bond flows, making capital flows (and the exchange rate) less sensitive to interest rate differentials.

Figure 14: Exchange rates, interest rates and net portfolio flows



Source: South African Reserve Bank

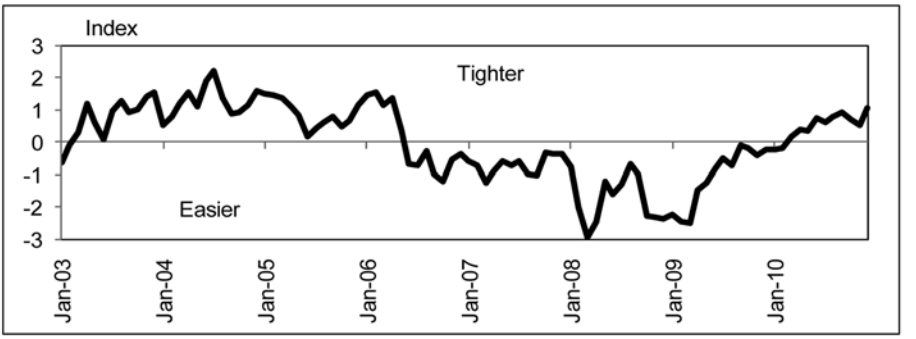
6.5.3. A Terms of Trade Channel and the Effect of Exchange Rate Shocks

In South Africa, monetary policy does not focus primarily on the exchange rate. The central bank does not intervene in the foreign exchange market to influence the level of the exchange rate, but follows a flexible exchange rate regime which is largely determined by trade and investment flows. Reserves accumulation is moderate, intended as an external buffer more than limiting exchange rate appreciation.

Policy-makers in South Africa as in the rest of the world tend to use the Monetary Conditions Index (MCI) as an input into their policy decision making, although limited importance is attached to it. As shown in Figures 15 and 16, the MCI for

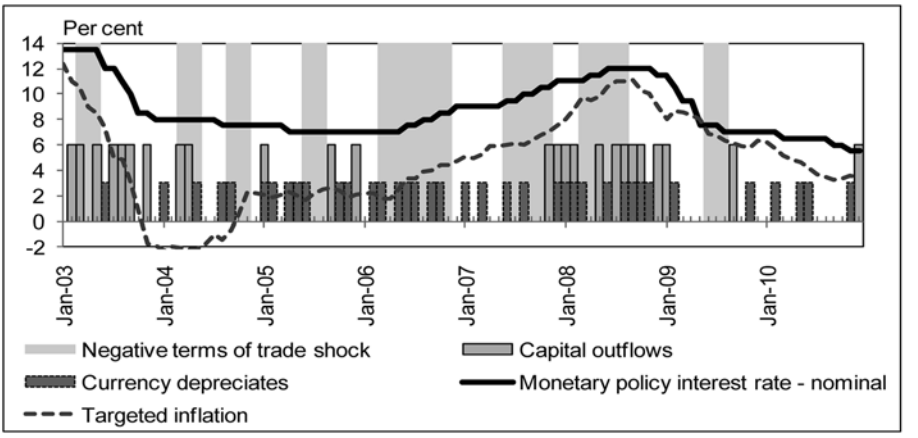
South Africa[20] remained relatively easy during the tightening cycle that started in 2006, before becoming somewhat tighter in 2010, towards the end of the subsequent easing cycle that started at the end of 2008. The MCI outcome reflected the weights attached to the real exchange rate and real interest rate.

Figure 15: The monetary conditions index in South Africa



Source: South African Reserve Bank

Figure 16: The international transactions channel in South Africa



Source: South African Reserve Bank

However, the MCI does not provide for the nature of the exchange rate shock (Mishkin, 2001:11). As shown in Figure 16, when the exchange rate depreciates (appreciates) because of capital outflows (inflows) it ought to lead to higher (lower) inflation and therefore justifies an increase (decrease) in interest rates.

[20] The MCI for South Africa is a normalised one-third and two-thirds combination of the real exchange rate (estimated in respect of most recent data points by applying the percentage change in the nominal exchange rate), and the real short-term interest rates (*i.e.*, the nominal rate on 3-month bankers' acceptances adjusted by targeted inflation shifted back twelve months and updated with Reuters inflation estimates).

This corresponded with the increase in interest rates in 2008, as well as the declines in interest rates in 2009 and in 2010. However, the interest rate response is different in the event of a real shock such as terms of trade shock. In these instances, the exchange rate depreciates (appreciates) in response to a negative (positive) terms of trade shock as exports decline (increase), lowering (increasing) aggregate demand. These effects ought to be deflationary (inflationary) and therefore justify a decrease (increase) in interest rates. According to this approach, South Africa experienced a positive terms of trade shock in 2009, and even more so in 2010. From 2009, South Africa experienced a deceleration in inflation, capital inflows, positive terms of trade and an appreciation in the exchange rate. The former two call for a decrease in interest rates and the latter for an increase. The MCI indicated tighter monetary conditions on account of the real exchange rate. This highlights the conundrums between the interaction between interest rates and the various channels of the transmission mechanism, and suggests that policymakers ought to look beyond the MCI and also factor in capital flows and changes in the terms of trade.

In conclusion, the role of the exchange rate in the asset price channel of the transmission mechanism, as referred to in some economic literature and comments by policymakers, does not take adequate account of the effect of capital flows on the exchange rate and how this may have changed in a globalised world. Literature on the exchange rate channel often focuses on trade flows (net exports), and assumes a too simplistic causality between interest rates and the exchange rate. In addition, exchange rate shocks and changes in the terms of trade can give misleading signals in terms of the MCI, as well as conflicting effects in terms of the interaction between interest rates and the various channels of the transmission mechanism.

6.6. Credit and Asset Prices[21]

Credit markets and asset prices are central in the transmission of monetary policy. Credit markets facilitate an exchange of funds for the acquisition of investment assets to accumulate wealth. Such investment assets, for example listed shares and real estate, are acquired in expectation of price appreciation, with the underlying assets providing collateral. Credit-funded investment drives up asset prices, thereby validating the expected increase, increasing collateral values and lowering loan-to-value ratios. This in turn facilitates more credit growth and a further reduction in perceived risk. Aglietta and Scialom (2009)[22] describe this self-feed-

[21] Mendoza and Terrones (2008:2), "The results show that credit booms are associated with periods of economic expansion, rising equity prices and house prices,..."

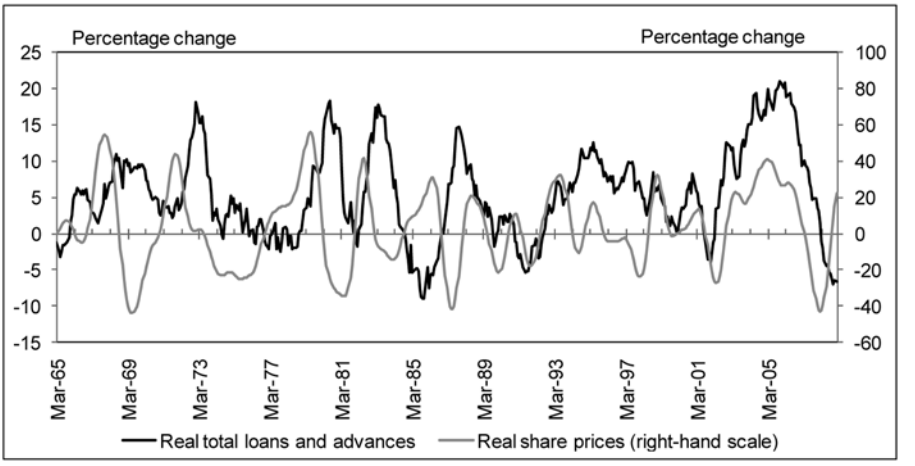
[22] Aglietta and Scialom (2009:7), describe this circular process as a vicious circle of increasing asset prices leading to an increase in the ratio of equity to debt with a concomitant decline in the probability of default and increased leverage.

ing process of credit and asset price increases, and conclude that credit markets have the propensity to move to extremes in close correlation with asset prices.

6.6.1. Credit and Share Prices

Figure 17 shows the trends in real total loans and advances and the real all-share price index in South Africa. A separate analysis of these trends revealed that, in all but one of the share price and credit cycles since the mid-1960s, the cycle in share prices led the credit cycle both at the upper and lower turning points. During the upward (downward) phases, the upper (lower) turning points of credit on average lags that of share prices by about 15 (18) months. The analysis clearly shows that an increase (decrease) in share prices validates an increase (decrease) in credit, with the rate of increase in credit extension only slowing (increasing) with a significant lag once it is confirmed that the increase (decrease) in share prices is not sustainable (has made way for an increase). Since the late 1990s, these lags have shortened.

Figure 17: Credit and share prices[a]



Source: South African Reserve Bank

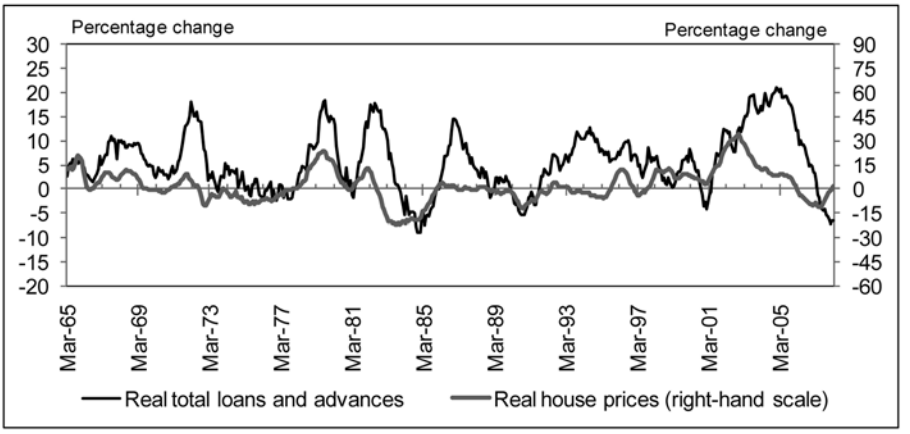
a. The share price is based on the JSE Limited all-share index, rebased to 2005 and converted to a real variable by adjusting for targeted inflation. The subsequent year-on-year percentage change was adjusted with a 23-term Henderson moving average. The year-on-year percentage change in the stock of real total loans and advances is derived using the nominal values adjusted for targeted inflation.

For the transmission mechanism, the implications are that monetary policy initially seems to affect share prices before credit, with subsequent feedbacks from the one to the other. Policymakers should be cognisant of the significant (though shortening) lag in the reaction of credit to asset prices, which tends to conceal actual credit conditions. Due to the circular feedback effects, share prices that rise (fall) represent an endogenous easing (tightening) of credit conditions.

6.6.2. Credit and House Prices[23]

A comparison of real total loans and advances and the real house prices as in Figure 18 shows that since the mid-1960's the upper and lower turning points of the house price and credit cycles coincided very closely, with house prices leading the cycles. This could partly be attributed to the fact that mortgage loans account for the largest portion of total loans and advances. These trends indicate that an increase (decrease) in house prices foreshadows an increase (decrease) in credit.

Figure 18: Credit and house prices[a]



Source: South African Reserve Bank

a. The year-on-year percentage change in the stock of real total loans and advances is the nominal values adjusted for targeted inflation. The year-on-year percentage change in real house prices is derived from the nominal seasonally adjusted Absa house prices adjusted for targeted inflation.

However, the upper turning point in the most recent cycle differs substantially from previous cycles, with house prices leading by 27 months. This lagged response in credit growth could be indicative of reluctance to accept that the prolonged upward trend in house prices had come to an end. This reluctance concealed the deterioration in credit conditions. The implication is that house prices play a key role in credit growth and credit conditions, and reflect the financial position of both borrowers and lenders. House prices that rise (fall) represent an endogenous easing (tightening) of credit conditions.

[23] Havylchyk (2010) found that South African banks are sensitive to changes in real interest rates and property prices because of the significant share of mortgages to total credit and the prevalence of flexible interest rates. This research also concluded that the main drivers of property prices are inflation, interest rates and building cost.

6.7. Links Between Monetary Policy and Financial Stability

The traditional theory on the transmission mechanism assumes a "simple, immaculate, inter-temporal substitution effect whereby changes in policy rates would induce expenditures shifting across time (and)… credit was implicitly supposed to respond only to interest rate movements" (Landau, 2011:1). However, financial frictions affect the transmission mechanism and cause the channels to react in different ways than those built into most central bank models. Excessive leverage and maturity transformation fuel rapid asset price build-ups and credit extension. Conversely, liquidity shocks and deleveraging are the drivers of financial instability and crises. Monetary policymakers assume that credit extension and asset prices are always sensitive to interest rates. However, the global crisis has shown that this is not necessarily the case: global deleveraging and asset price collapses occurred despite ultra-loose monetary policies in some countries. Even before the crisis excessive leverage had built-up and rapid asset price growth occurred in some countries despite fairly high interest rates (Landau, 2011:2). This was also the case in South Africa. In fact, the introduction of the National Credit Act, aimed at consumer protection rather than at containing credit extension, was more effective in reigning in bank credit growth than higher policy rates, in an environment where asset prices increased at double-digit rates.

The less-than-perfect sensitivity of credit to interest rates as well as the effect of market frictions may at times create a need for additional macroprudential policy tools in support of the interest rate policy (Landau, 2011:2).

The National Treasury of South Africa in February 2011 released a policy document[24] which contains a framework of how monetary policies, financial stability policies and fiscal and debt policies interact and support one another. This framework is partially represented in Box 2 (p. 105), which indicates how various policies interact and potentially support each other in the achievement of macroeconomic objectives.

This framework indicates that, while the policy rate is likely to remain the primary policy tool of monetary policy, it could be complemented by adjustments to liquidity facilities and central bank balance sheet policy (either tightening or expanding, depending on the policy stance). Similarly, regulatory and financial stability policy instruments could enhance the impact of interest rate policy, for example through capital requirements, loan-to-value adjustments, liquidity requirements or requirements relating to economic capital. Fiscal policies should also be complementary to monetary policy and financial stability policies,

[24] National Treasury (2011). A safer financial sector to serve South Africa better. 23 February 2011. Available at www.treasury.gov.za.

Box 2: A framework of policy interaction

Monetary policies	Financial stability policies	Fiscal and debt policies
Policy rate	Capital requirements	Fiscal policy
Liquidity facilities	Liquidity requirements & facilities	Debt management
Quantitative actions (central bank balance sheet policies	Economic capital	Reserves Management

Source: Gray & Malone, 2008. Adapted.

through effective and countercyclical fiscal budgets, debt management and reserves management processes.

6.8. Conclusions

This paper aims to provide a pragmatic assessment of the channels of the monetary policy transmission mechanism in an emerging-market economy such as South Africa. There seem to be some discrepancies between the theoretical assumptions regarding the transmission mechanism and its practical workings, in particular with regard to the following:

- the absence of an exogenous limit on credit growth;
- the amount of liquidity in the money market has an impact on the transmission of the policy rate to market rates. A central bank's balance sheet policy can either enforce or dilute its interest rate policy;
- the pricing of credit depends on the cost of banks' funding, clients' creditworthiness and the banks' appetite for credit risk. The policy rate has some, but not complete, control over these factors;
- the pricing and amount of bank credit have strong procyclical characteristics, with expectations also playing an important role;
- broad credit responds to changes in the policy rate, but are also influenced by supply of and demand for funding, risk appetite and the credit standing of the issuer;
- the borrower's margin (*i.e.* expected return in excess of the cost of funding) plays an important role in the demand for credit, which is not taken into account in the theory on the transmission mechanism;
- the policy rate affects household spending through its effect on disposable income (net of mortgages) and on wealth effects, rather than only through

direct effects on consumer credit demand. The stock of household credit consists predominantly of mortgage credit. The change in the stock of non-mortgage credit, as well as the churn within this credit, provides finance for household spending;
- the sensitivity of household balance sheets to interest rates has increased due to the predominance of mortgage loans, property prices and the level of household debt. This has increased the significance of the level of household debt and property prices on household credit and spending;
- the linkages between policy rate and exchange rate changes in a system of large portfolio flows are unpredictable and display circular causality;
- the theoretical explanations of the exchange rate channel of the transmission mechanism tend to focus on net exports, and should also take account of financial flows;
- exchange rate shocks and the terms of trade can give misleading signals in terms of the monetary conditions index;
- monetary policy affects share prices before it affects credit extension, with subsequent feedbacks from one to the other; and
- changes in house prices constitute an endogenous easing or tightening of credit conditions.

In summary, it is concluded that the policy rate has a significant impact on credit, aggregate demand, asset prices, output and inflation, but in a more complex way than proposed by the conventional theory on the transmission mechanism of monetary policy. There is also room for complementary policies (*i.e.* fiscal, financial stability and macroprudential) to support monetary policy in achieving its goals. However, these policies play a supportive role and cannot be a substitute for sound, conventional monetary policy.

References

ADRIAN, T. and SHIN, H., 2008, *Money, Liquidity and Monetary policy*, Federal Reserve Bank of New York and Princeton University, December.

AGLIETTA, M. and SCIALOM, L., 2009, *A systematic approach to financial regulation: a European perspective*, University of Paris West and CEPII, Working Paper 2009-29.

BATINI, N. and DOWLING, T., 2011, *Interpreting currency movements during the crisis: What's the role of interest rate differentials?*, IMF Working Paper WP/11/14.

BERNANKE, B., 2007, *The financial accelerator and the credit channel*, Speech given at The Credit Channel of Monetary Policy in the Twenty-first Century Conference, Federal Reserve Bank of Atlanta, Atlanta, Georgia, June 15.

BERNANKE, B. and GERTLER, M., 1995, "Inside the Black Box: The Credit Channel of Monetary Policy Transmission", *Journal of Economic Perspectives*, Vol. 9, No. 4, Autumn, pp. 27-48.

BRINK, N. and KOCK, M., 2010, *Central bank balance sheet policy in South Africa and its implications for money-market liquidity*, South African Reserve Bank Working Paper, WP/10/01, available on www.reservebank.co.za.

BOIVIN, J., KILEY, M.T. and MISHKIN, F.S., 2010, *How has the monetary policy transmission mechanism evolved over time?*, National Bureau of Economic Research, Working Paper No. 15879, April.

BORIO, C. and DISYATAT, P., 2009, *Unconventional monetary policies: an appraisal*, BIS Working Paper No. 292.

DISYATAT, P., 2010, *The bank lending channel revisited*, BIS Working Papers No. 297, February.

GRAY, D. and MALONE, S., 2008, *Macrofinancial risk analysis*, Wiley Finance.

HAVRYLCHYK, O., 2010, *A macroeconomic credit risk model for stress testing the South African banking sector*, South African Reserve Bank Working Paper WP/10/03, March.

INTERNATIONAL FINANCIAL STATISTICS,. *International Monetary Fund*, www.imf.org, Country Tables on South Africa.

KOCK, M., 2010, *A diagnostic of credit in South Africa*, South African Reserve Bank Discussion Paper, DP/10/15, October.

LANDAU, J.P., 2011, *The role of central banks: Lessons from the crisis*, Remarks as Deputy Governor at a Banque de France Symposium, Paris, 4 March.

MENDOZA, E.G. and TERRONES, M.E., 2008, *An Anatomy of Credit Booms: Evidence from Macro Aggregates and Micro Data*, Board of Governors of the Federal Reserve System, International Finance Discussion Papers No. 936, July.

MISHKIN, F.S., 1995, "Symposium on the monetary policy transmission mechanism", *Journal of Economic Perspectives*, Vol. 9, No. 4, Fall.

MISHKIN, F.S., 1996, *The channels of monetary transmission: Lessons for monetary policy*, National Bureau of Economic Research, Working Paper No. 5465.

MISHKIN, F.S., 2001, *The Transmission Mechanism and the Role of Asset Prices in Monetary Policy*, National Bureau of Economic Research, Working Paper No. 8617, December.

MISHKIN, F.S., 2007, *Globalisation, macroeconomic performance and monetary policy*, Speech at the Domestic Prices in an Integrated World Economy Conference, Board of Governors of the Federal Reserve System, Washington DC, 27 September.

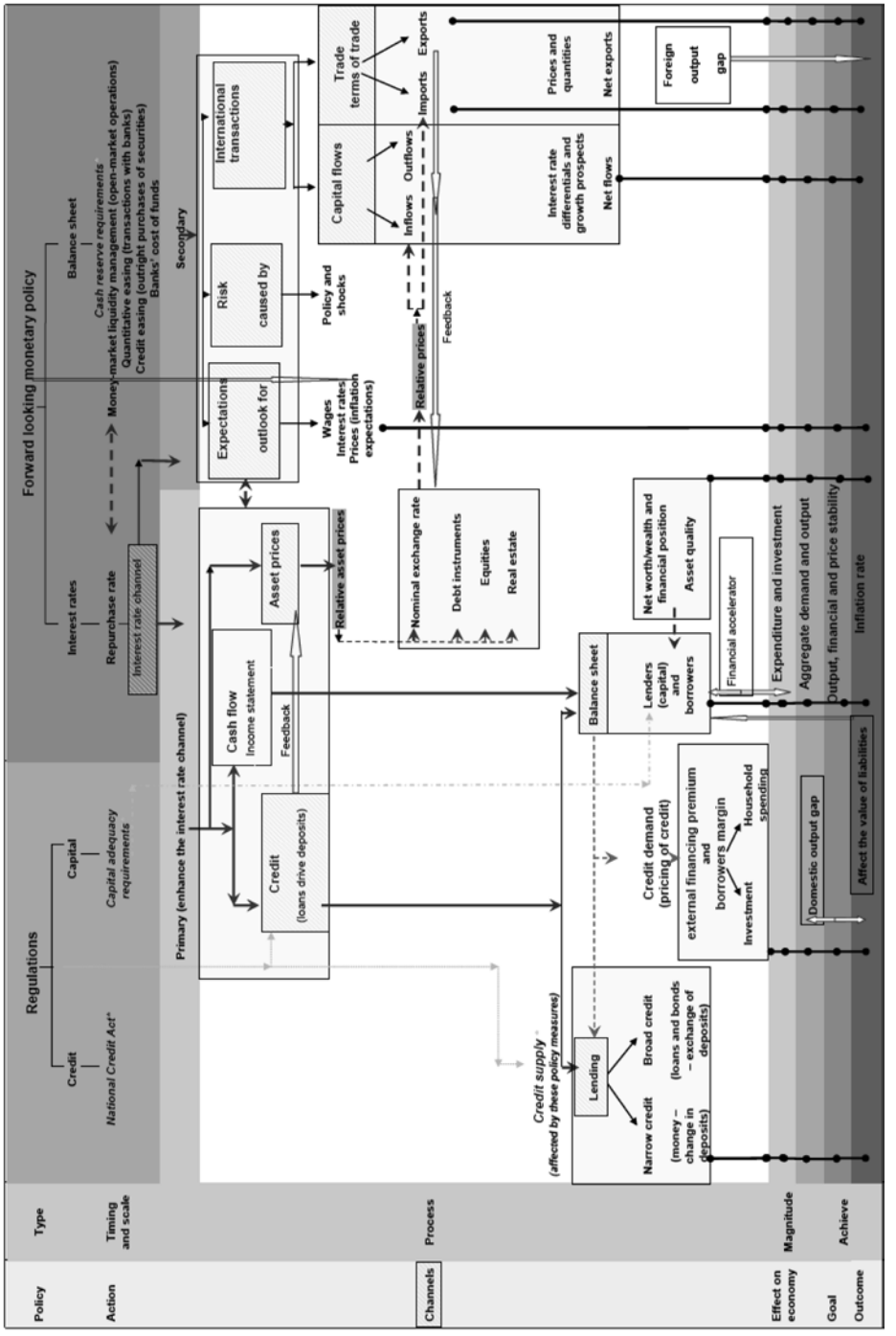
MOHANTY, M.S. and TURNER, P., 2008, *Monetary policy transmission in emerging market economies: what is new?*, BIS Papers No. 35.

NATIONAL TREASURY OF SOUTH AFRICA, 2011, *A safer financial sector to serve South Africa better*, Policy Document, 23 February 2011.

SOUTH AFRICAN RESERVE BANK AND BANKING ASSOCIATION OF SOUTH AFRICA, 2010, *Press release: The role of the prime rate and the prime-repurchase rate spread in the South African banking system*, 4 April 2010, available on www.reservebank.co.za.

WESSO, G.R. and KOCK, M., 2003, *Inflation expectations and the credibility of monetary policy in South Africa: some preliminary results*, South African Reserve Bank Working Papers, WP/03/04.

ANNEXURE: THE TRANSMISSION MECHANISM



7. Norges Bank's experiences with Publishing Interest Rate Forecasts

Amund Holmsen and Øistein Røisland

Abstract

Monetary policy works mainly through private agents' expectations. How precisely future policy intentions are communicated may, according to theory, have implications for the outcome of monetary policy. Norges Bank has gone further than most other central banks in communicating its policy intentions. The Bank publishes its own interest rate forecast, along with forecasts of inflation, the output gap, and other key variables. Moreover, Norges Bank aims to be precise about how the policy intentions are formed. In this note, we discuss the main arguments for publishing the interest rate forecast and validate against six years of experience with such forecasts.

7.1. Introduction

It is now widely accepted that monetary policy works mainly through private agents' expectations. The widespread influence of the New Classical Synthesis (New-Keynesian 'model') in academic research on monetary policy and the trend towards using DSGE models in central banks have underpinned the focus on expectations. Woodford (2005) puts it in a clear-cut way: "*For not only do expectations about policy matter, […] very little else matters*". The interest rate set by central banks is normally a very short-term interest rate, which in itself has minor effects on economic decisions. It is mainly expectations about future policy rates that affect market interest rates and thus economic decisions.

Most central banks communicate future policy intentions in one way or another. The majority of central banks communicate indirectly through forecasts based on technical interest rate assumptions, and by giving verbal signals about future interest rate decisions in policy statements and speeches. With such indirect communication, the market participants gain information about the *sign* of the future interest rate decisions, but may have less information about the *size* and the *timing* of interest rate changes. Until November 2005, Norges Bank used technical interest rate assumptions in the monetary policy reports. Since then, the Bank has used endogenous interest rate forecasts. Norges Bank was the second central bank that started publishing interest rate forecasts, following the Reserve Bank of

New Zealand which introduced it in 1997[1]. Later, also the Swedish Riksbank and the Czech National Bank started to publish interest rate forecasts.

The move to publication of the interest rate forecast was gradual. The decision to publish the forecast appeared as the next logical step in the development of the Bank's communication. Still, the novelty in the communication followed a thorough discussion of pros and cons of such an approach. As the Bank has gained experience with publishing interest rate forecasts, some concerns have been left behind and the internal analysis has developed. The introduction of interest rate forecasts demanded attenuated focus on making the framework comprehensible to financial market participants, to journalists, to banks and to a broader audience. A key issue was to convey the contingency and the uncertainty in the forecast. In general, our experience with publishing interest rate forecasts is that it has worked well. The arguments against publishing such forecasts, put forward by both academics and central bankers, have been manageable. We know of nobody today who argues that the Norges Bank should abandon interest rate forecasting, or analysts or observers who claim that they would be better off without this information. In the next, we shall explain our communication approach and experiences.

7.2. Transparency and Communication – The Academic Debate

There has been a strong trend towards increased transparency in monetary policy in the last 20 years. Transparency and communication have gained considerable attention in the academic literature in recent years. Some argue that transparency is important for democratic accountability, in particular when central banks have gained more independence. However, according to Geraats (2006), transparency practices do not seem to be driven primarily by required accountability. Instead, central banks appear to have embraced transparency for its perceived economic benefits. Geraats notes that transparency can have different types of effects on economic decisions, where the distinction between *information effects* and *incentive effects* is important. Information effects are direct effects of information disclosure, which implies that the public gets more information and the central bank looses a potential information advantage. Incentive effects are indirect effects where information disclosure alters the behaviour of the central bank.

The increased focus on the beneficial effects of transparency reflects the development in monetary theory. The earlier view was that monetary policy could affect the real economy only to the extent the central bank could *surprise* the market

[1] See Archer (2004, 2005) for a discussion of the New Zealand experience.

participants. This view can be illustrated by the fact that before 1994, the Federal Reserve did not announce its target for the federal funds rate, and left it to the market participants to try to figure it out. Such a view could be rationalised by models based on the "Lucas supply curve", where monetary policy could affect output and employment through unanticipated changes in inflation.

In the last decade, models based on policy surprise have been replaced by a new theoretical consensus based on the New Keynesian (New Neoclassical Synthesis) paradigm. Within this theoretical framework, monetary policy affects inflation and output mainly through expectations. By affecting private sector expectations, the central bank can achieve a better outcome of policy. Monetary policy has become 'management of expectations' (Woodford, 2003). Due to the important role of expectations within the New Keynesian framework, there has been enhanced focus on the role of commitment in monetary policy. Woodford (2005) highlights the benefits of commitment, and argues that in order to achieve these benefits, central banks should be transparent about their reaction pattern. By publishing the central bank's own forecast of the interest rate, it will be easier for private agents to confirm that the central bank follows a commitment strategy. Svensson (2006a and 2008) applies similar arguments in favour of publishing the interest rate forecast. Rudebusch and Williams (2008) provide a more thorough analytical argument within a New Keynesian model, and confirm the views of Woodford and Svensson that publishing the forecast of the interest rate path makes the private agents' estimate of the central bank's reaction function more precise, which improves welfare.

The literature on transparency is, however, not unambiguous as regards the merits of transparency. Morris and Shin (2002) showed in a much debated article that transparency could under certain assumptions be harmful, notably if private agents might put too much weight on public information and this information is erroneous. Svensson (2006b) showed, however, that with realistic parameter values, the Morris and Shin finding is turned into a pro transparency result. Walsh (2007) and Gosselin, Lotz, and Wyplosz (2008) have applied similar arguments within a New Keynesian model. Walsh shows that optimal transparency decreases with the degree of accuracy in the central bank's forecasts of demand shocks, while the optimal degree of transparency increases with the accuracy of the central bank's forecasts of cost-push shocks. Gosselin, Lotz, and Wyplosz show that transparency can be harmful if the central bank's forecasts of cost-push shocks are sufficiently noisy.

Despite the above cited arguments against (full) transparency, there seems to be consensus among researchers that central banks should be as transparent as possible about their objectives. With regard to the interest rate assumption behind the inflation forecasts, there is more disagreement. As mentioned above, Wood-

ford (2005) and Svensson (2006a and 2008) advocate publishing an endogenous interest rate path, while others are more sceptical. One commonly held view, *e.g.*, by Mishkin (2004) and Goodhart (2005), is that publishing the central bank's interest rate forecast might lead private agents to interpret the path as an unconditional promise and thereby put too much weight on the central bank's forecast.

Mishkin and Goodhart also give a more practical argument against publishing the interest rate path: It is difficult for a monetary policy committee to agree on a whole path of future interest rates. Blinder and Wyplosz (2004) argue that the choice of interest rate assumption could depend on the type of decision-making framework in the central bank. Agreeing on a specific interest rate path is particularly difficult, they argue, in individualistic committees like *e.g.*, the MPC in the Bank of England. However, based on the recent experience with publishing interest rate forecasts at the Riksbank, Svensson (2008) disputes the difficulty of such a committee deciding on an interest rate path.

Some have argued that policymakers themselves may put too much weight on the interest rate forecast when the forecast is published, in the sense that they may feel too constrained by the published interest rate path, particularly if publishing the interest rate path turns into prestige. It may then be more difficult to adapt the interest rate to economic developments. We will show in Section 7.3., however, that Norges Bank's forecasts have indeed been adjusted when economic developments have deviated from expectations. We would argue that deviating from the announced interest rate forecast is not perceived as costly to the central bank as long as it is possible to give plausible reasons for it. On the contrary, we would argue that *not* responding appropriately to new developments would harm the central bank's credibility far more than letting the interest rate deviate from the forecast.

The empirical literature on the effects of publishing interest rate forecasts is not vast. As no central bank has a long history of publishing interest rate forecasts, with the notable exception of the Reserve Bank of New Zealand, there are few empirical studies on this specific topic. Most of the empirical literature on transparency deals with aspects of transparency other than publication of interest rate forecasts, for example transparency about inflation targets, verbal communication, voting records etc. The ultimate objective of monetary policy is to provide a credible nominal anchor and, given that, contribute to macroeconomic stability. Transparency and communication can be regarded as a means to achieve the ultimate objective. Chortareas, Stasavage and Sterne (2002) and Cecchetti and Krause (2002), and Geraats, Eijffinger and van der Cruijsen (2006) find that transparency makes monetary policy more credible and better capable of achieving the ultimate objective. They do not, however, consider the last step of publishing the central bank's interest rate forecasts.

A large part of the empirical literature on communication considers predictability of monetary policy. If monetary policy becomes more predictable, there will be less volatility in market interest rates, and monetary policy becomes more effective. Evidence of improved monetary policy predictability due to transparency is provided by Muller and Zelmer (1999), Haldane and Read (1999), Poole and Rasche (2003) and Fracasso et al (2003).

There are only a few studies that consider the role of interest rate forecasts. Ferrero and Secchi (2009) study the effects of announcing future policy intentions, with focus on the Reserve Bank of New Zealand. Volatility in short-term money market rates on the days of interest rate decisions has decreased along with the introduction of qualitative and quantitative announcements on future policy intentions. There are too few observations to discriminate between qualitative and quantitative announcements in Ferrero and Secchi's study. Moessner and Nelson (2008) study the effects of communication in the US, the euro area, and New Zealand, and find that communication influences market rates. Moreover, they do not find any evidence that interest rate forecasts impair the functioning of financial markets, which has been claimed in the academic debate. Andersson and Hoffman (2009) consider the Reserve Bank of New Zealand, the Riksbank and Norges Bank and do not find any strong evidence that publication of interest rate forecasts increases monetary policy predictability. For New Zealand they find, however, some evidence that interest rate forecasts can increase the central bank's influence medium term market interest rates. Winkelmann (2010) finds that publishing the Norges Bank's interest rate forecasts has not increased the predictability of current interest rate decisions, but it has decreased the revisions of the expected future policy rate path and thus has improved the Bank's communication.

7.3. Norges Bank's Communication Approach

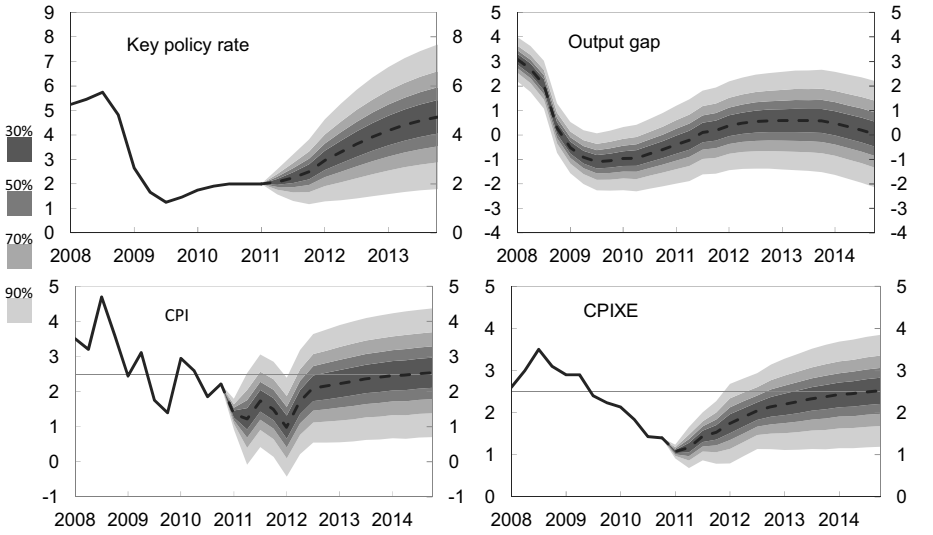
We will in the following describe how Norges Bank communicates the forecasts, the reaction function, and the criteria and assessments behind the chosen interest rate path and compare our approach with that of comparable central banks.

7.3.1. The Forecasts

Today, the central banks in New Zealand, Norway, Sweden and the Czech Republic publish forecasts based on an explicit endogenous interest rate path. Norges Bank and Sveriges Riksbank have forecasts of the policy rate, while the Reserve Bank of New Zealand and the Czech National Bank have forecasts of the money market rate, *i.e.*, the 90-day interest rate and the 3-month PRIBOR respectively.

Among the central banks publishing interest rate forecasts, all but the Reserve Bank of New Zealand present a probability distribution ('fan chart') around the point forecast of the interest rate. Communicating uncertainty through fan charts in the inflation reports was introduced by the Bank of England in 1997. The fan charts for inflation were meant "*to convey to the reader a more accurate representation of the Bank's subjective assessment of medium-term inflationary pressures, without suggesting a degree of precision that would be spurious.*" (Britton, Fisher and Whitley, 1998). While the fan charts for inflation illustrated that inflation could not be controlled perfectly by the central bank, this argument does not apply for the policy interest rate. The fan chart for the interest rate serves, however, a different purpose. It illustrates that the interest rate path is not a promise, but a forecast which is conditional on the outcomes of the other variables which are uncertain. Moreover, it reflects that the central bank adjusts the interest rate as a response to economic developments which are subject to uncertainty.

Figure 1. Baseline scenario in Monetary Policy Report 1/11



Sources: Statistics Norway and Norges Bank

Figure 1 shows Norges Banks' forecasts of the key variables; the key policy rate, the output gap, headline inflation (CPI) and underlying inflation (CPIXE). The fan charts are based on model simulations, where the shocks are identified using a small macro model[2] and historical variances of the shocks.

[2] Husebø *et al.* (2004).

7.3.2. The Assessments behind the Forecasts

The interest rate forecast has both a positive and a normative interpretation. First, it represents the expected path of future interest rate decisions. Second, it represents the way the Bank balances the various trade-offs in monetary policy. In balancing these trade-offs, Norges Bank aims at communicating the criteria and assessments as precisely as possible, without limiting the Board members' room for maneuvre. The Bank has developed a set of criteria for an appropriate interest rate path. The criteria serve both the purpose of communicating the reasoning behind the interest rate path to the public, and of providing an agenda for the Board's discussion, which makes it easier to decide on a particular path.

The criteria used by Norges Bank to assess the interest rate reflect the general policymakers' views and assessments. They are therefore not 'carved in stone', but can be changed and modified due to new insights. Currently, the Bank uses four criteria, which can be summarised as follows[3]:

1. Achievement of the Inflation Target

The interest rate should be set with a view to stabilising inflation close to the target in the medium term. The horizon will depend on disturbances to which the economy is exposed and the effects on the prospects for the path for inflation and the real economy.

2. Reasonable Balance between the Inflation Gap and the Output Gap

Norges Bank conducts flexible inflation targeting, which implies that stabilising inflation around the target should be weighed against stability in the real economy. The chosen interest rate path should therefore imply a reasonable balance between the objectives if there is a conflict in the short term between stabilising inflation around the target and stabilising the real economy.

3. Gradualism and Consistency

Interest rate adjustments should normally be gradual and consistent with the Bank's previous response pattern.

4. Robustness and Cross-Checking

As a cross-check for interest rate setting, any substantial and systematic deviations from simple, robust monetary policy rules should be explained.

How does Norges Bank make these criteria operational? To ensure consistency, the Bank produces the forecasts using a modern DSGE model[4], but where consid-

[3] See Qvigstad (2006) for a more thorough discussion of the criteria.
[4] See Brubakk *et al.*(2006) for a description of the model.

erable judgments are applied. One important issue that arises is how to model monetary policy. Norges Bank has chosen to use a loss function approach ('optimal policy') to guide the discussions. The loss function approach has the advantage over the instrument rule approach in being explicit about the objectives and the trade-offs. Currently, the Bank uses the following operational loss function:

$$L_t = E_t \sum_{k=0}^{\infty} \beta^k [(\pi_{t+k} - \pi^*)^2 + \lambda y_{t+k}^2 + \delta(i_t - i_{t-1}) + \gamma(i_t - i_t^S)^2]$$

where π_t is the inflation rate, π^* is the inflation target, y_t is the output gap, i_t is the nominal interest rate, and i_t^S is the interest rate implied by a simple robust rule (*e.g.*, a Taylor-type rule), see Alstadheim *et al.* (2010) for a further description. The first term in the loss function represent criterion 1 above. Adding the second term represents criterion 2. The third criterion is captured by the third term in the loss function, and the fourth term represents how we operationalize cross-checking in the policy analysis. The rationale for this term is that placing some weight on simple robust rule provides some insurance against model uncertainty.

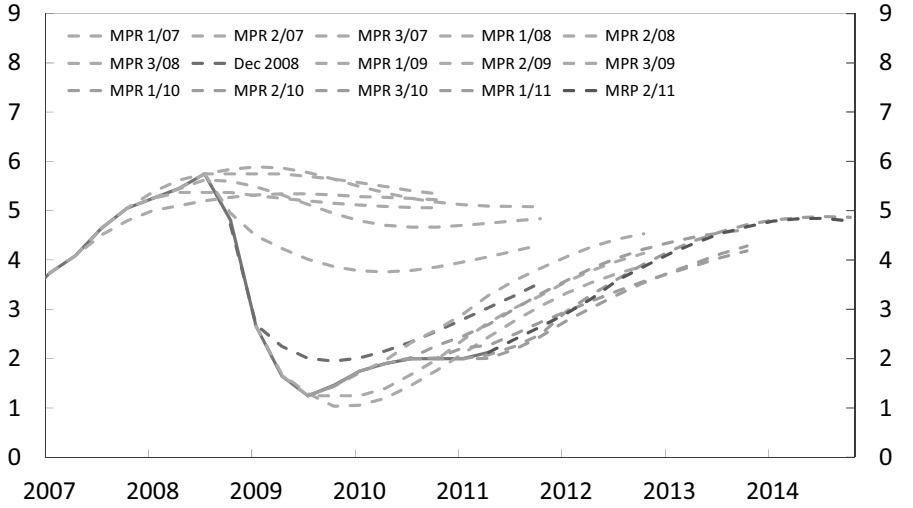
7.4. Experiences

After six years our experiences with publishing interest rate forecasts are in general good. Many of the arguments that had been raised against publishing such forecasts seem to have lost some power. For example, the argument that the market would not understand the conditionality of the forecasts, and that the central bank would feel overly constrained by the forecasts, does not seem relevant. As illustrated by figure 2 (p. 119), Norges Bank has indeed deviated substantially from the forecasts several times, and most markedly during the financial crisis.

The market participants seem to understand that the interest rate forecast is indeed a forecast, and not a promise. For example, the Norges Bank was not criticized for deviating substantially from the interest rate forecast in 2008. On the contrary, the Bank would probably have been criticized if it had not responded appropriately to the large negative shocks hitting the economy.

An important goal for the Bank's communication is that the market should understand our reaction pattern and respond appropriately when economic news occur. One implication of a good understanding by market participants is that announcement of the policy decisions should not lead to significant changes in market interest rates. Figure 3 (p. 119) shows the changes in the one-year money market rate at the dates where the policy decisions were made. If the policy decision was perfectly predicted, there should be no change in the money market rate.

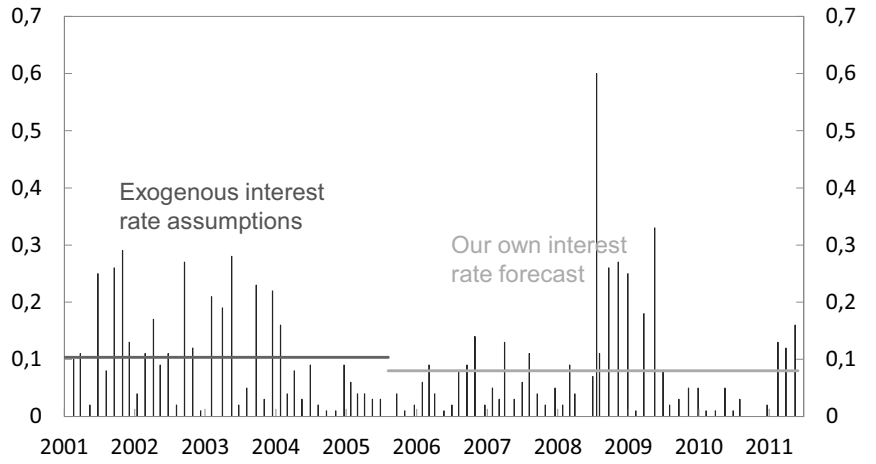
Figure 2: Norges Bank's forecasts and the realized interest rate path



Sources: Norges Bank

The flat lines represent the 'regime' average changes. We see that the average change for the period with endogenous interest rate paths is slightly smaller than the average for the period with exogenous interest rate assumptions. However, a number of large surprises during the financial crisis increase the average in the latter period. If we consider the events during the financial crisis as special, and focus on 'normal' times, policy decisions seem to have become more predictable. It is, however, still too early to make a strong conclusion on this issue.

Figure 3: Average absolute change in short term interest rates after policy announcements. 12-month NIBOR



7.5. Summary and Final Remarks

Norges Bank started to publish its own interest rate forecasts in november 2005. In addition to the forecast, Norges Bank strives to be transparent about its reaction function and the criteria used by the Board for assessing monetary policy in general and the interest rate forecast in particular. Even if several arguments against publishing the interest rate forecast have been raised in the academic literature, Norges Bank's experiences are so far reasonably good. The market seems to understand that the interest rate path is conditional on economic developments, and monetary policy appears to have become more predictable.

One internal effect of publishing interest rate forecasts is that it provides discipline in the decision process and good incentives for the staff. With an endogenous interest rate path, there is a stronger link between the assessments of inputs like investment, productivity, consumption etc, and the interest rate. Each sector expert may then see more directly the implication of his or her analysis for monetary policy. Moreover, computing optimal policy in a modern DSGE model as a normative benchmark brings policy discussions closer to the research frontier. Although it is important to recognise the simplifying assumptions and limitations of DSGE models, letting the interest rate forecast be based on optimal policy in such models forces the staff and the decision makers to use modern macroeconomic theory as a framework for discussions. The staff and the decision makers have to take a stand on challenging questions like: which variables should enter the loss function? What concept of the output gap should one apply? How important is the expectations channel? What type of issues is the model not suited to address adequately? If nothing else, the Bank's communication approach should make better economists.

References

ALSTADHEIM, R., BACHE, I.W., HOLMSEN, A., MAIH, J., and RØISLAND, Ø., 2010, "Monetary Policy in Practice", Norges Bank, *Staff Memo* No. 11, 2010.

ANDERSSON, M. and HOFMANN, B., 2009, *Gauging the Effectiveness of Quantitative Forward Guidance*, Evidence from Three Inflation Targeters, European Central Bank Working Paper 1098.

ARCHER, D., 2004, *Communication with the public*, paper presented at the Czech National Bank Conference on Practical Experience with Inflation Targeting, Prague, May 2004.

ARCHER, D., 2005, *Central Bank Communication and the Publication of Interest Rate Projections*, Paper presented at the Riksbank workshop "Inflation targeting: implementation, communication and effectiveness", Stockholm, June 2005.

BLINDER, A.S. and WYPLOSZ, C., 2004, *Central Bank Talk: Committee Structure and Communication Policy*, paper prepared for the session "Central Bank Communication" at the ASSA meetings, Philadelphia, January 9, 2005.

BRITTON, E., FISHER, P. and WHITLEY, J., 1998, "The Inflation Report Projections: Understanding the Fan Chart". *Bank of England Quarterly Bulletin* (February), pp. 30-37.

BRUBAKK, L., HUSEBØ, T.A., MAIH, J., OLSEN, K., and ØSTNOR, M., 2006, *Finding NEMO: Documentation of the Norwegian Economy Model*, Norges Bank Staff Memo 6/2006.

CECCHETTI, S.G. and KRAUSE, S., 2002, "Central bank structure, policy efficiency, and macroeconomic performance: exploring empirical relationships", *Review*, Federal Reserve Bank of St. Louis, July, pp. 47-60.

CHORTAREAS, G., STASAVAGE, D. and STERNE, G., 2002, "Monetary Policy Transparency, Inflation and the Sacrifice Ratio", *International Journal of Finance & Economics* 7, pp. 141-55.

FERRERO, G. and SECCHI, A., 2007, "The Announcement of Future Policy Intentions", presented at Banca d'Italia/CEPR Conference on Money, *Banking and Finance* 27 September 2007.

FRACASSO, A., GENBERG, H. and WYPLOSZ, C., 2003, *How do central banks write? An evaluation of inflation targeting central banks*, Geneva Reports on the World Economy Special Report 2. ICMB, Norges Bank and CEPR.

GERAATS, P., 2006, "Transparency of Monetary Policy: Theory and Practice", *CESifo Economic Studies* 52(1), March 2006, pp. 111-152.

GERAATS, P.M., EIJFFINGER, S.C.W. and VAN DER CRUIJSEN, C.A.B., 2006, *Does Central Bank Transparency Reduce Interest Rates?*, DNB Working Papers 85, De Nederlansche Bank.

GOODHART, C.A.E., 2005, *The Interest Rate Conditioning Assumption*, Financial Markets Group London School of Economics.

GOSSELIN, P., LOTZ, A. and WYPLOSZ, C., 2008, "The Expected Interest Rate Path: Alignment of Expectations vs. Creative Opacity", *International Journal of Central Banking, International Journal of Central Banking,* vol. 4(3), pp. 145-185.

HALDANE, A. and READ, V., 1999, "Monetary policy and the yield curve", *Bank of England Quarterly Bulletin*, May 1999, pp. 171-176.

HUSEBØ, T.A., MCCAW, S., OLSEN, K. and RØISLAND, Ø., 2004, *A Small Calibrated Macromodel to Support Inflation Targeting at Norges Bank*, Staff Memo 2004/3. Oslo, Norges Bank.

MISHKIN, F., 2004, *Can Central Bank Transparency Go Too Far?*, NBER working paper 10829.

MOESSNER, R. and NELSON, W.R., 2008, *'Central Bank Policy Rate Guidance and Financial Market Functioning*, BIS Working Papers, vol. 246.

MORRIS, S. and SHIN, H.S., 2002, "The Social Value of Public Information", *American Economic Review* 92, 1521-1534.

MULLER, P. and ZELMER, M., 1999, "Greater Transparency in Monetary Policy: Impact on Financial Markets", *Techincal Report No. 86*, Bank of Canada.

POOLE, W. and RASCHE, R.H., 2003, "The impact of changes in FOMC disclosure practices on the transparency of monetary policy: are markets and the FOMC better 'synched'?", *Review*, Federal Reserve Bank of St. Louis, January, pp. 1-10.

QVIGSTAD, J.F., 2006, *When does an interest rate path 'look good'? Criteria for an appropriate future interest rate path*, Norges Bank Working Paper 2006/5.

RUDEBUSCH, G. and WILLIAMS, J., 2008, "Revealing the Secrets of the Temple: The Value of Publishing Central Bank Interest Rate Projections" in *Asset Prices and Monetary Policy*, ed. by J.Y. Campbell: Chicago, University of Chicago Press, 2008, 247-284.

SVENSSON, L.E.O., 2006a, "The Instrument-Rate Projection under Inflation Targeting: The Norwegian Example" in *Stability and Economic Growth: The Role of Central Banks*, Banco de Mexico, 2006, 175-198.

SVENSSON, L.E.O., 2006b, "Social Value of Public Information: Morris and Shin (2002) Is Actually Pro Transparency, Not Con", *American Economic Review* 96, 2006, 448-451.

SVENSSON, L.E.O., 2008, *Transparency under Flexible Inflation Targeting: Experiences and Challenges*, Paper presented at the Riksbank's conference "Refining Monetary Policy: Transparency and Real Stability", Stockholm on September 5-6, 2008.

WALSH, C., 2007, "Optimal economic transparency", *The International Journal of Central Banking* 3(1), March 2007, 5-36.

WINKELMANN, L., 2010, *The Norges Bank's key rate projections and the news element of monetary policy: a wavelet based jump detection approach*, Discussion Paper No. 62, Freie Universität Berlin.

WOODFORD, M., 2003, *Interest and Prices: Foundations of a Theory of Monetary Policy,* Princeton University Press, 2003.

WOODFORD, M., 2005, *Central-Bank Communication and Policy Effectiveness*, paper presented at FRB Kansas City Symposium on "The Greenspan Era: Lessons for the Future", Jackson Hole, Wyoming, August 25-27, 2005.

8. China's Saving and Exchange Rate in Global Rebalancing

Guonan Ma and Robert McCauley[1]

8.1. Introduction

The widening of the Chinese current account surplus from the neighbourhood of 2% of GDP around the turn of the century to as much as 10% of GDP before the global financial crisis led to calls for the renminbi to be revalued. The rationale for this call is that a stronger renminbi would make Chinese exports less competitive and imports cheaper for Chinese consumers. This rationale is based on a conception of external surplus as a function of relative prices that the exchange rate can alter to produce a desired narrowing in the surplus.

Another, and in many ways richer, conception of China's external surplus is that it reflects a shortfall of the domestic absorption of output, whether consumption, investment or government spending, in relation to the productive capacity of the economy. Viewed from this perspective, the Chinese economy in this century showed a rise in investment in relation to output, but an even larger rise in savings. The gap between the substantial rise in investment as a share of output and the stronger rise in savings produced the current account surplus. On this view, to understand the widening of China's current account requires an answer to the question: what drove savings up?

Our examination of China's savings rate emphasises the contribution of both corporate and government savings more than that of households. On this view, many popular accounts of the rise in Chinese savings, such as household income insecurity, suffer from not explaining the behaviour of firms or the government, whose savings showed the greater rise. Corporate savings rose in classical fashion as profits rose, and wages declined, as a share of output. Government savings rose as the revenue dividend from higher growth was ploughed to a considerable extent into public capital formation.

When the global financial crisis hit, the Chinese public finances permitted an increase in direct spending and an even larger increase in infrastructure investment by agencies created by subnational governments. This response shrunk the current account surplus substantially but only by raising investment to an unprecedented and unsustainable share of output. The scale and distribution of the con-

[1] Robert.mccauley@bis.org; guonan.ma@bis.org. The views expressed in this paper are not necessarily those of the Bank for International Settlements (BIS). We would like to thank the participants of the SUERF conference in Brussels in May 2011 and Stephen Cecchetti for comments and Lillie Lam for her able assistance.

tingent liabilities of the Chinese government for this investment boom remain a matter of keen debate.

Looking forward, demography and politics are working together to narrow China's current account surplus. Real wages are rising rapidly, making Chinese exports less competitive and pointing to higher consumption and less corporate profits and savings. For its part, the government may shift its spending from building infrastructure to providing services.

In this scenario of a rebalancing Chinese economy toward consumption and government services, the exchange rate can continue to play a complementary role. If the renminbi continues to appreciate in real terms, it would help to shift production from exports to goods and services for home use.

Our review of the management of the renminbi suggests that policy has been prepared to some extent for such a shift. Policymakers broke the peg to the dollar in 2005, and, after a transition period of a year, they allowed the renminbi to trade as if it were being managed to appreciate gradually against a broad basket of trading partner currencies. This experiment was interrupted by the global financial crisis, but may have resumed in some fashion in mid-2010.

However one interprets the data, it is clear that the renminbi had by end-2010 appreciated by a sixth against the currencies of its trading partners. This nominal appreciation combined with China's higher inflation than that of its trading partners to produce a real effective appreciation of over a quarter by end-2010.

The paper first reviews Chinese savings behaviour and then the management of the renminbi. These discussions draw on our published work but extend it with a forward looking view.

8.2. Saving-Investment Perspective

China has been one of the largest surplus economies globally in recent years. Its current account surplus widened considerably in the 2000s and ranged between 5% to 10% of its own GDP during 2005 to 2010. In terms of the world GDP, it ranged between 0.3% to 0.7%. While there are many ways to examine the sources and causes of China's large current account imbalances, we focus on the saving-investment balance.

8.2.1. China's Exceptionally High Saving Rate

China is an economy marked by both high saving and high investment. In 2010, its gross national saving reached 53% of GDP, and investment spending 48%, leaving a current account surplus at 5% of GDP. Such a high saving rate has

attracted much attention in the context of global imbalances and global financial crisis (Bernanke, 2005; ADB, 2009; and Zhou, 2009).

By definition, a high and rising saving rate implies a low and falling consumption share in the Chinese economy. China's share of private consumption in GDP declined from 46% to 36% between 1995 and 2010. However, contrary to common perceptions, China's private consumption has not been at all weak by any measure. Its consumption expenditure has grown at a strong pace of some 8% per annum over the past fifteen years. The penetration of most consumer durables such as colour TVs, refrigerators, washing machines and air conditioners tripled during these fifteen years. Private car ownership more than quadrupled, albeit from a tiny base. Meanwhile, outbound Chinese tourists increased more than eight times.

Yet, the overall Chinese economy grew even faster than consumer demand in the 1990s and 2000s. Its GDP growth on average registered 10% annually between 1995 and 2010, powered mainly by stronger investment demand. Fixed asset investment increased at a breakneck speed of more than 12% a year over these fifteen years, as its share in GDP rose from 40% to a staggering 48% by 2010. Remarkably, such a high level of investment has been more than financed by even higher and rising saving since the early 2000s. China's gross national saving rose from 40% of GDP in 1995 to 53% in 2010. As a result, the current account surplus surged from around zero to 10% of GDP in 2005, before falling back towards a still high level of 5% of GDP in 2010 (Graph 1, p. 139).

From the saving-investment perspective, the key to understanding China's recent large current account surpluses clearly lies not in insufficient investment but in extremely high domestic saving. If anything, there have been many expressions of concern about the risk of over-investment in China among academics, think tank economists, market analysts and even Chinese policymakers.

China's aggregate saving rate has been exceptionally high relative to its own history, compared to its Asian emerging market peers or relative to any empirical model predictions. During the 2000s, China's aggregate marginal propensity to save exceeded 60%. Within one decade, China swung from an international net debtor of 10% of GDP to an international net creditor of 30% of GDP, even though its per capita GDP remained well below US$5,000 (Ma and Zhou, 2009). China now is the highest saver in the world, having edged out Singapore. China emerges as a clear outlier in almost all cross-sectional or panel estimation exercises, with its actual saving rate typically 10 to 15 percentages higher than predictions (Ma and Wang, 2010).

8.2.2. Main Drivers behind High Chinese Saving

Both the dynamics and composition of China's rising gross national saving defy any simple interpretation. All three sectors in the Chinese economy – household, corporate and government sectors – have been high savers. Yet, taken individually, none is an exceptional saver by comparison to its global counterparts. Instead, high saving by all three sectors makes China's aggregate saving rate exceptionally high. And contrary to conventional wisdom, the Chinese household sector accounted for less than one-sixth of the increase in China's gross national saving in the 1990s and 2000s. The corporate and government sectors made the big contributions to the rising Chinese saving over the past fifteen years (Graph 2, p. 139). In particular, the saving of the government sector almost tripled, from 4.4% of GDP in 1992 to 11% by 2008, as robust revenues were ploughed into public works.

The factors behind China's high and rising saving rate are likely multiple, leaving many puzzles to be resolved and suggesting that a cocktail of policies might be needed to rebalance the Chinese economy. At minimum, the principal causes for high Chinese saving in the 2000s include two sets of forces (Ma and Wang, 2010). These two sets of forces interacted with each other to drive China's gross national saving higher during this period.

The first set consists of powerful structural forces in the domestic Chinese economy. As described by Lewis (1954), surplus rural labour allowed rapid industrialisation paced by capital-widening investment, and the ready pool of migrants kept wages from rising (Lewis, 1954). This transition was accentuated by the commune system's keeping millions of surplus peasants down on the farm for decades and the very compressed demographic transition, featuring a rapidly falling ratio of child dependents on working-age adults. This transfer started at a time when the communes were collapsing under Deng Xiaoping. A central result of such a large-scale transfer of labour at a relatively stable wage is a falling labour share of output and correspondingly rising profit and savings rates in the economy. As a result of high returns to capital, investment has picked up considerably, driving faster economic growth which further lifted saving rate. China's WTO accession and the supportive global growth environment have also well accommodated this huge social and economic transition.

The other set of factors encompasses some of the key institutional changes that took place in China during the 1990s and 2000s. These include labour downsizing at state companies, reform of the pension system and introduction of private home ownership. In particular, employment at the state companies, which used to provide much of the social welfare and security, almost halved during 1995-2005. This large-scale corporate restructuring enhanced efficiency for the corporate sector while giving rise to increased job insecurity and expenditure uncer-

tainty for the household sector. These added to private saving by both the household and corporate sectors. Also, the pension reforms in China so far have resulted in reduced pension benefits and increased contributions to various government pension schemes, thus lifting both private and public saving. Finally, the introduction of private home ownership and the housing market in the 1990s have boosted household demand for real estate assets and increased land revenues to the Chinese government in a high growth environment, again pushing up both public and private saving.

In addition, other government policies may have also played a role in lifting the Chinese saving rate. These include a long-held promotion policy for officials that encourages investment rather than social services, slow weaving of the new social safety net after the widespread shutdown of state companies, considerable entry barriers to and a heavy tax burden on services and the still limited access by small companies and households to credit.

Of these, the most important may be the promotion policy for government officials. Since a record of rapid growth has met with rewards, Chinese local government officials have had a strong incentive to invest additional public revenues, as this may boost GDP growth in the short term and increase the odds of their promotion. At 12% of GDP, China's government consumption is not low relative to many emerging market economies, but it has room to rise toward 15% of GDP over time, judging from the OECD standard. That alone would halve China's current account surplus currently at 5% of GDP.

Other commonly-cited policies are somewhat less convincing accounts of the path of Chinese savings. It is sometimes suggested that high Chinese saving mostly relates to government subsidies, distortions and market power of state-owned enterprises, for instance, in telecommunications and energy. While such frictions may help explain inefficiency, they are not very useful in offering insight into why China's aggregate saving rate suddenly surged in the 2000s, after a period of notable declines in gross national saving and significant economic liberalisations in the 1990s (Ma and Wang, 2010).

The potential contributions of these frictions need to be more carefully gauged. Firstly, much of the higher corporate saving has been driven by indigenous private firms, which have played a much greater role in the Chinese economy in the past two decades. Their uncertain and restricted access to credit may account for their reliance on retained earnings to fund expansion. On this view, not subsidies and monopoly to state-owned enterprises but the lack of access to credit of private firms makes sense of higher corporate savings. However, large private firms in China have much better access to credit nowadays. Also, more restricted access by small firms to external financing has been a problem globally, and it is not clear that China is worse or better in this aspect. Secondly, another frequently

cited factor, the limited availability of consumer credit, may indeed force Chinese households to save more than otherwise. But it cannot explain much of the rise in the aggregate savings rate, since households played only a secondary role in its recent rise. Moreover, household loans expanded significantly relative to both the household income and economy, precisely at a time when both gross national saving rate and household saving rate rose markedly.

8.2.3. Implications for Rebalancing and Prospects

China's saving rate is central to any evolution of its internal and external balances, for two reasons. First, China needs to move to a more balanced and sustainable twin growth engine firing on both consumption and investment demand. By definition, any meaningful shift away from an investment-driven growth model to a more consumer-oriented one requires a decline of the extraordinary saving rate. Second, to narrow its large current account surplus from the recent 5%-10% of GDP, China will have to principally trim its exceptionally high saving rate, given its already very high investment rate.

It should be noted that the medium-term outlook for China's saving rate matters not only for its future economic growth path but also for rebalancing of the global economy. Given that China is a large and fast-growing surplus economy, the rest of the world could best manage the tensions between sustaining global growth and narrowing global imbalances via Chinese domestic rebalancing. Of course, corresponding and meaningful domestic restructuring on the part of major deficit economies is equally imperative, if global current account imbalances are to be narrowed.

One key challenge for Chinese policymakers in the coming decades, though, is to maintain robust internal demand while rebalancing the economy more towards consumption. In this regard, a fascinating question during this anticipated transition is whether China's private consumption growth could accelerate to say 12% a year so as to maintain its current 9%-10% GDP growth. Alternatively, consumption growth could maintain its current pace of around 8%, leaving its economy to slow noticeably towards around 6%, via a combination of slower investment expenditure and smaller net exports.

Both domestic structural factors and policy measures could influence such a transition. Three structural factors can be highlighted in view of their implications for the evolution of the Chinese saving rate in the coming decade: state-enterprise restructuring; demographic change; and continued urbanisation. At the same time, policy can play a useful role in deregulating the economy, strengthening the safety net and improving the financing and incentives for the provision of government services.

8.2.3.1. Structural Factors

First, it is reasonable to assume that the large-scale labour retrenchment observed during 1995–2008 is at writing by and large behind us. In these years, 73 million jobs in the urban state sector were shed, even while 110 million jobs on net were created in the cities. Going forward, the scope for one-off large-scale efficiency gains and cost saving in the corporate sector will be more limited, and the associated income and expenditure uncertainties for Chinese households should become less pronounced. This is more so given that the social safety net is nowadays less based on a connection to state enterprises and much more a part of the general government services. That in turn will dampen private saving by both the household and corporate sectors.

Second, China can hardly avoid a phase of accelerated population ageing within a decade, which carries two implications. On the one hand, growth of the Chinese labour force will slow down. This could lead to a declining household saving rate and a slower pace of corporate investment spending, likely resulting in lower potential output growth unless productivity growth surprisingly rises in an offsetting manner. Indeed, China's working-age population could stop growing in 2015 and start shrinking afterwards for ten years or more. On the other hand, China's government and firms may invest strongly in infrastructure and manufacturing capacity for some years to come, to build up the physical capital stock and pension assets in preparation for the ageing of the population, to invest in labour-saving processes in manufacturing as well as to accommodate ongoing urbanisation. Hopefully, while slower growth and an ageing population work to lower the saving rate, the urbanisation momentum and need to invest in labour-saving technology may keep investment robust.

Third, the migration from agriculture to the cities is likely to continue in the years ahead, as the urban share of the population is projected to rise from the current 45% to 60% in a decade. However, although fast economic growth and labour-intensive export industries have been absorbing rural surplus labour for twenty five years, there are some early and tentative signs (and considerable academic debate) that China is at or approaching the 'Lewis turning point' when much of the surplus rural labour has been absorbed into the modern economy, entailing faster wage increases going forward (Garnaut, 2010). When pressure on labour supplies in agriculture reaches this point, industrial wages have to rise to attract further migrants into industry. Then, wages can rise faster than productivity, raising labour's share of income and depressing corporate saving (while appreciating the renminbi in real terms). Then personal consumption can gradually displace investment in China's internal demand profile. Recent reports of double-digit wage growth highlight the important role of this factor.

Taken together, a key implication from these medium-term structural forces is that China's aggregate saving rate over the next 10 years is likely to plateau and then to ease off noticeably from the current rate of over half of output. Pronounced structural change should underpin such an expected decline in the Chinese saving, albeit only gradually. The marked U-shaped experience of China's saving rate between 1982 and 2008 also suggests that the prospective Chinese saving rate can fall meaningfully in the years ahead. At the same time, investment may remain strong for some years to come. Combined, we expect China's current account surplus to trend lower, if policy supports are also in place.

8.2.3.2. Policy Changes

During this process, government policy can play a useful role in assisting the desired transition to a more balanced growth model. At least three complementary sets of domestic policy options would help: deregulating the economy, strengthening the safety net and improving the financing and incentives for government provision of services.

First would be further deregulation. This could facilitate rural-urban migration, enhance the access of small firms to external financing and reduce entry barriers in the labour-intensive services sector to create more jobs and support the demand for labour and wage growth, thus stabilising the labour income share and boosting private consumption. These liberalisation moves would also facilitate the reallocation of resources to non-tradable sectors while supporting domestic consumer demand. The Chinese government has recently rolled out policies to assist rural migrant labour, to lower some of the taxes on service industries and to encourage more bank credit to flow to small companies which have been the main source of job creation in China. In addition, venture capital and private equity funds are advancing rapidly in the Chinese domestic market, helping to sustain corporate investment while lessening the need for internal financing and thus potentially lowering corporate saving.

A second option would be a strengthened social safety net. The current public welfare system remains fragmented and its coverage is still quite limited. The recent moves to enhance benefit portability and to broaden the coverage of social welfare and insurance programmes are encouraging initiatives in this direction. And more can be done, such as improving the transparency and management of the various public social welfare funds to boost public confidence, which would enhance the substitution between private (voluntary) and public (mandatory) saving. But, a poorly designed social safety net could also entail its own risks, as many countries have demonstrated. These include the questionable credibility of an over-generous social welfare scheme in the context of an expected rapid population ageing and its potential for unintended side-effects on current employ-

ment, saving and consumption decisions. An enhanced social safety net should first and foremost serve the purposes of social equity and risk pooling and should not be used as a makeshift and ultimately unsustainable means to quickly lift personal consumption growth beyond the recent 8% pace.

A third group of policy options would aim to improve the financing and incentives for the provision of higher levels of social and public services by various levels of the Chinese government. These may include the transfer of some listed state company shares to the national pension fund, higher dividend payouts by state firms to the government out of corporate profits, an enhanced role for the central government in funding social spending, and tilting the promotion standards for government officials to encourage provision of public services. Since 2009, the Chinese government has announced a series of new policies to gradually require higher remittance of profits of state companies to the government, which would be used to fund the pension schemes, social spending programmes and income tax reductions for low-income families. The new five-year plan rolled out in early 2011 also proposes to include better public services into the new promotion criteria for local government officials.

In sum, changing structural forces and sensible policy initiatives can gradually move the Chinese economy towards a more balanced model featuring a lower saving rate and still respectable growth. This requires a more prominent role for both private and public consumption spending in driving economic growth. Both structural factors and policy measures may help reduce the high Chinese saving rate.

We have so far discussed the trends, determinants and prospects of the Chinese saving rate without discussing investment in detail, as is necessary to assess the impact on the saving-investment balance or, identically, current account balance. As emphasised by Kindleberger (1967, pp 16-18), the Lewis turning point itself is likely to lead to a reduction of the current account surplus. Kuijs (2006) tables the possible effects of a set of policy measures and reforms on both saving and investment for 2005. He proposes that a new dividend policy, a shift of government spending, financial market reforms and structural changes could potentially lower both saving and investment as a share of GDP by 18% and 11.5%, respectively. These estimates imply a reduction in the current account surplus by 6.5% of GDP. Our hunch is that a more sensible recalibration would about halve these effects over a horizon of a decade, so that the saving and investment rates may decline by 9% and 7%, respectively, leading to a fall in the current account surplus by 2% of China's GDP from the expected level of 4% of GDP in 2011.

8.3. The Renminbi Exchange Rate Management

Most observers' reading of China's exchange rate management since the unpegging from 8.2 renminbi per dollar in 2005 remains very much in the axis of renminbi per dollar (Graph 3, p. 139, the left-hand panel). The usual view is that, from mid-2005 to mid-2008, the renminbi crawled at a snail's pace upward against the dollar, then held steady against the dollar during the next two years as a play-safe policy in response to the global financial crisis, and since June 2010 has resumed its slow upward crawl (Graph 3, right-hand panel, grey line).

On this view, the years since mid-2005 have not well anticipated the renminbi's playing a supporting role in the rebalancing of the Chinese economy. Such a supporting role would require that the renminbi gain value against the currencies of China's trading partners as a whole. A gradual upward crawl against the dollar accomplishes this only accidentally as a result of the dollar's own movements against the currencies of China's trading partners.

We contend that this conventional view of the management of the renminbi is materially incomplete. We identify two developments in the management of the renminbi over the six years since 2005 that have prepared the way for the exchange rate to contribute to the rebalancing of the Chinese economy. We interpret the management of the renminbi over the last six years as having, first, at least experimented with a multi-currency orientation of the nominal exchange rate and as having, second, sought a substantial real effective appreciation (Ma and McCauley, 2011a and 2011b). Both a transition away from the focus on the dollar and a real appreciation are consistent with what would be required in a rebalancing of the Chinese economy away from investment and exports to domestic consumption.

An extraordinary set of essays posted by a Peoples's Bank of China (PBC) Deputy Governor on the central bank website gives weight to both the nominal effective exchange rate (NEER) and the real effective exchange rate (REER). Hu (2010a) does not make the distinction but Hu (2010b) starts with the observation that "Theoretically, the best indicator to measure the international relative price of tradeables is real effective exchange rate, *i.e.* the exchange rate measured by a basket of currencies of major trading partners". A lower price of tradeables (an appreciation of the real effective exchange rate) sends signals to producers that there is more profit in production of services, whether haircuts or karaoke, than in production of goods for export, and so contributes to rebalancing the economy. She goes on, however, to point out two practical advantages of the NEER for policymaking: (1) no need to agree on an appropriate and comparable price index; and (2) 'real time' availability of the NEER. Hu (2010c and 2010d) also refer to the power of renminbi appreciation to damp imported inflation, pointing

to the NEER as an important point of reference[2]. Thus, these essays highlight both the NEER and the REER as important points of reference for Chinese exchange rate policy.

In what follows, we consider the policy of managing the renminbi against the basket of currencies of China's trading partners. Then we turn to the related policy of permitting the real or price-adjusted appreciation of the renminbi.

8.3.1. Management of the Nominal Effective Exchange Rate

After the abandonment of the peg against the dollar in July 2005, for about a year the renminbi did in fact do little more than crawl upward against the dollar. As a result, the fluctuation in the dollar against the currencies of US trading partners continued to be reflected in the fluctuation of the renminbi against the currencies of Chinese trading partners.

Starting in late spring of 2006, however, there was a subtle shift. It was not the sort of shift that many observers were looking for, namely a sizeable increase in the renminbi's daily moves against the US dollar. These remained very small by the standards of heavily managed currencies like the Indian rupee, much less free-floating currencies like the Australian dollar or Japanese yen. Despite continued tight management of daily fluctuations, over weeks and months, the renminbi's movement against the currencies of China's trading partners no longer shared the movements of the dollar against those of US trading partners (Graph 4, p. 140, left-hand panel).

Instead, the NEER of the renminbi showed steady upward movements. In short, what appeared to be an upward crawl against the dollar slowly and imperceptibly turned into an upward crawl against China's trade weighted currency basket as measured by the BIS NEER index (Graph 4, right-hand panel). With still narrow movements in the renminbi's daily movements against the *one* dollar, the renminbi traded in such a way as to appreciate against the *many* trading partner currencies, the more so if one turns his attention more towards weekly or monthly movements[3].

---

[2] "When domestic inflationary pressures are heightened, a stronger domestic currency will help bring down the price of imports. The role played by exchange rate in easing imported inflationary pressures is particularly important for a country like China that has a robust demand to import primary products due to unfavourable resource endowment" Hu (2010c). "Yuan appreciation against the US dollar in this period [2005-08] lowered the RMB-denominated price of import products and cushioned the impacts brought by the rise of international raw material price on domestic price level, which directly eased domestic inflationary pressures" (Hu (2010d)).

[3] If one started with the prior of a Singapore-style management of the renminbi, the data did not reject it. In particular, the renminbi traded as if its nominal effective exchange rate were following an upward path at a rate of something like 2% per annum during the two-year episode from mid-2006 to mid-2008. Since daily fluctuations against the dollar were limited, sharp dollar moves could blow the renminbi's effective exchange rate off course. Movements over weeks, however, could return it to centre of the crawling band. Most days, the renminbi traded within 1% of the centre and it remained within a ±2% band (Graph 4, right-hand panel, thin and thick dotted lines, respectively). See Ma and McCauley, 2011a.

In mid-2008, the global financial crisis worsened, sending the dollar soaring as non-US banks scrambled to obtain dollars. The management of the renminbi quietly reverted to a dollar peg[4]. The two-year experiment of a basket management was suspended in favour of the familiar ground of a dollar peg. Considering that the US dollar rose sharply in value, a continuation of the experiment in multicurrency management would have required a sharp depreciation of the renminbi against the dollar – even if neighbours' currencies had not depreciated further in response to the renminbi movements (Graph 3, right hand panel, dark line). There is no telling how much the offshore nondeliverable renminbi might have depreciated, and how much capital might have flowed out of China, had not stability against the US dollar been restored.

In June 2010, the renminbi resumed its movement against the dollar when the PBC announced an end to the 'special measure' of pegging to the dollar. It appreciated against the dollar by 3% by end-2010, and another 3.5% by mid-2011. Some observers detected a quickening of its appreciation vis-à-vis the dollar after the downgrade by Standard & Poor's of US Treasury obligations from AAA in August 2011.

Looking at Graph 4, right-hand panel, the renminbi exchange rate policy after the PBC announcement in June 2010 is not clear. It was not stable, much less did it crawl upwards, against the currencies of China's trading partners. This would have required a much greater appreciation against the dollar given the dollar's depreciation against other currencies[5].

A possible interpretation is that since June 2010, the renminbi was allowed, given the depreciation of the dollar, to decline in effective terms back to what a continuation of policy from 2006-08 would have implied (ie a continuation of the imputed band; Graph 4, right-hand panel, dark and dashed lines). On this view, in 2010-11 the renminbi returned to the path of 2006-08, and so by mid-summer 2011 the effective renminbi could resume its upward path.

In summary, if one interprets the renminbi's exchange rate in 2006-08 as following a basket, band and crawl (the so-called BBC first coined by Williamson (2001)), then it is possible to read the 2010-11 exchange rate as returning to that policy. This view puts the spotlight on how the renminbi trades from the summer of 2011, looking for evidence that it has resumed a policy defined in terms of its nominal effective exchange rate.

[4] Hu (2010d) explains the re-pegging to the US dollar: "Around end July 2008, in order to address the deepening international financial crisis, China narrowed the floating range of RMB exchange rate and did not devalue the currency as many other countries did. This contributed much to stabilizing external demand, helped mitigate the impacts of the international financial crisis, and promote Asian and global economic recovery".

[5] To have returned to the same upward crawl in the NEER in mid-2010 would have required what used to be called in the era of Federal Reserve monetary targeting 'base drift', *i.e.*, ignoring the rise in the renminbi NEER in the period of stability against the dollar during 2008-10.

Thus far, we have focused on the nominal effective exchange rate. But, as noted, the real effective exchange rate bears closely on the balance between production for domestic use versus net exports in the Chinese economy. As far as China's role in the global rebalancing is concerned, its real effect exchange rate is more relevant. We now turn to the real effective exchange rate.

8.3.2. Management of the Real Effective Exchange Rate

The Chinese experiment with a policy of guiding the real effective exchange rate upward represents good practice for the exchange rate policy that would complement a rebalancing of the Chinese economy to more domestic, consumption-led growth. The experiment in guiding the nominal effective exchange rate described in the preceding section was at the same time an experiment in gradually appreciating the real exchange rate.

In fact, the appreciation of the renminbi in real terms in the period mid-2006 to mid-2008 was even more marked than its appreciation in nominal terms (Graph 5, p. 140, left-hand panel). That is, higher inflation in those years in China than in her trading partners led to a steeper path of real appreciation of the renminbi. In particular, using monthly data – inflation data are only available monthly in most economies – the rate of appreciation was 0.44% per month or about 5% per annum (Graph 5, right-hand panel)[6].

After 2005, the renminbi's real effective exchange rate had cumulatively appreciated by 17% by end-June 2011, while the nominal effective had only appreciated by 12%. Since the renminbi resumed fluctuations in June 2010, the nominal effective depreciated by some 8% while the real effective dropped by only 3%.

Given the lags in the data, and therefore the difficulty of controlling the real effective exchange rates in real time, one could propose an alternative to the above interpretation of the 2010-11 exchange rate policy that was posed in terms of the NEER. Instead of allowing US dollar depreciation to undo some of the nominal effective renminbi appreciation in 2008-10, it is possible to read the 2010-11 policy as one of holding steady the real effective exchange rate. Such a policy could be based on an analysis that the renminbi's real value is close to equilibrium or fair value in some sense, or alternatively that stability is advised to preserve competitiveness in an uncertain global trading environment. In either case, of

[6] Unfortunately, the conceptual and practical problems of measuring a real effective exchange rate (REER) pose great challenges. Tourists from abroad might be content to know how differences in consumer price inflation alter the impression afforded by nominal rates. Such a calculation is fairly straightforward and we can rely again on REERs produced by our colleagues at the BIS. However, manufacturers competing with China would want to compare the evolution of unit labour costs, that is, wage inflation in relation to productivity rises. In any economy, measuring wages and productivity in manufacturing is far from straightforward. In an economy like China that is undergoing rapid structural change and that has much room for improvement in the government provision of statistics on both wages and productivity, the challenge of measuring unit labour cost developments is very difficult and beyond the scope of this article.

course, exchange rate policy would have shifted the burden of restraining inflation entirely onto the tools of monetary policy, including interest rate hikes, reserve requirement hikes and window guidance on lending.

Looking forward, some observers have concluded that the policy of allowing substantial wage increases and rises in distorted administered prices (for energy, water, etc) implies that future appreciation of the real effective exchange rate will be accomplished more through rises in the price level in China than through the nominal appreciation of the renminbi.

How much real exchange rate appreciation would be implied by the two percent decline in net savings that we discussed above? Obstfeld and Rogoff (2007) analyse the implications of a hypothesised jump in US savings for the real exchange rate, given the need to maintain employment in the nontraded goods sector. Working through their argument for China, the challenge there would be to keep a sudden decline in savings from leading to excess demand for nontraded goods and services, given the short-run capacity to produce them. One would have to take into account that the structure of the Chinese economy is different from that of the US economy, with a larger traded goods sector and a smaller nontraded goods and services sector.

However, as these authors acknowledge, if the adjustment is allowed to operate over the medium term, the problem changes. What price signals are sufficient to induce private investment in nontraded goods and services so that supply is sufficient given lower savings and higher consumption? We do not have a rigorous answer to this question. Over a five to ten year horizon, we conjecture that expectations of a steady 5% real appreciation per year might be sufficient.

8.4. Summary

This chapter has argued that the same several factors that help to account for the rise of Chinese savings over the last decade or so point to their decline over the present decade. The state-owned sector will have to work harder to achieve productivity gains; the working age population will shrink; and wage growth will match or exceed productivity growth so that Chinese household consumption will gain share in aggregate expenditure. Policy may prove to cut in the same direction. The government may deregulate services, strengthen the social safety net and the credibility of stated-funded pensions and flush income out of state-owned industry while shifting incentive for officials to deliver services rather than to pour concrete.

The exchange rate could play a supporting role in shifting from investment and net-export led growth to a more balanced growth model. What would be

required is an appreciation of the real effective exchange rate to provide signals of profit to investment in the non-traded goods sector. Such an appreciation has been underway in earnest in the last six years. It has resulted from both a nominal effective appreciation of the renminbi against the currencies of China's trading partners as well as faster inflation in China than in those trading partners. There is no reason to believe that real appreciation cannot continue, though an interesting question concerns whether it might draw more on domestic inflation than on nominal appreciation going forward.

A final reflection on the implications of China's rapid growth should suffice to make clear that the stakes are high. China's current account surplus as a share of the world GDP had declined from a peak of 0.7% in 2008 to 0.5% by 2010. But even if the Chinese economy slows to 6% trend growth, it will continue to grow faster than the rest of the world. The implication of such ongoing unbalanced growth is that any decline in China's current account surplus in relation to its GDP will imply a smaller decline in the deficit of the rest of the world than in relation to its GDP. Even a trend current account surplus of 2% of China's own GDP could potentially imply a trend widening of the rest of the world's deficit. If the outlook for the savings-investment imbalance in China that we have sketched proves too benign, unbalanced global growth will make it all the harder to manage the consequences.

References

Asian Development Bank, 2009, *Asian Development Outlook 2009: Rebalancing Asia's Growth*, Manila.

Bernanke, B., 2005, *The global saving glut and the US current account deficit*, speech at the Homer Jones Lecture, St. Louis, 14 April.

Garnaut, R., 2010, "Macroeconomic implications of the turning point", *China Economic Journal*, Vol. 3, No. 2, pp. 181-190.

Hu, X., 2010a, *A managed floating exchange rate regime is an established policy*, 15 July.

Hu, X., 2010b, *Three characteristics of the managed floating exchange rate regime*, 22 July.

Hu, X., 2010c, *Exchange rate regime reform and monetary policy effectiveness*, 26 July.

Hu, X., 2010d, *Successful experiences of further reforming the RMB exchange rate regime*, 27 August.

Kuijs, L., 2006, How will China's saving-investment balance evolve?, World Bank Policy Research Working Paper No. 3958.

KINDLEBERGER, C.P., 1967, *Europe's postwar growth: the role of labor supply*, Cambridge, Harvard University Press.

LEWIS, W., 1954, "Economic development with unlimited supplies of labour", *The Manchester School*, Vol. 22, No. 2, pp. 139-191.

MA, G. and WANG, Y, 2010, "China's high saving rate: myth and reality", *International Economics* No. 122, December, pp. 5-40.

MA, G. and MCCAULEY, R., 2011a, "The evolving renminbi regime and implications for Asian currency stability", *Journal of the Japanese and International Economies* No. 25, pp. 23-38.

MA, G., 2011b, "La gestion du renminbi depuis 2005" in *Finance Chinoise*, *Revue d'économie financière* No. 102, June, pp. 163-181.

MA, G. and ZHOU, H., 2009, *China's evolving external wealth and rising creditor position*, BIS Working Papers No. 286, July, Basel.

OBSTFELD, M. and ROGOFF, K., 2007, "The unsustainable U.S. current account position revisited" in R. CLARIDA (ed.), *G7 current account imbalances*, Chicago, pp. 339-366.

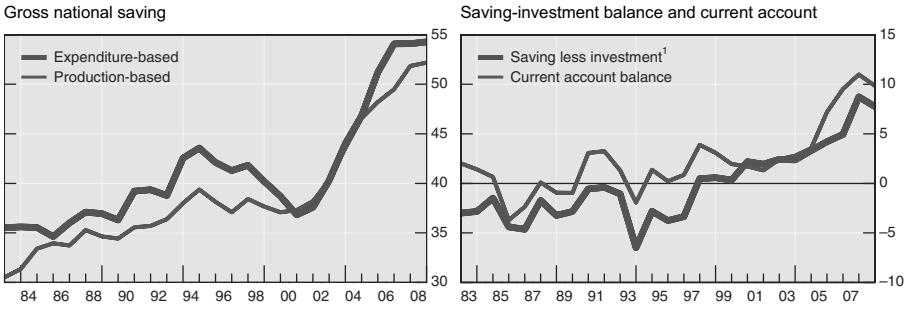
PEOPLE'S BANK OF CHINA, 2008, *China's Monetary Policy Report*, May.

PEOPLE'S BANK OF CHINA, 2010, *Further reform the RMB exchange rate regime and enhance the RMB exchange rate flexibility*, policy announcement on 19 June 2010, (www.pbc.gov.cn/english/detail.asp?col=6400&id=1488).

WILLIAMSON, J., 2001, "The case for a basket, band and crawl (BBC) regime for East Asia" in Reserve Bank of Australia Conference volume *Future Directions for Monetary Policies in East Asia*, pp. 97-111.

ZHOU, X., 2009, *Some Observations and Analyses on Savings Ratio*, speech at the High Level Conference Hosted by Bank Negara Malaysia on 10 February 2009, Kuala Lumpur.

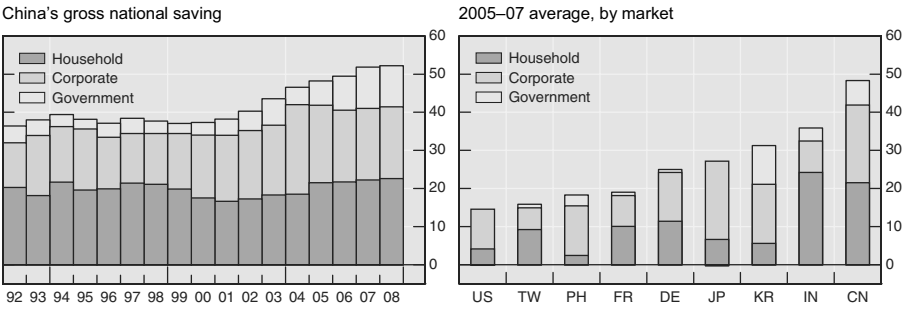
Graph 1: China's gross national saving – As a percentage of GDP



[1] Gross national saving is estimated using either expenditure-based GDP or production-based GDP. Saving less investment here is calculated using national gross saving estimated by production-based GDP, which is consistent with the flow-of-funds statistics and will be employed for the rest of this paper unless otherwise specified.

Sources: National Bureau of Statistics of China (NBS); authors' own estimates.

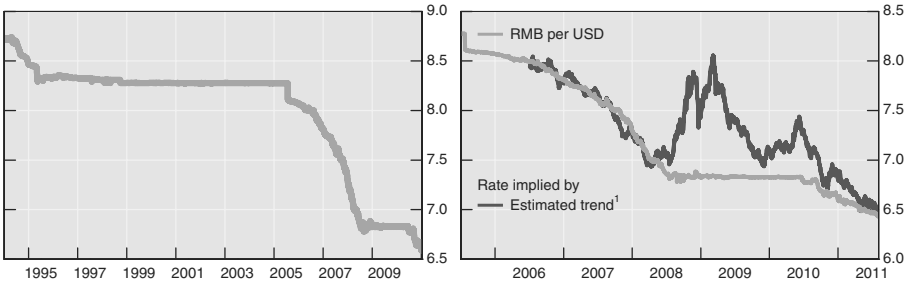
Graph 2: Gross national saving, by institutional sector – As a percentage of GDP



CN = China; DE = Germany; FR = France; IN = India, JP = Japan; KR = Korea; PH = Philippines; TW = Chinese Taipei; US = United States.

Sources: Asian Development Bank (ADB); NBS; OECD; authors' own estimates.

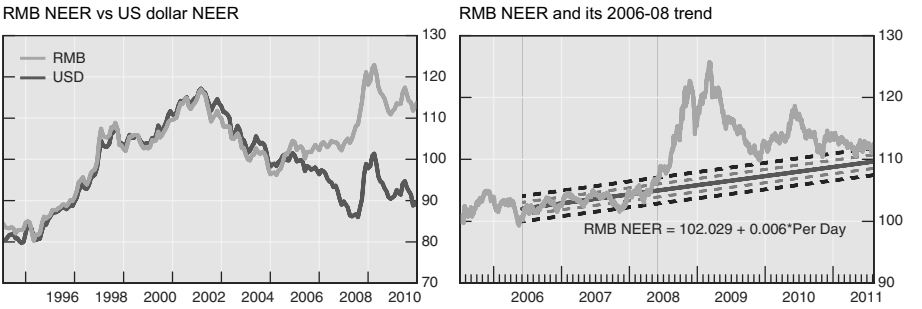
Graph 3: Bilateral renminbi/dollar rate



Note: Dark grey line in right-hand panel shows renminbi/dollar rate implied by NEER trend shown in Graph 4.

Sources: BIS; authors' own estimates.

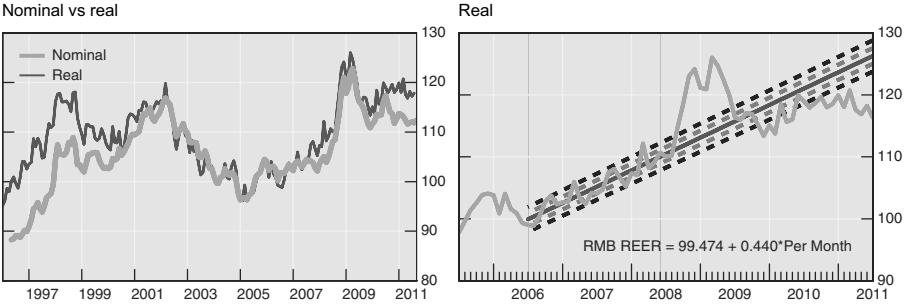
Graph 4: Nominal effective exchange rates – Daily data



[1] The trend line is estimated over a two-year period of 1 Jun 2006 and 30 May 2008, regressing the RMB NEER against a constant and a trading day trend. The thick dotted lines represent ±2% of the trend line, while the thin dotted lines ±1% of the trend line.

Sources: BIS and authors' calculation.

Graph 5: BIS nominal and real effective exchange rate for the renminbi[1]
Index, 2005 = 100



[1] BIS effective exchange rate index based on 58 economies. The trend line is estimated over the two-year period of 1 Jun 2006 and 30 May 2008, regressing the effective exchange rate against a trend. The thick dotted lines represent ±2% of the trend line, while the thin dotted lines ±1% of the trend line.

Sources: BIS; authors' estimations.

9. Macro-Finance Interactions in the US: A Global Perspective

Fabio C. Bagliano & Claudio Morana

9.1. Introduction

Considering the recent US business cycle history, two severe recession episodes stand out, namely the double dip 1980-1981 recession and the 1990 Savings and Loan (S&L) crisis. Looking further back in the past, several periods of deep contraction in economic activity can be found, such as the 1918-21 World War I/ Spanish flu pandemic crisis and, most importantly, the 1929-1933 Great Depression. Both the S&L crisis and the Great Depression do seem to be informative for an understanding of recent US macroeconomic and financial developments. In fact, while the initial epicenter of the 2007 financial crisis, *i.e.* the US subprime mortgage market, was indeed peculiar to the current crisis, its real consequences unfolded through mechanisms already at work in previous episodes: likewise the S&L crisis and the Great Depression, a boom-bust credit cycle, extended also to the housing and stock markets, and reinforced by pro-cyclical credit and leverage by banks, well summarizes the major features of the crisis[1].

While the crisis was triggered by developments in the US subprime mortgage market, other factors should however be taken into account: first, following the 2000 stock market crash and 2001 recession, monetary policy adopted an extremely accommodative stance (with low short- and long-term rates and rapid money growth), while the deepening of the 'originate to distribute' banking model and financial engineering allowed for over stretching of credit. Likewise in the S&L crisis, both a benign price stability environment and deregulated financial markets then worked as amplifying mechanisms for the subprime mortgage market shock. Second, in addition to the above domestic factors, also foreign macroeconomic developments contributed to asset prices misalignments, particularly in the housing and stock markets, and ultimately to the size of the 'subprime' shock. In fact, since the late 1990s, large capital inflows were financing a growing current account deficit in the US, widening the savings-corporate investment imbalance[2]. As capital inflows were progressively redirected from US stock and bond markets to the housing market, increasingly risky investments were underwritten and bad

[1] See Bernanke (1983) and Eichengreen and Mitchener (2003) for a boom-bust interpretation of the Great Depression and the 1990 S&L crisis. See also Borio (2008), Almunia *et al.* (2010), Temin (2010) and Grossman and Meissner (2010) for a comparative view.

[2] Inadequate financial markets, preventing higher levels of domestic consumption and investment in emerging economies, as well as currency controls, motivated by export led growth objectives in key emerging economies, *i.e.* China, might have also contributed to the ballooning of the US trade deficit. See Jagannathan *et al.* (2009) on the contributions of globalization and technological innovation to the recent crisis.

loans generated: then, again similarly to what happened in the S&L crisis, the bust phase of the credit cycle followed expected, but not materialized, housing price appreciation, leading to the breakdown of the predatory lending mechanism and to a generalized decline in asset prices and a tightening of credit conditions.

From a domestic financial phenomenon the crisis then quickly spread to the real side of the US economy and spilled over to other countries: the year-on-year US GDP contraction in Q2-2009 (which marked the end of the contraction phase of the cycle, according to the official NBER business cycle dating) reached -3.9%, similarly to other advanced OECD countries (-2.6% in France, -5.5% in the UK, -5.9% in Germany, -6.0% in Italy, -7.2% in Japan). According to the metric of Claessens *et al.* (2009), this episode can be classified as a severe recession for OECD standards: it is actually the most severe downturn since the Great Depression of the 1930s, justifying the label of 'Great Recession'.

Against this background, the present paper aims at understanding the main channels of macro-finance interaction that have featured during the US 'Great Recession'. The domestic interactions of US macro and financial shocks is investigated within a global framework, allowing for spillover effects of the US financial/economic crisis to other OECD countries, as well as to major emerging economies, and controlling for further feedback effects on the US economy. A total of 50 countries is investigated by means of a large-scale open economy macroeconometric model, set in the factor vector autoregressive (F-VAR) framework, over the period 1980:1-2009:1.

To preview some of the results, we find that demand side shocks are more relevant for real activity than supply side (productivity) disturbances in the short-term, with the latter gaining importance over a medium-term horizon, and financial shocks being more relevant for real activity fluctuations in the medium-term than in the short-term. Moreover, financial variables respond to both fundamentals and purely speculative shocks, with stock prices showing a larger speculative component than bond and housing prices. Close interrelationships among financial assets are also detected, with the short-term interest rate being relevant for financial fragility and house price fluctuations, as well as excess liquidity dynamics. The overall picture appears to be consistent with a boom-bust credit cycle mechanism, whereby financial factors are the triggering force of the downturn in real activity and worsened economic conditions feed back to asset prices, starting a cumulative process.

While Keynesian macroeconomics originated from the Great Depression, the 'Great Recession' will not probably lead to any comparable revolution in Macroeconomic theory; yet, it has made mandatory an in-depth exploration of the interrelationships between macroeconomics and finance. Our contribution provides insights on both the econometric methodology which may be useful for the accu-

rate modeling of the macro-finance interface, as well as on the main macro-finance linkages relevant for the US economy.

The rest of the paper is organized as follows. In the next section the economics of the macro-finance interface is discussed, while the econometric methodology is introduced in section 9.3.; in section 9.4. the data are presented, while the empirical results are reported in section 9.5. Finally, conclusions are drawn in section 9.6.

9.2. The Economics of the Macro-Finance Interface

Recent empirical evidence points to significant interactions between real and financial variables at the business cycle horizon. According to the metric of Claessens *et al.* (2009), severe recessions tend to be deeper (-5%, rather than -2%, GDP contraction) and last longer (5 quarters rather than 4 quarters) than average recessions, particularly when the housing market is involved; recovery to pre-recession credit growth rates and upswing in housing prices require, as for corporate investment, about three years. Moreover, differently from stock prices, housing price boom-bust cycles affect the entire distribution of the output gap, lowering its level and increasing its volatility and negative skewness (Cecchetti, 2006; see also Basurto *et al.*, 2006). Severe financial crises are likely to turn into quasi-depressions, with GDP falling 9% over two years; real house and stock prices declining 35% (over six years) and 55% (over three years), respectively, and the real value of government debt raising to over 80% (Reinhart and Rogoff, 2009). Finally, according to Barro and Ursua (2009), depression (-10% GDP growth or less) cum stock market crash (-25% or less) would tend to last even longer, *i.e.* about 4 years.

Different mechanisms can be assumed to relate financial assets, credit conditions and macroeconomic performance. For instance, asset prices and credit conditions are interrelated in various ways, as the former may influence the credit market through both demand and supply effects. On the demand side, falling asset prices lead to a reduction in the value of collateral that households and firms can post, impairing their borrowing ability; on the supply side, falling asset prices lead to a worsening of financial institutions' balance sheets, forcing tightening of credit standards, deleveraging and recapitalization. The effect on balance sheets may be direct, as bank's property wealth is directly affected, as well as indirect, through the value of the loans secured by real estate. Similarly, non-performing loans and uncertainty on the value of collateralizable assets may negatively affect credit supply. Financial accelerator and debt-deflation (Fisher, 1933) mechanisms may finally amplify the above effects, fuelling a negative asset price-balance sheets-credit spiral, with potentially deep consequences for real activity. In particular, a

credit crunch may be expected to negatively affect both investment and private consumption, reducing the availability of funds needed to finance aggregate expenditures; expected deflation may also affect negatively investment spending by increasing the expected real interest rate. The latter channel may become increasingly relevant as liquidity-trap conditions set in and the nominal interest rate cannot be further reduced. Moreover, expected falling prices (which also increase the real return on savings) may induce agents to postpone consumption to the future. Finally, by transferring purchasing power from borrowers (with a relatively high propensity to consume) to lenders (with a lower propensity to spend), both current and future consumption may be negatively affected.

Recent empirical evidence does point to a significant contractionary impact of tight credit conditions on private consumption, residential investment and GDP growth (Gauger and Snyder, 2003; Leamer, 2007; Greenlaw *et al.*, 2008; Dell'Ariccia *et al.*, 2008; Bayoumi and Mellander, 2008; Shularick and Taylor, 2009; Goodhart and Hoffman, 2008). For instance, Bayoumi and Mellander (2008) find that a 1% contraction in banks capital/asset ratio would yield a gradual contraction in US GDP of about 1.4% within three years; Cihak and Brooks (2009) similarly find that a 10% contraction in bank loans would lead to a 1% contraction in GDP for the euro area. As subdued capital accumulation shifts downwards the potential output growth path, the effects of a negative credit shocks may then be long-lasting. Bordo and Haubrich (2009) do find a close association between tight money and recessions for the US, with deeper GDP contraction having occurred during financial crises episodes. Indeed impaired credit conditions would seem to have contributed to the depth of the Great Depression (Bernanke, 1983; Eichengreen and Mitchener, 2003). Only for the most recent recession the linkage between tight money and economic contraction seems to have broken down, possibly due to the lower sensitivity of the money multiplier to financial turmoil, and a larger role for the credit channel. Finally, evidence from the Japanese deflation seems to suggest that a moderate deflation may not have deep real consequences on the economy (Morana, 2005).

Moreover, falling asset prices may affect the real economy also through wealth effects on consumption and Tobin's Q effects on investment. According to the life-cycle model, a permanent increase in housing wealth leads in fact to an increase in spending and borrowing by homeowners, as they try to smooth consumption over their life cycle. The increase in property value actually enables them to borrow more out of the increased value of collateral. Additional effects can be expected through the Tobin's Q channel, as a surge in house prices determines an increase in property value over construction costs, stimulating residential investment. Overall, the available empirical evidence points to an inelastic, yet significant, impact of house and stock prices on real activity, which is in general stronger for investment than for GDP and consumption, and for the US than

for the other countries. Moreover, the effects on aggregate demand are stronger for housing prices than for stock prices, with the latter affecting private investment in particular (Beltratti and Morana, 2010; Bagliano and Morana, 2010, 2011; Case *et al.*, 2005; Chirinko *et al.*, 2004; Carroll *et al.*, 2006). Yet, less supportive results have been found by Calomiris *et al.* (2009).

9.3. Econometric Methodology

To investigate the dynamic linkages between US macroeconomic and financial variables, allowing for international spillovers and feedback effects, we use a large-scale econometric model composed of two sets of equations. The first one refers to the US economy (with variables collected in vector X_t), while the second to other $m-1$ non-US countries (collected in vector Y_t). The joint dynamics of q macroeconomic variables for each of the m countries of interest (in vector $Z_t = [X_t \quad Y_t]$) are modeled by means of the following F-VAR system:

$$F_t = \mathbf{\Phi}(L)F_{t-1} + \eta_t \tag{1}$$

$$G_t = \mathbf{\Psi}(L)G_{t-1} + \zeta_t \tag{2}$$

$$Z_t - \mu_t = \mathbf{\Lambda}F_t + \mathbf{\Xi}G_t + \mathbf{D}(L)(Z_{t-1} - \mu_{t-1}) + \nu_t \tag{3}$$

In (3) $Z_t \sim I(0)$ is the $n \times 1$ stationary vector of variables of interest, with $n = m \times q$, and $\mu_t = [\mu_t^X \quad \mu_t^Y]$ is a $n \times 1$ vector of deterministic components, including an intercept term, and linear or non-linear trend components. F_t is a $r \times 1$ vector of observed or unobserved common factors, generated by the autoregressive process in (1), where $\mathbf{\Phi}(L)$ is a $r \times r$ finite order matrix lag polynomial, and η_t is a vector of i.i.d shocks driving the F_t factors. G_t is a $s \times 1$ vector of non-US factors, generated by the autoregressive process in (2), where $\mathbf{\Psi}(L)$ is a $s \times s$ finite order matrix lag polynomial, and ζ_t is a vector of i.i.d. shocks driving the G_t factors. The effects of both sets of factors on the US and non-US variables in Z_t is captured by the loading coefficients collected in the matrices $\mathbf{\Lambda} = [\mathbf{\Lambda}^X \quad \mathbf{\Lambda}^Y]'$ and $\mathbf{\Xi} = [\mathbf{\Xi}^Y \quad \mathbf{\Xi}^Y]'$ (of dimension $n \times r$ and $n \times s$, respectively). Finally, $\mathbf{D}(L)$ is a $n \times n$ finite order matrix lag polynomial, partitioned as

$$\mathbf{D}(L) = \begin{bmatrix} \underset{q \times q}{\mathbf{D}_{XX}(L)} & \underset{q \times (m-1)q}{\mathbf{0}} \\ \underset{(m-1)q \times q}{\mathbf{D}_{YX}(L)} & \underset{(m-1)q \times (m-1)q}{\mathbf{D}_{YY}(L)} \end{bmatrix}$$

with

$$\mathbf{D}_{YY}(L) = \begin{bmatrix} \underset{q\times q}{\mathbf{d}_{11}(L)} & \mathbf{0} & \dots & \mathbf{0} \\ \mathbf{0} & \underset{q\times q}{\mathbf{d}_{22}(L)} & \dots & \mathbf{0} \\ \vdots & \vdots & \ddots & \vdots \\ \mathbf{0} & \mathbf{0} & \dots & \underset{q\times q}{\mathbf{d}_{m-1,\,m-1}(L)} \end{bmatrix}$$

and $\nu_t = [\nu_t^X \quad \nu_t^Y]'$ is the $n \times 1$ vector of reduced-form idiosyncratic (*i.e.* country-specific) i.i.d. disturbances. It is assumed that all polynomial matrices $\mathbf{\Phi}(L)$, $\mathbf{\Psi}(L)$, and $\mathbf{D}(L)$ have all roots outside the unit circle. Moreover, $E(\eta_{jt}\nu_{is}) = E(\eta_{jt}\zeta_{is}) = E(\zeta_{jt}\nu_{is}) = 0$ for all *i*, *j*, *t* and *s*.

The specification of the model has important implications for cross-country linkages: firstly, US idiosyncratic shocks (ν_t^X) do not only affect the US (through $\mathbf{D}_{XX}(L)$), but also the other countries (through $\mathbf{D}_{YX}(L)$). Differently, non-US idiosyncratic disturbances (ν_t^Y) do not affect US variables, while only own-country linkages are relevant for the other countries ($\mathbf{D}_{YY}(L)$ is block diagonal). The specification selected is then consistent with the view that the US play a leading role in the transmission of macroeconomic shocks, interpreting US macroeconomic dynamics in terms of global dynamics (see for instance Beltratti and Morana, 2010; Bagliano and Morana, 2009). This however does not rule out a role for linkages between the US and the other countries, which are parsimoniously described by means of the non-US factors G_t.

By substituting (1) and (2) into (3), the dynamic factor model can be written in standard vector autoregressive form as

$$\begin{pmatrix} F_t \\ G_t \\ Z_t - \mu_t \end{pmatrix} = \begin{pmatrix} \mathbf{\Phi}(L) & 0 & 0 \\ 0 & \mathbf{\Psi}(L) & 0 \\ \mathbf{\Lambda\Phi}(L) & \mathbf{\Xi\Psi}(L) & \mathbf{D}(L) \end{pmatrix} \begin{pmatrix} F_{t-1} \\ G_{t-1} \\ Z_{t-1} - \mu_{t-1} \end{pmatrix} + \begin{pmatrix} \varepsilon_t^F \\ \varepsilon_t^G \\ \varepsilon_t^Z \end{pmatrix} \tag{4}$$

where

$$\begin{pmatrix} \varepsilon_t^F \\ \varepsilon_t^G \\ \varepsilon_t^Z \end{pmatrix} = \begin{pmatrix} \mathbf{I}_r \\ \mathbf{0} \\ \mathbf{\Lambda} \end{pmatrix} \eta_t + \begin{pmatrix} \mathbf{0} \\ \mathbf{I}_s \\ \mathbf{\Xi} \end{pmatrix} \zeta_t + \begin{pmatrix} 0 \\ 0 \\ \nu_t \end{pmatrix},$$

or $Z_t^* = \mathbf{H}^*(L) Z_{t-1}^* + \varepsilon_t$ (5)

with $Z_t^* = [F_t \quad G_t \quad Z_t - \mu_t]'$, and variance-covariance matrices

$$E(\varepsilon_t \varepsilon_t') = \mathbf{\Sigma}_\varepsilon = \begin{pmatrix} \mathbf{\Sigma}_\eta & 0 & \mathbf{\Sigma}_\eta \mathbf{\Lambda}' \\ 0 & \mathbf{\Sigma}_\zeta & \mathbf{\Sigma}_\zeta \mathbf{\Xi}' \\ \mathbf{\Lambda}\mathbf{\Sigma}_\eta & \mathbf{\Xi}\mathbf{\Sigma}_\zeta & \mathbf{\Lambda}\mathbf{\Sigma}_\eta \mathbf{\Lambda}' + \mathbf{\Xi}\mathbf{\Sigma}_\zeta \mathbf{\Xi}' + \mathbf{\Sigma}_\nu \end{pmatrix}$$

and $\mathbf{\Sigma}_\eta = E(\eta_t \eta_t')$, $\mathbf{\Sigma}_\nu = E(\nu_t \nu_t')$, and $\mathbf{\Sigma}_\zeta = E(\zeta_t \zeta_t')$.

The F-VAR model is estimated by means of a consistent and efficient iterative procedure, featuring the Granger and Jeon (2004) robust approach, yielding median estimates for all the parameters of interest, obtained through simulation with 1000 replications. The inversion of the F-VAR form to obtain the reduced vector moving average (VMA) form for the Z_t^* process, as well as the identification of the structural shocks, is discussed in detail in Bagliano and Morana (2011).

9.4. The Data

We use seasonally adjusted quarterly macroeconomic time series data, over the period 1980:1 through 2009:1, for the US, 14 euro area member states (Austria, Belgium, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, the Netherlands, Portugal, Slovakia, Slovenia and Spain), and 16 additional advanced economies (Australia, Canada, the Czech Republic, Denmark, Hong Kong, Iceland, Israel, Japan, New Zealand, Norway, Singapore, South Korea, Sweden, Switzerland, Taiwan, United Kingdom), 5 additional advanced emerging economies (Brazil, Hungary, Mexico, Poland, South Africa), and 14 secondary emerging economies (Argentina, Chile, China, Colombia, India, Indonesia, Malaysia, Morocco, Pakistan, Peru, Philippines, Russia, Thailand, Turkey), for a total of 50 countries[3].

The set of US variables, included in vector X_t, is composed of real GDP, civilian employment, real private consumption, real private investment, fiscal deficit to GDP, current account deficit to GDP, CPI all-items index, three-month Treasury Bills real rate, 10-year Federal government securities real rate, real house prices, the real effective exchange rate, real share prices (S&P500). Moreover, in order to monitor the impact of the financial crisis, 'financial fragility' and 'excess liquidity' indices have been constructed and included in vector X_t alongside macroeconomic and financial variables. In particular, the financial fragility index is computed as the first principal component extracted from the TED spread, the

[3] US data are from FRED2; OECD countries data are from OECD Main Economic Indicators, integrated with IMF International Financial Statistics (bank loans series); data for the other countries are from IMF International Financial Statistics; house price series for OECD countries are taken from a non-official OECD database.

AGENCY spread, and the BAA-AAA corporate spread, providing an overall measure of credit/liquidity risk, stress in the mortgage market and risk appetite. Figure 1(a) portrays the behavior of the three spreads and the constructed index over the estimation sample, showing two major peaks at the beginning of the 1980s and in 2008. The excess liquidity index is computed as the first principal component extracted from the M2 to GDP ratio and the total loans and leases at commercial banks to GDP ratio; this index, displayed in Figure 1(b), captures the gradual build-up of liquidity that started around 1995 and accelerated over the period 2006-2008.

The data set for the other countries is smaller and consists of real GDP, the CPI all-items index, real bank loans to the private sector relative to GDP, the real short-term interest rate (either a 3-month interbank rate or a 3-month Treasury Bills rate), and real house (depending on availability) and stock prices. All these variables are included in the Y_t vector.

Crude oil price and primary commodities price shocks (excluding energy), computed following Hamilton (1996), have been considered and included in the vector F_t of common factors affecting both the US and the non-US economies. In order to account for feedback effects from the world economy to the US economy, a single common non-US GDP growth factor, accounting for about 20% of total variance, has been extracted from the GDP growth series of the 37 countries for which data are available since 1980:1[4]. This factor is included as the only element in the G_t vector.

As the econometric model is set in a stationary representation, data have been transformed according to the results of the KPSS test (Kwiatkowski *et al.*, 1992; Becker *et al.*, 2006).

In particular, weak stationarity, in deviation or not from a non-linear deterministic trend component, modeled by means of the Gallant (1984) flexible functional form, *i.e.* $\mu_t = \mu_0 + \mu_1 t + \mu_2 \sin(2\pi t/T) + \mu_3 \cos(2\pi t/T)$, was assumed for the levels of the long-term and short-term real interest rates, the US current account to GDP ratio, the US public deficit to GDP ratio, and for the growth rates of all the remaining series. These deterministic terms are included in vector μ_t[5].

[4] That is, the largest 18 OECD countries (Austria, Belgium, Denmark, Finland, France, Germany, Ireland, Italy, the Netherlands, Norway, Spain, Sweden, Switzerland, the UK, Australia, Canada, Japan and New Zealand), and a selection of the Latin American countries (Argentina, Brazil, Chile, Mexico, Peru), Asian countries (China, Hong Kong, Korea, Taiwan, Indonesia, Malaysia, Philippines, Singapore, Thailand, India, Pakistan, Turkey) and African countries (South Africa).

[5] Details are not included for reasons of space, but are available upon request from the authors.

9.5. Empirical Evidence

In order to investigate the transmission within the US economy of several structural disturbances it is necessary to impose an identification scheme on the reduced-form disturbances in (5). To this aim, we impose a set of exclusion restrictions on the contemporaneous responses of the US and non-US variables to the structural disturbances, implying a precise 'ordering' for the elements in the Z_t vector, based on plausible assumptions on the relative speed of adjustment to shocks. In particular, the ordering of the variables is country-by-country and, within each country, from relatively 'slow-' to relatively 'fast-moving' variables. Then, the X_t vector for the US is ordered as follows: employment growth, real GDP growth, the Federal Deficit/GDP ratio, real private consumption growth, real private investment growth, the current account/GDP ratio, the CPI inflation rate, the excess liquidity index, the real three-month Treasury bills rate, the real ten-year Government Bonds rate, real house price returns, real effective exchange rate returns, real stock price returns, the financial fragility index. Concerning the slow-moving variables, the economic rationale behind the assumed recursive structure lies on the assumption that, over the business cycle, real activity is contemporaneously determined by employment (through a short-run production function), with the latter adjusting to the phase of the cycle only with a one-quarter delay. Moreover, output contemporaneously determines private consumption (through the consumption function), investment (investment function) and net imports, while the fiscal stance is adjusted according to output dynamics; private consumption and investment contemporaneously adjust to changes in the fiscal stance (either anticipating future output growth or due to Barro-Ricardo and/or crowding out effects), and net imports are contemporaneously determined by the state of domestic demand; aggregate demand then feeds back, with a one-quarter delay, to aggregate supply, and prices adjust according to aggregate demand and supply interactions. On the other hand, concerning the fast-moving variables, the assumed ordering (from excess liquidity to real short- and long-run interest rates, real house prices, the real exchange rate, real stock prices, and the financial fragility index) implies that liquidity conditions contemporaneously determine interest rates and asset prices, while liquidity may respond to asset prices developments only with a (one-quarter) delay. This is consistent with asset prices rapidly adjusting to the stance of monetary policy, with the Fed at most implementing a leaning-against-the-wind strategy, relatively to asset price dynamics; hence, the real short-term rate is contemporaneously determined by liquidity conditions, while the real long-term rate is contemporaneously determined by the real short-term rate. Real house prices and the real effective exchange rate are contemporaneously determined by liquidity conditions and interest rates, while real stock prices contemporaneously react to any change in the economy. Finally, the financial fragility index embeds all contemporaneous information on the state

of the business cycle. Note also that the slow- to fast-moving ordering implies that monetary policy, the key determinant of liquidity and interest rates in the economy, is set according to the state of the business cycle. The robustness of the adopted identification strategy is discussed at the end of this section.

The dynamic specification of the econometric model has been selected by means of the BIC information criterion, supporting the choice of a first-order F-VAR system. Assuming an own-variable diagonal structure for the corresponding elements of the $\mathbf{D}(L)$ matrix for the non-US countries (*i.e.* a diagonal $\mathrm{D}_{YY}(L)$), the euro area block then counts 77 equations, each containing 13 parameters, of which 1 for the lagged own variable, 5 are for the lagged US series, 3 for the lagged F_t and G_t series, and 4 for the deterministic component (including a constant, a linear trend and two non-linear components, as described in the data section). The same applies to the remaining elements in vector Y_t. Differently, the 14 equations corresponding to the US block in X_t contain 21 parameters each, of which 14 are for the lagged US series, 3 for the lagged F_t and G_t series, and 4 are for the deterministic component. The full system therefore counts 278 equations.

Operationally, the identification of the structural shocks for the US has been achieved by means of a Choleski decomposition approach, capturing the recursive structure described above. Then, a forecast error variance decomposition exercise (whereby the forecast error for each variable at various horizons is attributed to the identified structural disturbances) has been performed up to a horizon of three years, in order to investigate the macro-finance interactions featuring the US economy.

9.5.1. Forecast Error Variance Decomposition

Table 1 (p. 158) shows the results of the forecast error variance decomposition analysis over short- (2- quarter) to medium-term (4-quarter and 12-quarter) horizons. The overall picture is fairly consistent with standard macroeconomic theory. In particular, demand side (output) shocks are more relevant for real activity than supply side (productivity) disturbances (identified as shocks to the inflation rate) in the short-term, with the latter gaining importance over a medium-term horizon. Private consumption shows quicker adjustments than investment; financial shocks are more relevant for real activity fluctuations in the medium-term than in the short-term. Moreover, fluctuations in financial variables may be determined by both fundamentals (ultimately driven by consumption and productivity shocks) and purely speculative factors, with stock prices showing a larger speculative component than bond and house prices. Close interrelationships among financial assets are also detected, with the short-term interest rate being relevant for financial fragility and house price fluctuations, as well as excess liquidity dynamics. The detected interactions appear then to be consistent with a scenario

in which financial shocks trigger a misalignment in asset prices, then spilling over to real activity, and worsened economic conditions feeding back to asset prices, starting a cumulative process, *i.e.* with boom-bust financial cycle mechanics. A selection of the most relevant results is presented in detail below.

9.5.2. Real Side Fluctuations in the US

Fluctuations in US real activity are mostly determined by real side shocks in the short-term, while financial factors may have some role in the medium-term. In fact, in the short-term, real output responds only to the own shock (to which we attribute the structural interpretation of as aggregate demand disturbance, accounting for 68% of the forecast error variance at the 2-quarter horizon), and to disturbances to employment (23%) and inflation (aggregate supply/productivity shock, 5%); rather, in the medium-term (12-quarter horizon) the aggregate demand (44%) and employment (11%) disturbances loose somewhat importance, while the aggregate supply (12%) and the short-term real interest rate shock (18%) become more relevant.

A coherent pattern can be detected for consumption and investment as well, with the employment and aggregate demand shocks having sizable effects at all forecasting horizons for both variables (13% to 30%), while the house price (7% to 8%), the current account deficit (13%), the financial fragility index (on consumption, 7%) and the real short-term rate (on investment, 21%) disturbances play a larger role in the medium-term. Finally, employment is strongly idiosyncratic, with the aggregate supply, aggregate demand and real short-term rate shocks contributing somewhat to fluctuations only at the three-year horizon (8%, 13% and 17%, respectively).

9.5.3. Financial Fluctuations in the US

Concerning asset price volatility, a relevant role is played by consumption and productivity shocks, at all horizons. For instance, the contribution of the consumption shock to fluctuations of real short- and long-term rates is always sizable (15% to 21%), while the productivity shock is actually dominant (40% to 54%); similarly for house prices (12% to 29%) and financial fragility conditions (productivity, 14% to 22%; consumption, 7% in the medium-term); for stock prices, as well as excess liquidity, somewhat less (productivity, 5% to 9%; consumption, 4% to 11%); for the latter variable also the aggregate demand shock plays an important role (14% to 38%).

Yet, other disturbances also matter, albeit to a lower extent: the public deficit shock is relevant for interest rates (4% to 7%), stock prices (6% in the very short-term), and economic and financial fragility conditions (4% in the medium-term);

the current account deficit shock matters for stock prices (11% to 20%) and excess liquidity (20% in the medium-term); employment disturbances are relevant for the short-term rate (7%), as well as for economic/financial fragility in the medium-term (7%); finally, the short-term interest rate is important for financial fragility conditions (9% to 17%), house prices (11% in the medium-term), and the long-term rate (medium-term, 5%).

9.5.4. Fluctuations in US Domestic and Foreign Debt

Both the fiscal deficit/GDP ratio and the current account deficit/GDP ratio are strongly idiosyncratic at the two-quarter horizon (their own shock accounting for 80% and 88%, respectively, of the forecast error variance), but somewhat less in the medium-term, as employment, house prices, productivity and interest rate shocks all play some role. For instance, figures for medium-term fluctuations in the fiscal deficit/GDP ratio are 5% to 7% for employment, house price and real short-term rate shocks; similar figures are found for the current account deficit/GDP ratio, *i.e.* about 5% for the aggregate demand, house price and productivity shocks, while short- and long-term rates disturbances have a more sizable effect (13% to 16%). Hence, our results point to a much weaker role of stock and house prices in determining US current account deficit fluctuations than that found by Fratzscher *et al.* (2009).

9.5.5. Robustness Issues

The chosen ordering of the US variables is based on two main assumptions: (i) supply-side disturbances have a contemporaneous effect on aggregate demand components, while demand feeds back to supply with a one-quarter delay; (ii) liquidity conditions determine contemporaneously the short-term real interest rate, while the latter feeds back to liquidity conditions only with a one-quarter delay. In order to assess the robustness of the forecast error variance decomposition results to the above assumptions, the analysis has been repeated with a different ordering of the variables, inverting the contemporaneous role of supply and demand, and liquidity and the short-term rate. In particular, for the slow-moving variables the following alternative ordering is considered: consumption, investment, public deficit to GDP ratio, current account deficit to GDP ratio, output, employment and inflation; on the other hand, for the fast-moving variables the alternative ordering is: real short-term interest rate, excess liquidity, real long-term interest rate, real house prices, real effective exchange rate, real stock prices and the financial fragility index. Thus, in this alternative ordering: (i) demand-side disturbances have a contemporaneous effect on the supply side of the economy, while aggregate supply feeds back to aggregate demand with a one-quarter delay; (ii) the short-term rate determines contemporaneously liquidity

conditions, while the latter feeds back to interest rates only with a one-quarter delay.

As shown in Table 2 (p. 160), the results of the forecast variance decomposition are robust to the ordering reversal considered, as no major differences can in general be noted concerning macro-finance interactions. There are however few important differences between the results reported in Table 2 and in Table 1, with reference to some macroeconomic shocks. First, the employment shock is much less idiosyncratic (its own disturbance accounting for 57% of the employment forecast error variance at the two-quarter horizon), also having a smaller effect on real activity (1% to 3%) and fiscal/trade deficits (0% to 5%) fluctuations at all horizons. Second, with the modified ordering, it is the consumption shock which should probably bear the interpretation of aggregate demand shock. In fact, the consumption disturbance is more idiosyncratic (accounting for as much as 92% of the consumption forecast error variance at the two-quarter horizon), and explains a larger proportion of fluctuations for GDP (17% to 38%), employment (14% to 19%), and excess liquidity (11% to 34%), but a smaller fraction of real short- and long-term interest rate fluctuations (6% to 11%); finally, a more important role for the consumption shock in accounting for the volatility of the financial fragility conditions index is also detected (5% to 13%). A similar pattern of results is found for the private investment shock (accounting for 53% of the investment forecast error variance at the two-quarter horizon), which also explains a larger proportion of fluctuations for GDP (5% to 11%), employment (9% to 13%), and real short- and long-term interest rates (5% to 7%). Finally, real GDP is found to be less idiosyncratic (43% of the output forecast error variance at the two-quarter horizon), exercising a smaller impact on consumption and investment (0%-3%) and excess liquidity (5% to 18%) at all horizons.

9.6. Conclusions

While the origin of the 2007 financial crisis, *i.e.* the US subprime mortgage market breakdown, was indeed peculiar to the current episode, its consequences on the whole financial system and on the real economy unfolded through mechanisms which were already at work at least during the 1990 Savings and Loan (S&L) crisis, and the Great Depression of the 1930s: a boom-bust credit cycle, involving also the housing and stock markets, strengthened by pro-cyclical credit and leverage by banks. Additional factors, such as the growing US current account deficit, and consequent foreign capital inflows since the 1990s, contributed to the size of the 'subprime' shock, while both a benign price stability environment and the deregulation of financial markets in the 2000s, worked as amplifying mechanisms. From a domestic financial phenomenon, the crisis then rapidly extended to the real sector of the US economy and gained an international

(indeed, global) dimension. Overall, this crisis episode can be classified not only as a severe recession by OECD standards (Claessens *et al.* 2009), so as to deserve the label of 'Great Recession', but as the deepest contraction since the Great Depression in the 1930s.

In this context, the paper aimed at detecting empirically the main features of the macro-finance interactions operative during the US 'Great Recession'. In particular, the domestic interactions of US macro and financial shocks have been investigated within a global framework, allowing for spillovers from the US to other OECD and emerging countries, and for feedback effects to the US economy.

On the whole, our empirical evidence is consistent with the view that macro-finance interactions in the US can be understood within a relatively standard macroeconomic theory framework. We found that demand side shocks are more relevant for real activity than supply side (productivity) disturbances in the short-term, with the latter gaining importance over a medium-term horizon; financial shocks are more relevant for real activity fluctuations in the medium-term than in the short-term. Moreover, fluctuations in financial variables are determined by both fundamentals (ultimately driven by consumption and productivity shocks) and purely speculative factors, with stock prices showing a larger speculative component than bond and house prices. Our results are also consistent with a boom-bust credit cycle mechanism, in which a prominent role is played also by the housing and the stock markets, whereby financial factors trigger the downturn in real activity, and worsened economic conditions feed back to asset prices, starting a cumulative process. The latter mechanism does seem to be particularly important for the understanding of the real side consequences of the US subprime financial crisis.

From a history of economic thought perspective, Keynesian macroeconomics was born out of the inability of prevailing 'Classical' macroeconomics to explain the depth and endurance of the Great Depression in the 1930s. The 'Great Recession' will not probably lead to any revolution in Macroeconomic theory of a comparable importance; however, it has made mandatory an in-depth exploration of the macro-finance interface. Macroeconomists have become increasingly aware of the task, at both the theoretical (for example by extending DSGE models to properly account for financial factors) and the empirical level. Our contribution provides useful insights on the econometric methodology appropriate for the accurate empirical modeling of the macro-finance interface, as well as the main relationships linking macroeconomic and financial variables for the US economy.

References

ALMUNIA, M., BENETRIX, A.S., EICHENGREEN, B., O'ROURKE, K.H., RUA, G., 2010, *From Great Depression to Great Credit Crisis: Similarities, differences and lessons*, Economic Policy, 62, 219-265.

BAGLIANO, F.C., MORANA, C., 2009, "International macroeconomic dynamics: A factor vector autoregressive approach", *Economic Modelling*, 26, 432-444.

BAGLIANO, F.C., MORANA, C., 2010, "Permanent and transitory dynamics in house prices and consumption: Some implications for the real effects of the financial crisis", *Applied Financial Economics*, 20, 151-170.

BAGLIANO, F.C., MORANA, C., 2011, "The Great Recession: US dynamics and spillovers to the world economy", *Journal of Banking and Finance*, forthcoming.

BARRO, R.J., URSUA, J.F., 2009, *Stock-market crashes and depressions*, NBER Working Paper Series No. 14760.

BASURTO, M.A.S., GOODHART, C. and HOFFMAN, B., 2006, *Default, credit growth and asset prices*, IMF Working Paper No. 06/223.

BAYOUMI, T., MELLANDER, O., 2008, *Credit matters: Empirical evidence on U.S. macro-financial linkages*, Working Paper 08/169, International Monetary Fund.

BECKER, R., ENDERS, W., LEE, J., 2006, "A stationarity test in the presence of an unknown number of smooth breaks", *Journal of Time Series Analysis*, 27, 381-409.

BELTRATTI, A., MORANA, C., 2010, "International house prices and macroeconomic fluctuations", *Journal of Banking and Finance*, 34, 535-545.

BERNANKE, B., 1983, "Non monetary effects of the financial crisis in the propagation mechanism of the Great Depression", *American Economic Review*, 73, 257-276.

BORDO, M.D., HAUBRICH, J., 2009, *The Great Depression analogy*, Working Paper 15584, National Bureau of Economic Research.

BORIO, C., 2008, *The financial turmoil of 2007?: A preliminary assessment and some policy considerations*, Working Paper 251, Bank for International Settlements.

CALOMIRIS, C.W., LONGHOFER, S.D., MILES, W., 2009, *The (mythical?) housing wealth effect*, NBER Working Paper No. 15075.

CARROLL, C.D., OTSUKA, M., SLACALEK, J., 2006, *How large is the housing wealth effect? A new approach*, NBER Working Paper Series No. 12746.

CASE, K.E., QUIGLEY, J.M., SHILLER, R.J., 2005, "Comparing wealth effects: The stock market versus the housing market", *Advances in Macroeconomics*, 5, art. 1, 1-33.

CECCHETTI, S.G., 2006, *Measuring the macroeconomic risks posed by asset price booms*, NBER Working Paper No. 12542.

CHIRINKO, R.S., DE HAN, L., STERKEN, E., 2004, *Asset price shocks, real expenditures, and financial structure: a multicountry analysis*, De Nederlansche Bank, Working Paper No. 14/04.

CIHAK, M., BROOKS, P.K., 2009, *From subprime loans to subprime growth? Evidence for the euro area*, IMF Working Paper No. 09-69.

CLAESSENS, S., KOSE, M.A., TERRONES, M.E., 2009, "What happens during recessions, crunches and busts?", *Economic Policy* 60, 653-700.

DELL'ARICCIA, G., DETRAGIACHE, E., RAJAN, R., 2008, "The real effects of banking crises", *Journal of Financial Intermediation*, 17, 89-112.

EICHENGREEN, B., MITCHENER, K., 2004, "The Great Depression as a credit boom gone wrong", *Research in Economic History*, 22, 183-237.

FISHER, I., 1933, "The debt deflation theory of Great Depressions", *Econometrica*, 1, 337-57.

FRATZSCHER, M., JUVENAL, L., SARNO, L., 2009, *Asset prices, exchange rates and the current account*, Federal Reserve Bank of St. Louis Working Paper No. 2008-031B, forthcoming European Economic Review.

GALLANT, R., 1984, *The Fourier flexible form, American Journal of Agicultural Economics*, 66, 204-08.

GAUGER, J., SNYDER, T.C., 2003. "Residential fixed investment and the macroeconomy: Has deregulation altered key relationships?", *Journal of Real Estate, Finance and Economics*, 27, 335-354.

GOODHART, C.A.E., HOFFMAN, B., 2008, "House prices, money, credit and the macroeconomy", *Oxford Review of Economic Policy*, 24, 180-205.

GRANGER, C.W., JEON, Y., 2004, *Thick modeling, Economic Modelling*, 21, 323-43.

GREENLAW, D., HATZIUS, J., KASHYAP, A.K., SHIN, H.S., 2008, *Leveraged losses: Lessons from the mortgage market meltdown*, US Monetary Policy Forun Report 2, University of Chicago Graduate School of Business.

GROSSMAN, R.S., MEISSNER, C.M., 2010, *International aspects of the Great Depression and the crisis of 2007: Similarities, differences and lessons*, Working Paper 16269, National Bureau of Economic Research.

HAMILTON, J., 1996, "This is what happened to the oil price-macroeconomy relationship", *Journal of Monetary Economics*, 38, 215-20.

JAGANNATHAN, R., KAPOOR, M., SCHAUMBURG, E., 2009, *Why are we in a recession? The financial crisis is the symptom not the disease!*, Working Paper 15404, National Bureau of Economic Research.

KWIATKOWSKI, D., PHILLIPS, P.C.B., SCHMIDT, P. and SHIN, Y., 1992, "Testing the null hypothesis of stationarity against the alternative of a unit root", *Journal of Econometrics*, 54, 159-78.

LEAMER, E., 2007, "Housing is the business cycle" in *Housing, Housing Finance, and Monetary Policy*, Federal Reserve Bank of Kansas City: Kansas City.

MORANA, C., 2005, "The Japanese deflation: Has it had real effects? Could it have been avoided?", *Applied Economics*, 37, 1337-52.

REINHART, C., ROGOFF, K.S., 2009, *This Time is Different: Eight Centuries of Financial Folly*, Princeton University Press, Princeton.

SHULARICK, M., TAYLOR, A.M., 2009, *Credit booms gone bust: Monetary policy, leverage, cycles and financial crises 1870-2008*, Working Paper 15512, National Bureau of Economic Research.

TEMIN, P., 2010, *The Great Recession and the Great Depression*, Working Paper 15645, National Bureau of Economic Research.

Table 1: Forecast error variance decomposition for US variables

	Panel A: 2-quarter horizon													
resp\sh	*e*	*g*	*pd*	*c*	*i*	*cad*	*π*	*exl*	*S*	*l*	*h*	*er*	*f*	*fr*
e	90.7	6.8	0.16	0.03	0.25	0.20	0.30	0.22	0.21	0.30	0.09	0.14	0.09	0.51
g	23.1	68.3	0.11	1.33	0.06	0.00	5.28	0.00	0.61	0.01	0.31	0.18	0.24	0.47
pd	4.81	1.18	79.5	0.42	0.53	1.86	0.93	1.79	1.30	0.25	4.59	0.77	1.75	0.33
c	19.0	18.4	2.02	54.6	0.22	0.93	0.75	0.00	0.71	0.12	2.08	0.00	0.08	1.06
i	26.7	27.4	0.11	6.57	32.4	0.10	0.49	0.34	3.01	0.17	0.48	0.13	0.91	1.00
cad	1.28	1.23	1.57	0.03	0.24	88.0	0.73	0.01	2.27	0.23	0.18	0.06	3.84	0.31
π	0.41	0.44	1.02	27.7	0.10	3.14	64.2	0.25	1.45	0.04	0.71	0.28	0.16	0.07
exl	2.17	37.7	0.19	10.8	4.50	1.07	3.69	37.7	0.10	0.86	0.27	0.43	0.43	0.02
s	6.56	0.66	4.14	16.7	0.61	2.03	47.4	1.19	19.2	0.09	1.14	0.25	0.02	0.02
l	2.39	1.07	6.11	21.4	0.59	0.43	53.8	0.77	4.01	7.14	1.69	0.20	0.25	0.17
h	1.13	1.13	1.66	14.9	1.21	1.60	29.2	0.33	1.42	0.17	46.9	0.00	0.04	0.28
er	1.66	1.47	0.60	1.46	1.66	0.64	0.20	0.09	2.92	3.13	0.66	84.7	0.80	0.01
f	0.17	1.32	5.63	4.38	0.92	11.1	6.22	1.62	1.80	13.7	2.20	2.95	47.8	0.21
fr	3.56	0.08	2.04	3.70	1.66	1.58	14.1	2.55	9.05	2.22	1.91	1.06	4.83	51.7

	Panel B: 4-quarter horizon													
resp\sh	*e*	*g*	*pd*	*c*	*i*	*cad*	*π*	*exl*	*s*	*l*	*h*	*er*	*f*	*fr*
e	77.1	11.3	0.20	0.02	0.44	0.14	3.84	0.46	3.63	0.32	2.06	0.08	0.17	0.23
g	22.5	54.9	0.46	0.81	1.00	0.23	9.88	0.15	7.96	0.01	1.10	0.07	0.58	0.43
pd	6.81	1.02	68.1	0.98	0.54	4.37	0.89	1.51	5.16	1.61	5.82	0.83	2.14	0.28
c	18.2	16.0	2.75	45.5	0.63	4.72	0.51	0.24	0.68	0.06	7.00	0.00	0.06	3.75
i	30.2	26. 8	0.06	5.33	18.3	1.78	1.25	0.20	8.96	0.15	5.84	0.08	0.60	0.53
cad	2.46	2.30	1.08	0.23	0.47	70.2	3.18	0.02	8.30	1.26	3.69	0.12	5.23	1.46
π	1.65	0.16	2.24	25.8	0.45	6.25	53.4	0.62	4.86	0.71	1.97	0.63	1.06	0.22
exl	1.63	31.4	0.42	11.7	4.82	6.08	1.65	33.6	5.66	0.57	1.89	0.29	0.29	0.03
s	7.29	2.14	4.46	15.3	0.61	1.98	42.8	1.45	19.4	0.72	1.49	0.52	0.81	1.09
l	2.43	2.58	7.40	18.6	0.66	0.41	47.0	0.89	3.48	12.1	2.36	0.35	1.31	0.50
h	0.83	0.48	0.65	14.5	0.56	1.46	22.0	0.87	2.31	0.59	52.7	0.09	1.30	1.73
er	3.79	0.87	0.41	2.30	2.27	1.31	0.14	0.30	4.11	2.51	1.53	79.7	0.74	0.02
f	0.17	0.67	4.04	2.71	0.58	15.5	7.62	0.83	1.51	14.7	4.13	4.22	43.1	0.36
fr	3.09	0.24	3.18	5.79	2.52	1.15	22.2	2.17	12.8	1.52	2.05	1.96	3.69	37.7

	Panel C: 12-quarter horizon													
resp\sh	*e*	*g*	*pd*	*c*	*i*	*cad*	*π*	*exl*	*s*	*l*	*h*	*er*	*f*	*fr*
e	47.7	13.7	2.27	0.81	1.37	1.10	7.59	0.43	17.1	3.26	2.57	0.20	1.57	0.26
g	11.0	44.8	3.09	0.35	1.62	2.76	11.5	0.26	18.3	3.68	0.76	0.05	1.45	0.35
pd	6.68	1.18	64.7	0.96	0.57	5.64	0.94	1.52	5.06	2.71	6.52	0.82	2.06	0.61
c	13.3	13.4	2.80	38.3	0.22	12.8	1.19	0.38	0.30	1.39	8.22	0.01	0.27	7.38
i	15.2	24.2	0.53	2.81	11.9	12.9	1.76	0.06	21.2	1.87	6.08	0.04	1.00	0.43
cad	1.39	4.65	1.08	0.78	0.45	44.0	4.03	0.03	15.5	12.6	6.51	0.40	6.07	2.51
π	2.74	0.21	4.80	22.7	0.79	8.61	41.2	0.28	9.04	3.65	3.71	0.74	1.45	0.07
exl	3.74	13.7	1.33	6.64	5.25	20.3	0.59	32.9	9.34	1.52	1.26	0.36	0.14	2.98
s	7.41	2.32	4.07	14.5	0.91	2.58	40.3	1.68	19.9	0.67	1.42	0.50	1.09	2.68
l	2.61	2.91	7.00	17.3	0.84	1.12	44.9	1.21	4.88	11.8	2.60	0.36	1.56	0.91
h	2.05	0.64	1.12	12.4	0.12	0.36	15.1	0.84	11.1	8.96	41.8	0.47	3.14	1.98
er	4.83	0.56	0.94	4.36	3.28	8.85	1.92	0.17	8.63	1.12	1.20	61.7	2.11	0.35
f	0.20	0.80	1.62	1.51	0.55	19.5	9.81	0.29	1.37	8.42	2.62	3.53	49.6	0.20
fr	6.82	0.18	5.41	7.11	2.97	0.87	21.1	2.10	16.7	1.98	2.89	1.26	3.21	27.4

The Table reports the results of the forecast error variance decomposition analysis for the US variables (rows), relative to the US shocks (columns). For instance element (1,2) in Panel A, i.e. 6.8, is the percentage of forecast error variance of US employment explained by the US output shock. The variables are real GDP (*g*), civilian employment (*e*), real private consumption (*c*), real private investment (*i*), fiscal deficit to GDP (*pd*), current account deficit to GDP (*cad*), CPI all items index (π), three-month Treasury Bills real rate (*s*), 10-year Federal government securities real rate (*l*), real house prices (*h*), the real effective exchange rate (*er*), real share prices (*f*), the economic/financial fragility indexed (*fr*), and the excess liquidity index (*exl*).

Table 2: Forecast error variance decomposition for US variables (Robustness analysis)

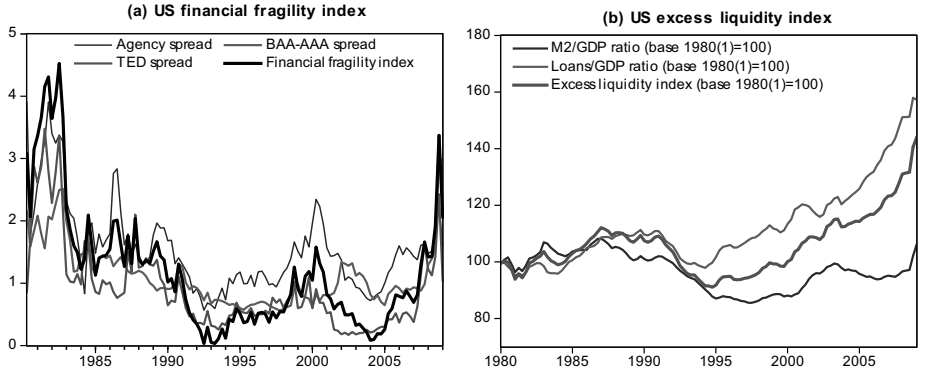
	Panel A: 2-quarter horizon													
resp\sh	*e*	*g*	*pd*	*c*	*i*	*cad*	*π*	*exl*	*s*	*l*	*h*	*er*	*f*	*fr*
e	57.5	7.75	0.27	18.50	14.2	0.16	0.27	0.26	0.12	0.21	0.11	0.10	0.10	0.45
g	2.05	42.69	0.34	35.75	11.9	0.13	5.28	0.02	0.57	0.01	0.30	0.23	0.27	0.47
pd	2.49	1.99	75.1	3.76	1.06	4.01	0.73	1.12	1.86	0.24	4.60	0.88	1.84	0.31
c	1.22	0.75	0.14	91.9	0.12	1.13	0.71	0.01	0.63	0.09	2.32	0.00	0.05	0.98
i	0.39	1.86	0.05	38.3	52.9	0.18	0.48	0.10	3.11	0.14	0.57	0.14	0.93	0.87
cad	0.41	2.12	1.69	0.61	0.07	87.4	0.84	0.03	2.15	0.25	0.20	0.07	3.73	0.41
π	1.09	3.32	0.68	23.7	1.46	2.88	63.9	0.12	1.55	0.07	0.73	0.28	0.12	0.08
exl	0.37	18.25	1.89	33.6	0.50	1.35	3.55	36.9	1.68	0.68	0.28	0.45	0.42	0.02
s	7.23	1.40	5.85	6.04	7.21	2.95	47.2	1.26	19.2	0.03	1.28	0.27	0.01	0.07
l	3.75	4.12	7.07	10.6	4.82	0.99	53.6	0.69	4.41	7.41	1.96	0.22	0.21	0.15
h	1.46	0.03	2.73	10.6	3.65	1.94	29.6	0.31	1.72	0.12	47.5	0.00	0.03	0.28
er	0.88	3.80	0.48	0.60	1.25	0.48	0.15	0.00	3.15	2.91	0.65	84.9	0.76	0.01
f	1.23	0.51	2.14	6.19	0.15	12.7	6.53	0.96	2.25	14.2	2.17	2.98	47.8	0.19
fr	0.99	1.68	1.58	4.53	1.00	1.31	15.3	1.16	10.2	2.48	2.16	1.24	5.07	51.3

	Panel B: 4-quarter horizon													
resp\sh	*e*	*g*	*pd*	*c*	*i*	*cad*	*π*	*exl*	*s*	*l*	*h*	*er*	*f*	*fr*
e	44.0	11.4	0.12	21.21	13.4	0.10	3.46	0.76	3.04	0.17	1.90	0.07	0.18	0.21
g	2.98	37.3	1.13	31.22	7.32	0.41	9.51	0.60	7.29	0.01	1.15	0.08	0.63	0.39
pd	4.59	1.72	64.7	3.23	1.18	6.76	0.73	1.13	5.03	1.57	5.91	0.97	2.27	0.27
c	1.48	0.65	0.14	80.6	0.11	5.25	0.47	0.25	0.53	0.04	6.96	0.01	0.03	3.49
i	1.92	3.29	0.07	37.7	37.3	2.14	1.14	0.50	8.60	0.11	6.06	0.08	0.63	0.49
cad	0.94	4.21	2.46	0.84	0.19	68.5	3.21	0.13	7.38	1.38	3.93	0.13	5.00	1.65
π	0.38	4.98	0.64	23.8	0.55	6.33	53.5	0.19	5.00	0.85	1.98	0.62	1.00	0.20
exl	0.35	13.4	3.19	30.7	1.10	5.87	1.58	30.5	10.1	0.48	2.02	0.30	0.33	0.03
s	6.77	1.97	6.10	7.38	6.79	2.74	42.8	1.46	19.4	0.56	1.66	0.50	0.84	1.05
l	3.55	4.76	8.30	9.48	4.52	0.92	46.9	0.87	3.84	12.3	2.64	0.36	1.16	0.42
h	0.57	0.60	1.08	11.5	1.92	1.27	22.4	0.79	3.31	0.51	53.3	0.10	1.26	1.49
er	1.28	2.85	0.29	2.73	2.40	1.24	0.14	0.38	4.20	2.25	1.65	79.9	0.69	0.02
f	0.59	0.45	1.27	3.97	0.39	16.2	7.69	0.64	1.61	15.2	3.97	4.20	43.5	0.34
fr	1.11	1.62	2.54	7.77	1.23	0.82	22.9	0.96	14.1	1.69	2.29	2.00	3.92	37.1

	Panel C: 12-quarter horizon													
resp\sh	*e*	*g*	*pd*	*c*	*i*	*cad*	*π*	*exl*	*s*	*l*	*h*	*er*	*f*	*fr*
e	27.2	14.6	1.72	13.5	9.33	0.80	7.77	1.33	16.1	3.26	2.48	0.17	1.56	0.23
g	0.99	33.0	5.13	16.8	4.45	2.97	11.7	1.30	17.4	3.67	0.78	0.05	1.44	0.31
pd	4.43	1.82	61.4	3.24	1.17	7.95	0.80	1.20	4.84	2.82	6.64	0.95	2.17	0.56
c	0.54	0.21	0.04	66.3	0.15	14.9	1.26	0.23	0.23	1.43	8.04	0.03	0.29	6.33
i	0.65	3.19	1.62	24.4	25.8	11.7	1.77	0.52	20.9	1.93	6.01	0.06	0.96	0.43
cad	0.66	6.24	1.68	0.50	0.16	43.5	3.64	0.17	14.5	13.2	6.71	0.38	5.93	2.76
π	0.15	7.60	1.36	21.9	0.12	9.12	41.5	0.04	8.88	3.59	3.43	0.74	1.51	0.05
exl	2.76	5.26	5.71	11.4	5.22	17.8	0.69	27.9	16.4	1.67	1.32	0.40	0.17	3.38
s	5.98	1.86	5.38	9.05	6.40	3.40	40.2	1.42	20.1	0.52	1.52	0.51	1.08	2.56
l	3.26	4.45	7.87	9.73	4.46	1.86	44.6	0.99	5.34	12.1	2.93	0.36	1.44	0.71
h	0.68	2.74	0.59	10.2	0.70	0.40	15.8	0.37	12.3	9.01	41.9	0.52	3.03	1.84
er	1.44	4.71	0.20	5.30	2.48	8.60	2.22	0.12	8.96	0.97	1.55	61.4	1.75	0.29
f	0.36	0.20	0.83	2.01	0.60	18.7	10.2	0.28	1.42	9.25	2.70	3.60	49.7	0.23
fr	1.48	2.14	3.93	12.5	2.14	1.19	21.1	0.77	18.3	2.26	2.67	1.26	3.59	26.7

The Table reports the results of the forecast error variance decomposition analysis for the US variables (rows), relative to the US shocks (columns). For instance element (1,2) in Panel A, i.e. 7.8, is the percentage of forecast error variance of US employment explained by the US output shock. The variables are real GDP (*g*), civilian employment (*e*), real private consumption (*c*), real private investment (*i*), fiscal deficit to GDP (*pd*), current account deficit to GDP (*cad*), CPI all items index (*π*), three-month Treasury Bills real rate (*s*), 10-year Federal government securities real rate (*l*), real house prices (*h*), the real effective exchange rate (*er*), real share prices (*f*), the economic/financial fragility indexed (*fr*), and the excess liquidity index (*exl*).

Fig. 1. US financial fragility and excess liquidity indices.



Panel (a) shows the US financial fragility index and the three spread series (Agency, BAA-AAA, and TED); panel (b) plots the US M2 to GDP ratio, Bank loans to GDP ratio (both in index form) and the extracted US excess liquidity index. The sample is: 1980:1-2009:1.

10. Revitalizing the SDR – Building a New and Sustainable SDR-Based Global Financial Infrastructure

Wim Boonstra[1]

10.1. Introduction

Since the collapse of the Bretton Woods exchange rate system in 1971, the world's monetary system has been based on a so-called 'paper standard'. In this system, the US dollar plays the role of global currency anchor. Although this paper standard has functioned reasonably well for several decades, with ups and downs, its disadvantages are becoming increasingly obvious. These disadvantages of the current situation originate not from the fact that it is a paper standard as such. The real problem is that the world's dominant monetary unit, the US dollar, is not a formal international standard, such as gold, but above all is the currency of a country.

One of the direct results of this situation have been the global balance of payments disequilibria, which have become increasingly marked in recent decades, and the accompanying building up of reserves. The US, whose currency functions as global currency anchor, has evolved into the world's biggest debtor, with one major deficit on its current account after the next. By contrast, there are a number of countries with substantial surpluses and rapidly accumulating reserves. These reserves, however, overwhelmingly consist of US dollars. For many years now, economists have expressed doubt about the sustainability of this development. This uncertainty has been heightened by the recent crisis, which was initially triggered by the collapse of the US subprime mortgage market. In August 2011, the United States was downgraded by Standard & Poor's, meaning that the country behind the global anchor currency is no longer perceived as having the best credit risk of the world.

In recent years, calls are regularly heard for the establishment of a new global currency standard (Zhou, 2009; Usshner, 2009; Strauss-Kahn, 2009; IMF, 2010, 2011, Camdessus a.o., 2011). In this article we will try to sketch the contours of a new system. To this end we will first very briefly look at a number of previous systems, such as the gold standard and the Bretton Woods system and some alternative proposals to introduce a commodity standard, discussing the pros and cons of the varying systems. Next, we will deal with the question whether the

[1] The author is indebted to Allard Bruinshoofd, Shahin Kamalodin and Hans Visser for their commentary on an earlier version of this article.

dollar's role in the course of time simply could be shifted to a future global currency, such as the euro or the renminbi, or whether we need an really international standard, meaning one not based on the national currency of a prominent country. We then address the issue of what a new international paper standard might consist of. Important considerations in this context are to what extent this new international standard can be made 'future proof', and how it will contribute to greater equilibrium in global balance of payments (current account) positions.

This paper expands on the various proposals that recently have been presented (Zhou, 2009; Usshner, 2009; Strauss-Kahn, 2009; IMF, 2010, 2011, Camdessus a.o., 2011);. Before discussing the various systems and recent proposals, however, we need a closer look into the issue of intrinsic value. The underlying question is, of course, whether money needs an intrinsic value.

10.1.1. Does Money Need an Intrinsic Value?

Over the centuries, the value of money tended to be based on one or more commodities. Although the gold standard (1871-1914) is the one that most often comes to mind, a variety of materials has served as money throughout the centuries. Although metal (gold, silver, iron) based systems are the best known, other materials (cowrie shells, wampum, tobacco) have served as money for ages. The Cowrie shell in particular, was used as money in parts of Africa until the early 20th century[2]. In many respects the era of the gold standard was a period of economic progress, a time when real globalisation first started to develop. Thus the gold standard may be regarded as the first modern global monetary standard.

Sometimes the link to the commodity was direct, as in the case of full value coinage; alternatively, an indirect link was established by linking the value of intrinsically worthless money (such a bank notes or bank accounts) to a commodity or index of commodities. Full value coinage means that the intrinsic value (of the material itself) is equal to the exchange value that the money has in commercial transactions. This, however, can only apply to coins. When the value of the material used for the money is lower than the purchasing power it represents, this is known as fiduciary money. Since the collapse of the exchange rate agreement based on the Bretton Woods standard in the early 1970s, the international system is no longer based on a commodity standard. Money as we know it today has virtually no intrinsic value; it is completely fiduciary. It can, of course, be exchanged into any available commodity (just as into any tradeable good or service), but not against a fixed and officially guaranteed price. It is this last charac-

[2] For a comprehensive overview of the history of money, see Davies (2004). Less heavily documented, but highly readable and at times hilariously funny is Galbraith (1975). The monetary history of gold is beautifully documented by Bernstein (2000).

teristic which distinguished commodity-based money from completely fiduciary money (that can be used to buy any tradable commodity for the current market price). In the end, the value of all money is based solely on the universal confidence in its general acceptance. A second, very important feature of the 'paper standard' as we now know it, is that the marginal production costs of money are virtually zero, particularly in the case of bank reserves and demand deposits.

10.1.1.1. The Intrinsic Value of Money: a Closer Look

A central issue in the analysis of monetary standards, however, is the often recurring question as to the necessity of an intrinsic value. Does money have to consist of or be covered by something valuable? In other words, does it need to have or represent an intrinsic value, or is it sufficient for it to be generally understood that it can be exchanged for something of value?

As far back as 1900, during the heyday of the gold standard, the necessity of an intrinsic value was disputed by Simmel. He believed it was sufficient for money to serve as a yardstick to express the relative value of goods or services. Likewise Knapp (1921, cited by Visser, 2010) expounded the theory that the essential value of money is that it is a legal creation. Both denied the necessity of any intrinsic value. Moreover, the concept of intrinsic value or material value is by definition problematic. An objective evaluation is only possible when a comparison is made between the relative values of two types of money that are different, though based on the same material: the intrinsic value of a 10 gram gold coin is twice as high as a five gram gold coin. But this is where the objective evaluation ends. All money, including so-called full value coinage, is at least partly fiduciary in nature by definition. Note, that the use of – and thus the value – of most types of money only originates form the possibility to exchange it for something that can fulfil one's primary needs. The exceptions are, of course, moneys based on consumables such as rice, grain, tobacco or liquor. But neither gold, nor silver, yap stones or cowrie shells have any value if there are no goods available to exchange them for. Whether the money can be exchanged for something that can be used will always depend on the local context[3]. And the relationship between the full value money and the amount of goods or services that can be purchased with it depends by definition on the relative amounts of the money in circulation and the goods or services to be purchased. This means that a very important role of full value money is to link one fiduciary system automatically to another (if based on the same commodity). Yet money that is largely based on material value has one major advantage compared to fiduciary money that has little or no material value. Fiduciary money is so easy to produce, and its production costs are far

[3] Indeed throughout the centuries, mystical properties have been attributed to physical substances used as money, regardless of the intrinsic value, whether Yap stones or gold.

lower than its purchasing power in the economic system, that the only constraint on its production is the discretion of the monetary authorities. This constraint has proven insufficient over time, particularly during periods of economic difficulty. It is then that the money supply grows excessively and inflation becomes a threat. Seen in this light, it may be asserted that the true intrinsic value of money consists in the scarcity of the material with which it is made, and the fact that the money is therefore difficult, or at least expensive to produce. Then the growth of the money supply will respond automatically to the economic situation, via a feedback loop.

10.2. Historic International Standards

As said, the value of money was often based on precious metal. This paragraph will very briefly discuss the pros and cons of the gold standard, the Bretton Woods system and a standard based on a basket of commodities. The first two have been extensively discussed in the academic literature (Eichengreen 2007; Kindleberger, 1993; Bernstein, 2000; Keynes, 1942; Redish, 1993). Therefore, I assume the reader to be aware of these systems. I will limit myself to discussing very briefly their major characteristics and (dis-)advantages. Systems based on a broad-based commodity index have been proposed for decades, but have never been put into practical use (Hayek, 1943; Usshner, 2007). This justifies a slightly more extensive discussion of their characteristics.

10.2.1. The Gold Standard and the System of Bretton Woods

During the era of the gold standard, the money supply was based on the available amount of monetary gold. The price of gold was fixed, which meant that an increase (decrease) in the gold stock translated directly into an increase (decrease) of the money supply. This, in turn, resulted c.p. in an increase (decrease) of the average price level[4].

The most important feature of a gold-based standard is of course that the price of gold must remain constant. This did of course not mean that the value, or rather the purchasing power, of gold was fixed. Even under the gold standard, there could be a shortage or surplus of monetary gold. Once the relationship changes between the supply of monetary gold (and hence the amount of money in circulation) and the supply of other goods and services, this has to be expressed

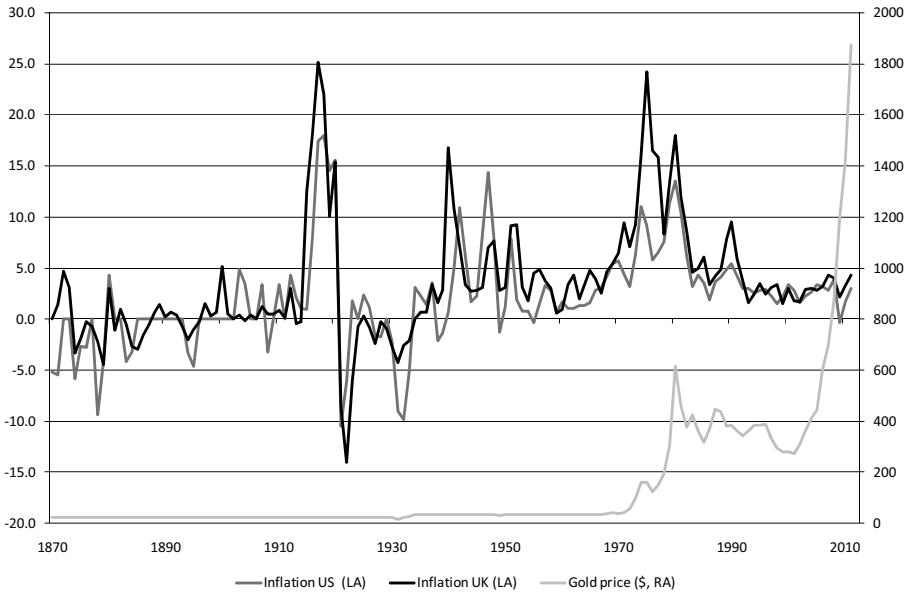
[4] It would be a mistake, however, if the impression exists that gold played an important role in daily transactions. Its role was limited to (very) large transactions, paid in large denominations. Besides gold, there were large quantities of lower value money in circulation, used for small transactions. Even during the heyday of the gold standard, the vast majority of domestic money flows took place in low denominations of money with an uncertain and strongly fluctuating value. During the era of the gold standard, most people rarely if ever saw a gold coin during their lifetime, and few ever possessed one or more (Helleiner, 2003).

in a change in relative prices[5]. In a non-gold standard, such as today's, such changes *ceteris paribus* would lead to a change in the gold price. During the days of the gold standard, however, the price of gold was fixed and the prices of all other goods and services had to rise (inflation) or decline (deflation) to bring about the change in the relative value of gold.

The advantage of a gold based system can be summarized as follows. It gives an objective and automatic anchor for monetary policy. It links countries and enhances international trade. It gives countries, especially emerging markets in the words of Bordo and Rockoff (1996) a "Good Housekeeping Seal of Approval". This helps them in attracting loans from other (richer) countries.

However, even Hayek, who is often cited as a major exponent of the gold standard system, was in reality rather critical of it. While he welcomed its positive features – automatic policy rules and the physical limits to the production of money – he was not blind to the irrationality of gold worshipping, as is evidenced by the following quote: "…. *The Gold Standard as we knew it undoubtedly had some grave deficits…….. A wisely and impartially controlled system of managed currency for the whole world might, indeed, be superior to it in all respects…..*" (Hayek, 1943. For Hayek this was the reason to argue for a monetary standard based on commodities (see below).

Figure 1: Price development in UK and US and the gold price from 1870 to date

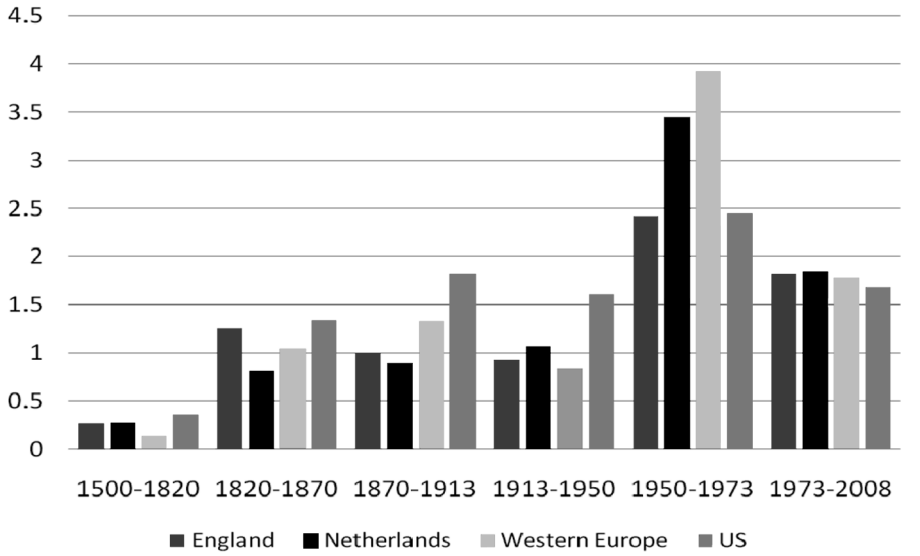


Source: EcoWin

[5] Changes could originate from new findings, new technology, changes in hoarding behaviour or disequilibria in international trade.

Economic growth under the gold standard was not exceptionally high. Neither was it a period of extremely stable conditions, it had its fair share of financial crises. Some of them, like the Barings Crisis of 1890 were really serious, of 'Lehman-proportions', so to say. Moreover, the era of the gold standard had a number of periods of deflation, lasting many years[6]. After 1945 price development (with the exception of the UK) was in general more moderate than under the gold standard, and certainly more so than during the interbellum. However, there was slightly more inflationary pressure; compared to the decades prior to World War II deflation was less of an issue. In the course of time, when systems develop and large nominal wealth and debt positions arise and nominal wages become stickier, the costs of deflation increased over time.

Figure 2: Average annual increase in real GDP per capita (1500 – 2008)



Source: Maddison (2007), OECD

The disadvantages of the gold standard and its accompanying fairly inflexible rules became increasingly apparent as time went on. The Bretton Woods system, which was basically a dollar-based system that borrowed its credibility from the 'great psychological value of gold' (Keynes, 1942) tried to evade some of the disadvantages of the gold standard, viz. its relatively large probability of deflationary episodes and the limited and unpredictable availability of gold. World trade flourished, fuelled by a strong supply of dollars. The supply of dollars, the-

[6] Incidentally, one can by no means attribute all deflationary pressure during the gold standard to a decline in the money supply. In fact, a marked number of recessions and deflationary periods were caused by supply shocks, such as mass imports of grain from new regions, or falling prices due to productivity enhancing innovations (Wilson, 1962).

oretically exchangeable into gold (by central banks alone), substantially exceeded the supply of gold. The very moment some central banks turned to the US to exchange their dollar reserves into gold, the system collapsed. The rest is history. (Eichengreen, 2007).

Under the Bretton Woods system, the link between gold and money had already become very loose. The transition to a fully fiduciary system, without a link to any material whatever, was therefore less radical in practice than might appear on paper. In this context, Redish (1993) uses the metaphor of an increasingly long chain with which the monetary system was ever more loosely anchored to gold. Secondly, the US dollar acquired a central role in the system, since all the participating currencies were linked to gold solely via the dollar. Thus the dollar's role under Bretton Woods was even more pivotal than that of sterling under the gold standard. The dollar's central role in the global economy since the collapse of Bretton Woods can be seen as a direct consequence of how that system worked[7]. The position adopted by a number of central banks also played an important part. The German Bundesbank, for instance, had never been in favour of a major international role for the deutschmark. It saw the disadvantages, particularly the threatening uncontrollability of the monetary aggregates, as outweighing the advantages in the long term. Currently, similar considerations concern the renminbi (Lee, 2010). A third assertion is that the International Monetary Fund (IMF) was unable to evolve into the central bank of central banks. From the beginning it was too small for such a role, lacked a money creating capacity and even today cannot function as automatic 'lender of last resort'. A fourth assertion is that while the IMF's core task was to preserve the equilibrium in balance of payments positions, the burden of adjustment fell disproportionately heavily to the countries with trade deficits. This outcome was hardly surprising, in view of the position of the US at the time which was not only the most powerful, but also the richest country in the world.

10.3. Alternatives to Metal Standards

Hayek insisted that throughout history it was chiefly rulers and governments that caused the loss of purchasing power of money, leading to inflation. The lure of generating wealth through money creation (seigniorage) by increasing the supply of fiduciary money has often been too great, as evidenced by the many episodes of hyperinflation throughout history. As Hayek put it: *"…the source and root of all monetary evil…[is]... the government monopoly on the issue and control of money"* (1978, p. 133).

[7] Eichengreen (2010) points out that under the gold standard, a number of currencies more or less equally occupied the position of reserve currency. At best, sterling was 'primus inter pares'.

He therefore showed himself to be an advocate of a commodities standard, which he saw as having several advantages over a gold standard (Hayek, 1943). Under a commodities standard, the money that is in circulation is not covered by gold reserves but by a basket of commodities (Ussher, 2009). Under a commodities standard, the government (or central bank) will react to an economic downturn by releasing extra money into circulation by buying up commodities consistent with their weighting in the index at the fixed price. The extra money initially finds its way to the producers. While their production costs have declined due to the general deflationary pressure – as is the case with the gold standard – their selling price remains more or less the same. Thus they are in a position to drive up production, which in turn provides momentum for the economy. It is worth noting that Hayek, despite his lifelong criticism of post-war Keynesian policy, effectively proposed an automatic spending stimulus via the commodity producing sector[8] During times of economic upswing, the mechanism works in the opposite way. Compared to gold, the supply of commodities is much more elastic in terms of price; therefore adjustment mechanisms will take effect relatively quickly, and the commodities standard is likely to be less pro-cyclical than the gold standard. Hayek was furthermore of the opinion that it would be best to adopt the commodities standard on an international scale, as it would lead to confusion if various countries were to operate standards with different commodities[9].

Hayek did recognise a number of disadvantages, however, referring to a.o. the costs of storing the goods to be bought up. However, for Hayek the dangers of unbridled government monopoly on money creation weighed more heavily than the practical drawbacks of a metal standard such as the gold standard, or a commodities standard. In his view, this applied not only to the international financial infrastructure, but also to domestic monopoly on money creation (Hayek, 1978a; 1978b).

Hayek's enthusiasm for a commodities standard was not shared by Friedman (1951), who was eager to point out its disadvantages. Because all adjustment mechanisms are automatic, as is the case with the gold standard, they offer no scope for pursuing an anti-cyclical policy. Furthermore, commodities standards are expensive, as they require large reserves. Friedman estimates the costs of holding reserves at some 3% of GDP. Moreover he points out that it is does not make sense that when a failed harvest leads to economic hardship, governments should

[8] With this kind of monetary stimulus, we are only one step away from a policy in which an economic slowdown is automatically countered by a monetary financed spending stimulus; while an upturn is met with automatic monetary tightening (a liquidity contraction).

[9] Interestingly, the gold standard has more advantages for international trade and less for the domestic economy. However, the commodities standard as put forward by Hayek is chiefly a domestic model, intended to anchor the discretionary authority of a government with regard to creating money. The commodities index can only function internationally if all countries operate an identical commodities index. The likelihood of this is not great, in view of the divergence of interests among the different countries. An oil producing nation will by definition operate a different index from a country that specializes in agricultural produce.

exacerbate the food shortage by buying up agricultural produce in the commodities index, in order to provide cover for money released into circulation. Friedman concluded that while a monetary standard based on commodities may have certain advantages vis à vis the gold standard, these are more than undone by the "*… tremendous inferiority to gold in the ability to command unthinking support and reverence…*". Compared to fiduciary or paper money (*fiat currency*) it is, in his opinion, technically inferior in every respect. He concludes:.. *"(A commodity reserve currency)… can not match the non-rational, emotional appeal of the gold standard, on the one hand, or the technical efficiency of the fiat currency, on the other."* (1951, p. 232).

To conclude, it may be asserted that neither the gold standard nor a monetary standard based on commodities can offer a sound alternative to the current dollar-based system. In part two of his article we will address a possible alternative.

10.4. A Modern 'Paper Based' Standard

10.4.1. The Necessity of a Universal Currency

A return to a commodity-based monetary standard is not likely. We may expect that in the future the global currency standard will still be a 'paper standard'. This begs of course the question as to what are the pros and cons of an international monetary system that is based on the currency of a single financially dominant country.

History has only few examples of currencies that played a globally dominant role as trade currency, investment currency, vehicle currency and reserve currency. During the era of the gold standard it was the British pound sterling. After the Second World War, the dollar assumed the role that had been occupied by sterling, and initially as anchor currency for the Bretton Woods system. After the link between dollar and gold was severed, the dollar retained its pre-dominance, albeit without its formal role. It may thus be asserted that in 1971 the Americans unilaterally embarked upon a new monetary experiment of global proportions. From 1971 onwards, for the first time there was a global standard based purely on fiduciary money. Although in daily practice the differences between the years prior to and after the collapse of Bretton Woods were not very sizeable, nonetheless the global economy entered an entirely new era in 1971.

What Great Britain in the 19th century and the US in the 20th century had in common was that they were the undisputed world leaders of their time. These were countries that formed the global economic centre of gravity. They had the most advanced banking systems and the most far-reaching financial markets. Financially, these were very powerful countries, enjoying a strong international

net creditor status. They were also political heavyweights commanding a military power that could be projected throughout the world.

A country whose currency is used as a global anchor enjoys certain privileges. The main advantage is that it can finance its external deficits without accumulating liabilities in a foreign currency. This applies both to how it finances its current account deficit and to the funding of its investment in foreign companies and securities. Effectively this is an international version of seigniorage, comparable to the profit made by a central bank after releasing fiduciary money into circulation. Moreover, there are benefits to be gained from what is known as the safe-haven effect in times of turbulence. Lastly, there is the international trade advantage. The country that owns the anchor currency incurs virtually no exchange rate risk in its international trade dealings, because the bulk of its exports and imports are conducted in its own currency.

A combination of the above effects may in practice result in overvaluing of the anchor currency. This occurs not only in turbulent times, when a safe haven is sought, but also during periods of relative calm. Even then, international demand for the anchor currency is greater than can be explained by economic fundamentals. This situation causes a deterioration of competitiveness for the anchor country, putting pressure on exports and pushing up demand for imports. Because the resulting trade deficits can largely be financed in the country's own currency, an important disciplinary force is lacking, which might otherwise reduce the external deficit. This situation can prevail for as long as the reputation of the anchor currency remains strong. Thus a paradox is created whereby a strong reputation will inevitably set the forces in motion that will undermine this reputation by weakening its financial status. This is analogous to the so-called 'Triffin dilemma' which was identified as far back as 1959.

These advantages – which on reflection may turn out to be a mixed blessing in the long term – are countered by an important obligation. The anchor currency is meant to be solid, not be prone to high inflation and certainly not constitute a source of financial instability. This requires above all of the dominant country that it acts responsibly vis à vis the special privileges that it enjoys as a consequence of having the anchor currency. Thus, not only direct domestic interests but also the international role of its currency must be taken into account in formulating national policy. This requires a level of discipline from policymakers that in practice appears difficult to sustain.

The US has neglected its task as guardian of international stability on a number of occasions, such as on the dissolution of Bretton Woods, in the run-up to the present crisis and, very recently, during the political quagmire about the increase of the public debt ceiling (leading to a downgrade of its sovereiegn rating by Standard & Poor's). In addition, its international financial position has weak-

ened, the country's economic weight in the global economy is showing a downward trend and its political influence, although still substantial, is under pressure. In many ways the situation is comparable to that of the British Empire after the First World War.

Calls for an alternative are becoming louder and are also coming from China (Zhou, 2009). However, it would not be logical for an alternative to emerge from another currency linked to a particular country. In contrast to 1918 when the US dollar was already clearly emerging as successor to sterling in view of the global shift in power, there is now no obvious successor. Neither the EMU nor China is sufficiently dominant from an economic, financial, political or military point of view to emulate the British position in the nineteenth century or the American position in the twentieth century. Moreover, China is not yet a free market economy, its financial markets lack depth and the renminbi is not a fully convertible currency. The fact that nowadays no single dominant country left also means that there is no obvious successor to the US dollar. Therefore for pragmatic reasons it might be thought that we may as well continue with the dollar for the time being. However, the problem remains that the Americans lack any restrictions on running savings deficits, thus remaining a source of major instability for the global economy. It would appear preferable, as in the words of Hayek (1943), to seek a "*..wisely and impartially controlled system of managed currency for the whole world*". The remainder of this article discusses how such a system might work.

10.4.2. Is a New Anchor Necessary?

With the waning financial strength of the US, it may be expected that the world is heading towards a period without a central currency anchor. A multi-polar system would make more sense, with the dollar, the euro, the yen, the renminbi – and in due course perhaps other currencies – playing an important regional role, but no longer dominating globally. The question is however, whether this system would require an anchor, and if so of what nature.

There is good reason to assume that a multi-polar system as that suggested above would function better with a central anchor. Otherwise, it may be expected that financial markets themselves will seek a key currency for the purpose of conducting international trade and transactions on the commodities markets. Central banks will want to hold their reserves in the most important currency. This would mean that the US dollar would continue for some time to occupy the role it currently plays, albeit with increasingly less conviction. Alternatively, the markets could shift their focus to the euro, as expected by Eichengreen (2007) for instance, or in the longer term to the Chinese renminbi. However, the same paradox will remain in place: the stronger the new currency is, the more powerful will be the forces that will undermine the economic fundamentals. Likewise, glo-

bal stability will ultimately depend on the way in which the dominant country weighs up its national priorities against global interests. Thus instability would seem almost inevitable, since the starting position of the successor to the dollar will be considerably weaker than that of the dollar itself in 1945 or of sterling in the 19th century. It would therefore appear preferable to create an entirely new, more stable anchor.

10.4.3. Towards a New International Standard

A new standard requires first and foremost renewal of the international infrastructure. In view of the central position still occupied by the IMF, the most obvious solution would be to reform this institution to enable it to form the basis for a new system. However, this would require the necessary changes to be made. The required reforms relate to:

1) the governance of the IMF;
2) making the IMF a 'lender of last resort';
3) converting the existing special drawing rights (SDR) to a fully-fledged global currency standard.

10.4.3.1. Re 1) The Governance of the IMF

Any increase in the global influence of the IMF should start by broadening its political support by making it a better reflection of the global economic powers. Therefore, if the IMF is to play a more heavyweight role as global economic supervisor, it is crucial that voting rights in the IMF are changed in favour of the emerging countries (IMF, 2011). The voting rights should be matched as closely as possible to the economic weight of the countries concerned within the global economy. Moreover, the IMF directors should be given greater autonomy in determining the amount of SDRs to be released into (or removed from) circulation (see below). Adjusting the supply of SDRs must be a decision based on monetary considerations, and must therefore be completely removed from the political arena. Needless to say, the directors will have to be answerable for their policies.

10.4.3.2. Re 2) Making the IMF a 'Lender of Last Resort' for Solvent Countries

Solvent countries that are faced with acute liquidity outflows must at all times be assured of automatic access to sufficient liquidity, without the imposition of additional conditions. This is crucial, in order to remove the incentive for countries to accumulate large reserves via sizeable surpluses on their current account of the balance of payments. For the global payments imbalances to be reduced, it is necessary not only that the US should reduce its savings deficit, but that the surplus countries should aim at reducing their surplus. By setting up a sound and

reliable *'lender of last resort'*, it will no longer be attractive to accumulate large reserves. And by removing the intrinsic overvaluation of an anchor currency (see above), the undervaluation of other currencies will automatically be reversed.

A function of this nature for the IMF requires strict monitoring of the solvency of countries. However, this 'credit rating' would be purely directed at the question: how solvent is the country? Does it merely have a liquidity problem or is there a solvency issue? Indeed this is not so far removed from the current working of the IMF, on the basis of which its conditionality is determined. If countries have certainty that they can fall back on liquidity support from the IMF, the building of large currency reserves is no longer necessary. Of course, the IMF must act with restraint in issuing qualitative judgements on policies pursued. Then perhaps a repeat of the effects may be prevented that were experienced by the Asian tiger countries during the Asian crisis of 1997, when the IMF abused its power to impose strict conditionality on basically well-run countries, in the process undermining its own reputation (Strauss-Kahn, 2009). Liquidity support can best be given by buying local currency treasury paper as collateral in exchange for support in SDRs. However, the exchange rate risk accompanying this transaction should lie entirely with the member state and not with the IMF.

10.4.3.3. Re 3) Converting the Existing SDR to a Fully-Fledged Currency Standard

The SDR is a unit of account created by the IMF in 1969, based on a basket of currencies which in terms of its design, closely resembles the European Currency Unit (ECU) which was launched in 1979. This unit of account could, subject to the conditions below, ideally play the role of international monetary anchor. If central banks were to hold the bulk of their reserves in SDRs, commodity prices were listed (and possibly also traded) in SDRs, and the official value of currencies were listed in SDRs, the result would be a stable anchor currency.

However, as was said earlier, the composition of the SDR will have to be adapted if it is to become a currency standard. If a basket of currencies is to be taken seriously as a global currency anchor, this basket must be a sound reflection of the global financial and economic balance of power. Currently, the SDR does not meet this requirement because it consists only of the dollar, euro, yen and sterling. The basket of currencies will therefore have to be adapted. The IMF (2011) proposes a system in which the currencies of in principle all members states could be included. This appears a bad idea, as it would raise insurmountable problems of valuation and stability. Such a SDR could never involve into a broadly used monetary anchor. It appears to better to include only the currencies of the most important economies, and maximize the number of constituent currencies to ten, taking account of the following criteria.

First, the SDR basket should consist of fully convertible currencies. Which means that both the current and financial accounts of the balance of payments of the countries concerned should be fully liberalized.

Secondly, the share of each currency has to be viewed in terms of its importance in the global economy, as measured by gross domestic product, importance in world trade and the extent to which a currency plays a role as regional currency anchor. Accordingly, the SDR should be composed of the currencies from the world's ten most important economies as determined on this basis. The future SDR (just like the current one) should not have any link to gold or commodities[10].

Thirdly, the SDR should not be defined on the basis of percentages, but on the basis of fixed amounts of the participating currencies[11]. Of course, these amounts should initially be determined in such a way that the percentage-wise composition of the SDR will reflect the currency weights in the global economy; however, these percentages will shift as soon as exchange rate fluctuations between the included currencies occur. This means that the weight of the weaker currencies in the basket will gradually decline, while that of the stronger currencies will increase. The valuation of the SDR in relation to the national currencies is then of course based on a weighted average of the individual currencies. Thus a certain element of competition is introduced between the most important currencies –at international level at least. Like in the case of the ECU, a rebasement of the SDR should occur not more than once in five years.

Purely for the purpose of illustration, the figure below (p. 177) shows a possible new-style SDR.

10.4.3.4. The Quantity of SDRs in Circulation

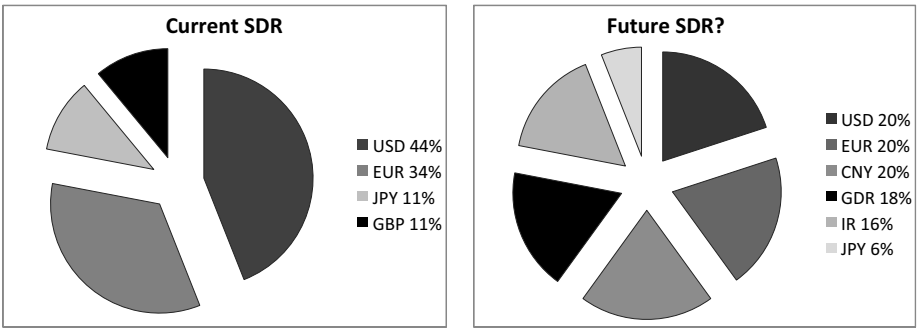
In a similar manner to how base money (M0) is created by central banks, the IMF could release SDRs into circulation[12]. This is necessary because the supply of SDR should be elastic enough to accommodate the demand resulting from growth in

[10] A recent IMF paper called for the creation of a new international currency alongside the SDR basket. This currency, named the 'bancor' in honour of Keynes, would be the real nominal anchor (Moghadam, 2010). In my view, this proposal is fundamentally flawed. The nominal anchor currency – the bancor – is not itself linked to anything, and its valuation is totally arbitrary. It would be better to allow the SDR basket to evolve into real money (see footnote 20). Because of the composition of the basket, the valuation of the currency is then totally objective.

[11] This was also the case with the ECU. If a basket of currencies is made up of a fixed number of currencies, it is known as a 'fixed basket'. The weights attached to the included currencies will, however, fluctuate according to their relative exchange rate development. If the weight of the included currencies is to remain constant ('fixed weight basket'), then the composition of the basket is always subject to change. This would severely undermine it usefulness for market participants.

[12] Base money, also known as the monetary base, or M0, consists of bank reserves plus cash in circulation. In case of the SDR, there will be no coins and notes, so all SDR-based M0 consists of official reserves. Because these reserves in turn form the basis for the liquidity creation process of commercial banks, M0 is also known as 'high powered money'.

Figure 3: Current and possible future composition of the SDR



Note: USD = US dollar, EUR = euro, JPY = Japanese yen, CNY = Chinese renminbi, IR = Indian Rupee, and GDR = gulf dinar (the common currency of the Middle Eastern oil producing countries, which does not yet exist)

world trade. Recall that the inelastic and uncertain supply of gold was one of the main flaws of the gold standard.

As a rule, central banks have two channels through which they can manipulate the amount of base money; these are the so-called open-market operations through which the central bank buys securities from the commercial banks (M0 rises, +) and sells them (-) or by issuing loans to banks or governments. When governments borrow money directly from the central bank, this is known as direct monetary financing. When commercial banks deposit government bonds with the central bank, this is indirect monetary financing. Normally, (government) loans are redeemed after a period of time. If the intention from the outset is to allow (part of) the increased base money to become permanent, then a perpetual government bond can be lodged with the central bank. SDRs released into circulation by the IMF effectively constitute an international variant of base money. The following balance sheets illustrate how things might work with the IMF in the role of global central bank for the member states.

IMF balance sheet changes when SDRs are created
1) Permanent increase in the quantity of SDRs

assets	liabilities
perpetual government paper +	reserves of member states +

Clarification

To date, the IMF has released SDRs into circulation on three occasions (in 1969, 1982 and 2009). On the asset side of the balance sheet, an item 'allocations' was listed. This item actually has no meaning – the member states do not deposit

funds with the IMF in order to obtain SDRs. This constitutes the main difference compared to ordinary drawing rights. New SDRs are created 'out of nothing'. The size of the allocations item is particularly of importance in determining the interest rates to be paid by or to the Fund. Countries whose SDR balance exceeds the allocations receive interest; in the reverse scenario, they pay interest to the IMF (IMF, 2010). Although the currently used method for creating SDRs could remain in place for the system proposed here, there is a lot to be said for allowing the IMF's money creating process to operate in a similar way to that of central banks. This example shows that the value of SDRs released by the IMF is ultimately guaranteed by the member states[13].

Temporary increase in the supply of SDRs via open-market operations

assets		liabilities
Government bonds	+	reserves of member states +

2) Temporary increase in the supply of SDRs via the extension of credit

assets	**liabilities**
Loans to member states +	reserves of member states +

In all cases, the supply of international liquidity increases. This is of course the weak spot of every monetary system, including the one proposed here. After all, by creating fiduciary money, including SDRs, the temptation remains to create extra money in order to increase seigniorage. Therefore it would be necessary to bind the IMF to an automatic policy rule, such as a fixed money growth rule based on the trend increase of global real GDP and/or world trade. This will mean that the supply of global base money can grow apace with the global real economy[14]. As under the gold standard, this would ensure that the global monetary

[13] In order to prevent discussion about the interest rates to be paid by the member states on the perpetual bonds to be accepted by the IMF, it is proposed that for the creation of SDRs – only in the case of a permanent increase – the IMF should accept perpetual zero bonds from the member states on a face value basis. Member states must undertake to buy back these bonds – likewise at face value – if the supply of SDRs is meant to shrink. This could happen if, for instance, world trade were to stagnate for a lengthy period or even contract.

[14] In practice, this would mean that the IMF would create a supply of SDRs annually (or quarterly or monthly) to be determined on the basis of economic indicators, by crediting the accounts of the central banks of the member states with an amount of SDRs in proportion to their economic weight. The asset side of the IMF balance sheet would then show an equally large item consisting of member state government bonds – whether perpetual or not. If a reduction of the money supply is needed, the same balance sheet entries would be shown, albeit in reverse.

standard is beyond the influence of everyday politics, thus removing the main disadvantage of a fiduciary monetary standard. And the main disadvantage of the gold standard – unpredictability and inelasticity of the money supply – is also gone.

Furthermore, the supply of SDRs can also be boosted by substitution. In that case, central banks exchange their reserves of, for instance, dollars or euro for SDRs. While the supply of SDRs then rises, the amount of dollars and/or euros is reduced by the same amount. Thus no new reserves are created – it is just the composition of them that changes. See below.

Changes to the supply of SDRs via substitution[a]

IMF Balance Sheet

assets		liabilities	
currencies (member states)	+	reserves of member states	+

Member State Balance Sheet

assets		liabilities
foreign currency reserves	-	
SDR reserves	+	

a. The Figure illustrates an increase in the SDR supply. If the supply is reduced, the symbols are reversed.

When base money is created in the form of SDRs, this gives rise to seigniorage. This profit can be for the account of the member states or the IMF. When SDRs are created by the lodgement of perpetual government paper with the IMF, the seigniorage goes entirely to the member states. In that case, the profit can be considerable, *i.e.* the total supply of the SDRs created minus the cash value of the difference between any interest payments on the perpetual loan (see footnote 13: in this proposal this would be zero) and any interest gains on the SDRs received. For this reason, it is important to remove this process entirely from the political arena and base it on objective criteria. These criteria need to be established contractually, in order to completely eliminate the lure of seeking excessive money creation[15]. In the case of other types of money creation, the extent of the seigniorage for the IMF is determined by the difference between the interest revenues to and interest paid by the IMF. Ideally, the IMF should charge interest at market

15 In order to ensure discipline regarding the growth of the global supply of base money by the IMF, it could be decided that any change to the code of conduct can only be implemented if permission is given by a qualified majority.

rates, with little or no interest paid on SDR deposits created via open market operations or loans[16]. The seigniorage accruing to the IMF from creating SDRs should be used to finance the running costs of the organisation, and any surplus should be added to the reserves.

The IMF should pay interest at market rates on SDR balances that are created via substitution[17]. Only in this way can countries be induced to hold their reserves in SDRs[18]. They can do this by lodging their currency reserves with the IMF in the form of an SDR deposit or by buying SDR denominated paper in the market (see below). Banks – both commercial and central banks – can also have deposits in SDRs with each other. In this respect too, past history with ECUs may pave the way. In contrast to the SDR, which although introduced in the early 1970s has so far played a subordinated role, the ECU was successful as an anchor currency from the start within the exchange rate mechanism of the European Monetary System. The currencies in the ECU basket reflected the economic weight of the participating countries within the European Union. Alongside the official ECU created by the authorities, a market for private ECUs soon emerged, in particular for investment products. The private ECU, albeit being just a currency backing without any official backing, developed into a major issuing currency on the international bond markets. It was as such by bank, companies and governments alike and at time did even a premium over its official value (IMF, 2011; Allen, 1986). In 1999 the ECU was discontinued as a currency basket, and was converted to the euro at parity[19].

[16] This raises the question as to what market interest rates are for countries. Often, countries will require extra international liquidity if they have difficulty in raising money on the international financial markets. It may be that the prevailing interest rates may not be representative of the fundamental situation of that country at the time. Therefore, it is important that agreement be reached beforehand, that the IMF will provide support at a rate based on a long-term average calculated over a period preceding that of the acute liquidity requirement.

[17] Interest on official SDR deposits is determined by the weighted average of interest paid on the currencies in the basket. Interest on private SDRs may deviate to a modest extent, because this market has a different dynamic. In this respect, experience with private ECUs may point the way.

[18] Keynes' proposal (1942) to charge interest also to those countries with a positive credit balance with the IMF (ICU in Keynesian terminology) would appear unrealistic nowadays with free movement of capital. Since the aim is for central banks globally to hold their reserves largely in SDRs, it would be counterproductive to 'penalise' them for doing so.

[19] Clearly, an important question is why the launch of the official ECU was quickly followed by the emergence of a sizeable market for private ECUs, whereas this did not succeed with the SDR. According to Allen (1986) the reasons for this include the following. The ECU was a so-called 'fixed-basket', whereas the SDR was a 'fixed weight basket' is. Thanks to its stable content, the former is better suited to the formation of private contracts, because private parties can create their own ECU from the currencies in the basket. This was not the case with the SDR. And the ECU was immediately subjected to widespread usage, because the EU conducted its financial business in this currency. Again, this was lacking with the SDR. The SDR had a large weight in dollars, whereas the ECU had a broader spread of currencies. And finally, the volatility of the SDR currencies is much greater than those that made up the ECU. The latter can be seen as a sensible compromise between the stronger and weaker currencies, an element greatly lacking in the case of the SDR (Allen, 1986, Chapter IV). In addition, Aglietta (2000) points to the paralysing effect of the discord between the US and France over the role of the SDR.

10.4.3.5. Floating Currency Blocks

Although the SDR in the role proposed here can develop into the world's most important internationally used currency, it is not envisaged as 'world money' in a literal sense. In our scenario, each country has the option of retaining its own currency or of introducing another currency, as for instance in the case of monetary integration. In practice many countries – particularly smaller ones – already have established some kind of link with another country's currency – usually that of a major trading partner. Under the proposed system, countries could continue to determine their own exchange rate system. A currency could be linked to a large currency such as the dollar, euro, yen or in due course the renminbi; alternatively it could be floated freely or 'managed' or linked directly to the SDR. Only the most important anchor currencies would have to be included in the SDR basket.

10.4.3.6. Greater Equilibrium in the Balance of Payments

A final important question is what influence the proposed system might have on global payment imbalances. A system based on the SDR can be expected to have a moderating effect. Because of the diversification inherent to the SDR, deficit countries will no longer be able to receive unlimited credit in their own national currency. This will remove a major cause of the current global imbalances and prevent an explosion of debt of the anchor country. Moreover, a well developed function of 'lender of last resort' should remove the incentive from most present day surplus countries to continue to build up excessively large reserves.

Nonetheless, there will always be countries with savings surpluses and those with deficits. There are often fundamental reasons for this, such as diverging business cycles, exchange rate fluctuations or demographic differences. However, if a consensus can be reached to the effect that a certain degree of equilibrium in trade should be aimed for in the foreseeable future, and that the exchange rate should play a role in restoring balance, then exchange rates should become more predictable. This can certainly be expected once the renminbi joins the ranks of fully convertible currencies.

10.5. Transitional Problems

In order to progress from the current inherently unstable situation to the system proposed here, changes in policy are required from all the major countries. To a point, this can be achieved by removing the faulty incentives from the system, and replacing them where possible with healthy incentives. Thus the incentive to accumulate excessively large currency reserves caused by the absence of a reliable *lender of last resort,* and the incentive for Americans to accumulate unbridled

foreign debt due to the special role of the dollar, will have disappeared from the new system. This means the removal of two major causes of the global balance of payments disequilibria. If trade in the major commodities is conducted in SDRs, countries will have an incentive to hold most of their reserves in SDRs and no longer overwhelmingly in dollars. As the SDR gains in importance, the market for private SDRs will grow and the proposed system will increase in effectiveness.

Both Europe and China face significant challenges. The euro and the renminbi will have to evolve into true competitors to the dollar. For the euro, this means above all that it should overcome its current problems, which necessitates that snags in its design will have to be addressed. For China the challenge lies in a long trajectory of deregulation of its financial markets and of international capital movement, before the renminbi can establish itself as a credible international currency[20].

Some countries will have to make concessions. For the US, a system based on the SDR means giving up the exorbitant privilege that it has enjoyed for over half a century. Although in the long term this will be good for America's own financial stability, the extra financial discipline required by the SDR system will not initially be seen by US policymakers as an improvement to their lot. In the long term, however, this discipline could be what might help prevent the US debt problem to run out of hand. The other major player – China – will also have to make adjustments to policy. A policy of export-driven growth, based on an undervalued currency is in any case not sustainable, if only on account of the international tensions it provokes – including a serious threat of protectionism. More painfully, perhaps, China will have to accept a hefty loss on its overwhelmingly dollar-denominated reserves when the SDR comes into effect.

Against this background, it is immediately clear that a transition to a new regime should take place gradually. It should start with the reform of the IMF and the incorporation of the right incentives, as described above. Bolstering the market for private SDRs is another important pre-condition. However, it will likely take some time – and perhaps another crisis or two, or a couple more trade wars, before both the US and China recognise that their future interests are best served by a reform of the global financial infrastructure.

[20] This does not mean that international capital movement has to be free of all restrictions. It is entirely justifiable for countries to want to curb inflows of speculative capital, as for instance Chile has traditionally done. Clearly, however, a country whose currency occupies an important position in the international system will liberalise its international capital movements as much as possible.

10.6. In Conclusion

The stability of the global economy would be greatly enhanced if instead of a national currency in the role of global anchor currency, a supra-nationally managed currency unit were to be introduced. It has been argued above that neither a return to the gold standard nor the introduction of a commodities standard would be a valid alternative. Therefore this article calls for the introduction of a nominal anchor in the form of a currency basket. As such, the SDR appears to be an ideal candidate for this role, but if it is to find universal acceptance, it will have to do greater justice to the interests of the emerging countries.

For a global currency to be managed, an international organisation is required. The IMF would appear to be the obvious candidate, in view of the role it has played since its inception. However, this organisation would itself first need to be reformed, both in terms of its structure and in the role it would have to play as *lender of last resort*. Only then can countries be induced to stop accumulating unnecessary savings surpluses. Deficit countries would have to contend with disciplinary forces at an earlier stage than is currently the case; accordingly, policymakers would have an incentive to address imbalances before they get out of hand. No single country would have an exclusive advantage based on its ownership of the key currency any longer.

With the growing importance of a revitalised SDR as official anchor, it may be expected that a private SDR market will soon develop, as was the case at the time with the ECU. If commodities are listed and traded in SDRs, this process will quickly gain traction. Major currencies like the euro, the dollar and the renminbi will continue to play an important role as regional anchors for the currencies of countries that have close trade links. These currencies, which will remain important players, may in principle fluctuate freely against each other. All in all, the end result will be a much more stable global economy.

References

AGLIETTA, M., 2000, *The International Monetary Fund and the International Financial Architecture*, CEP II, Document de travail No. 2000-08, May.

ALLEN, G.C., 1960, *The Economic Map of the World: Population, Commerce, and Industries*, Chapter II in The New Cambridge Modern History, vol. XII, The Era of Violence 1898-1945.

ALLEN, P.R., 1986, *The ECU: Birth of a New Currency*, Occasional Paper No. 20, Group of Thirty, New York.

ASIAN DEVELOPMENT BANK, ADB 2010, *The Future Global Reserve System – An Asian Perspective*, Manila, June 2010.

BERNANKE, B.S., 2005, *The Global Savings Glut and the U.S. Current Account Deficit*, Sandridge Lecture, Virginia Association of Economics, Richmond, Virginia, 10 March.

BERNANKE, B.S., 2007, *Global Imbalances: Recent Developments and Prospects*, Bundesbank Lecture, Berlin, September 11.

BERNSTEIN, P., 2000, *The power of gold. History of an illusion*, John Wiley & Sons, New York.

BORDO, M.D. & ROCKOFF, H., 1996, "The Gold Standard asa 'Good Housekeeping Seal of Approval'", *The Journal of Economic History*, Vol. 6 (2), June 1986, pp. 389-428.

BOUGHTON, J.M., 2002, *Why White, Not Keynes? Inventing the Postwar International Monetary System*, IMF Working Paper, WP/02/05, March 2002.

CAMDESSUS, M. e.a., 2011, *Reform of the international monetary system: a cooperative approach for the twenty first century* (Palais Royal Initiative), February 2011.

DNB (2010), "Nieuwe perspectieven op de rol van het IMF" (New perspectives on the role of the IMF, in Dutch), *Kwartaalbericht* maart 2010, pp. 24-28.

EICHENGREEN, B., 2010, "Managing a Multiple Reserve Currency World" in *ADB*, 2010.

EICHENGREEN, B., 2009, *Out of the Box Thoughts about the International Financial Architecture*, IMF Working Paper, WP/09/116, May.

EICHENGREEN, B., 2007, *Global Imbalances and the Lessons of Bretton Woods* (The Cairoli Lectures), MIT Press, Cambridge Massachusetts.

EUROPEAN LEAGUE FOR ECONOMIC COOPERATION, ELEC, 2010, "The creation of a common European bond market", *Cahier Comte Boël* No. 14, Brussels, March 2010.

FRIEDMAN, M., 1951, "Commodity-Reserve Currency", *The Journal of Political Economy*, Vol. 59, No. 3, June 1951, pp. 203-232.

GALBRAITH, J.K., 1975, *Money, whence it came, where it went*, Boston.

HAYEK, F.A., 1937, "Monetary Nationalism and International Stability", *Publication* No. 18, The Graduate Institute of International Studies, Geneva, reprinted in Kresge (1999b), Chapter 1.

HAYEK, F.A., 1943, "A Commodity Reserve Currency", *Economic Journal*, vol. 53, No. 210, June-September 1943, pp. 176-184, reprinted in Kresge (1999b), Chapter 2.

HAYEK, F.A., 1978, "Choice in Currency" in *New Studies in Philosophy*, Politics, Economy and the History of Ideas, reprinted in Kresge (1999b), Chapter 3.

HAYEK, F.A., 1978, *The Denationalization of Money: An Analysis of the Theory and Practice of Concurrent Currencies*, Institute of Economic Affairs, London, 1978, reprinted in Kresge (1999b), Chapter 4.

HELLEINER, E., 2003, *The making of National Money. Territorial Currencies in Historical Perspective*, Cornell University Press, Ithaca and London.

IMF, 2010, *Special Drawing Rights (SDRs)*, International Monetary Fund Factsheet, January (www.imf.org/external/np/facts/sdr).

KEYNES, J.M., 1942, "Proposals for an International Currency (or Clearing) Union (fourth draft of the 'Keynes Plan')" in *International Monetary Fund*, 1969-III, pp. 3-18.

KINDLEBERGER, C.P., 1993, *A Financial History of Western Europe*, 2nd edition, Oxford University Press.

KRESGE, S. (ed.), 1999a, *The Collected Works of F.A. Hayek*, vol. 5, "Good Money Part I – the new world", The Chicago Press, Routledge, London.

KRESGE, S. (ed.), 1999b, *The Collected Works of F.A. Hayek*, vol. 6, "Good Money Part II – the Standard", The Chicago Press, Routledge, London.

LEE, J.-W., 2010, *Will the Renminbi Emerge as an International Reserve Currency?*, Asian Development Bank, June.

MAYHEW, N., 1999, *Sterling. The Rise and Fall of a Currency*, Penguin Press, London.

IMF, 2010, *Reserve Accumulation and International Monetary Stability*, paper prepared by the Strategy, Policy and Review Department, Washington, April 13.

IMF, 2011, *Enhancing International Monetary Stability – A Role for the SDR?*, paper prepared by the Strategy, Policy and Review Department, Washington, January 7.

REDISH, A., 1993, "Anchors Aweigh: The Transition from Commodity Money to Fiat Money in Western Economies", *The Canadian Journal of Economics*, Vol. 26, No. 4, (Nov. 1993), pp. 777-795.

SIMMEL, G., 1990, *Philosophie des Geldes*, Berlijn, 1900, The English translation of 1978 was used (The philosophy of money, reprinted 1990), based on the second edition of 1907.

STRAUSS-KAHN, D., 2009, *Making the most of an historic opportunity: three principles for reshaping the global economic and financial framework*, address to the IMF annual conference, IMF, Istanbul, 2 October.

TRIFFIN, R., 1978, "The International Role and Fate of the Dollar", *Foreign Affairs* 1978-1979, pp. 269n-286.

USSHNER, L.J., 2009, "Global Imbalances and the Key Currency regime: The Case for a Commodity Reserve Currency", *Review of Political Economy*, Vol. 21, 3 July 2009, pp. 403-421.

VISSER, H., 1991, *Modern Monetary Theory. A Critical Survey of Recent Developments*, Edgar Elgar, Aldershot.

VISSER, H., 2010, "De zin en oorsprong van het geldgebruik: de conventionele analyse en het herleefde chartalisme" (Meaning and origin of money: the conventional analysis and the revived chartalism, in Dutch), *TPEdigitaal* 2009, jaargang 3(4), pp. 22-37.

WILLIAMSON, J., 2009, *Understanding Special Drawing Rights (SDR)*, Peterson Institute for International Economics, Policy Brief 09-11, June.

ZHOU, X., 2009, *Reform the International Monetary System*, paper, Peoples Bank of China, March.

ZIJLSTRA, J., 1992, *Per slot van rekening* (After all, memoirs, in Dutch), Uitgeverij Contact, Amsterdam.

11. The Nexus between Monetary Policy, Banking Market Structure and Bank Risk Taking

Tobias C. Michalak

Abstract

Using a sample of stock-listed bank holding companies located in Western Europe over the period from 1997 to 2008 this paper provides empirical evidence that an increase in short-term interest rates as well as an extended period of expansionary monetary policy has a negative impact on European stock-listed banks' soundness as measured by the Expected Default Frequency. Against this background and in order to evaluate interactions between the risk-taking channel of monetary policy and the competitiveness of a country's banking market we find a negative impact of an increase in competition in the loan market – proxied by the Boone-indicator – on financial soundness. Referring to the structural-conduct performance (SCP) paradigm, this paper provides further evidence that an increase in concentration in the banking market spurs financial soundness.

JEL classification: E43, E44, E52, E55, G01, G28

Keywords: risk-taking channel, competition, concentration, bank soundness, European banking

11.1. Introduction

Two years after the collapse of the U.S. investment bank Lehman Brothers the health of the global financial system seems to have recovered. However, the risks in the financial system still persist due to the fragile nature of the recovery and the ongoing restructuring of banks and sovereign balance sheets. In this context, the U.S. subprime mortgage crisis from mid-2007 triggered several phases of financial market turbulences, and in particular, several phases of unprecedented disruptions in the Credit Default Swap (CDS) market (IMF, 2010). In response to these unprecedented circumstances, a general reassessment of risks associated with structured finance instruments and European government bonds is observed across the whole financial community.

Under the framework of a 'flight to quality', the resulting lack of market liquidity during the height of the U.S. subprime mortgage crisis in combination with the upcoming uncertainty among investors has provoked a decrease in the fair value of financial instruments and a downward tendency of equity prices across European financial markets with an implied volatility of equity price indices being well above the levels experienced in recent periods of financial market turbulence

(BoE, 2007). A fortiori, central banks in major financial markets were forced to act as lenders of last resort by providing large amounts of liquidity to protect from further distortions, already before the collapse of Lehman Brothers on September 15, 2008 (BoE, 2007; BIS, 2007). To date, the International Monetary Fund (IMF) values the total bank write-downs and loan loss provisions at approximately USD 2,276 billion (IMF, 2010), probably constituting a serious threat of systemic fragility. The latter is supported by failures in valuating complex securitization instruments, a poor transparency in structured finance markets and weak forces of market discipline, which in total have exposed the financial system to a serious funding and confidence crisis (IMF, 2010, 2009, 2009a, 2008, 2008a, 2007).

Referring to these findings, recent theoretical and empirical studies suggest that the excessive risk taking was encouraged by the excessively low level of short-term interest rates over the period preceding the global financial crisis (*e.g.*, Taylor, 2009; Calomiris, 2009). In particular, the extended period of expansionary monetary policy may have contributed to an excessive credit expansion and thus ultimately to a boom-and-bust cycle in equity valuations and in the housing market. Recently, various authors suggest that monetary policy decisions are not necessarily neutral from a financial stability point of view (Delis and Kouretas, 2010; Altunbas *et al.*, 2010; Gambacorta, 2009; Diamond and Rajan, 2009, 2006; Adrian and Shin, 2009; Allen *et al.* 2009; Taylor, 2009; Calomiris, 2009; Borio and Zhu, 2008). In this context, Borio and Zhu (2008) point out the so called 'risk-taking channel' of monetary policy, which operates in at least three different dimensions. In particular, their analysis of the 'risk-taking channel' focuses on (a) the impact of low levels of short-term interest rates on valuations, income and cash flows (Adrian and Shin, 2009), (b) the nexus between low levels of short-term interest rates and target rate of returns – the 'search for yield' – (BIS, 2004; Rajan, 2005), and finally (c) the communication policy and reaction function of the monetary authority (see also Altunbas *et al.*, 2010; Gambacorta, 2009).

With regard to the second aspect of the 'risk-taking channel' (b), it is also suggested that a continuously increasing competitive pressure in banking markets in combination with a credit expansion may force banks to increase profit margins by softening their lending standards and increasing their risk exposure to fulfill capital market expectations (Keeley, 1990; Dell' Ariccia and Marquez, 2006; Peydrò and Maddaloni, 2010).

Again this background and to identify possible interactions between the 'risk-taking channel' and the competitiveness of a country's banking market, this paper investigates the nexus between low levels of short-term interest rates, monetary policy decisions, the banking market structure and financial soundness using a dataset of stock-listed bank holding companies for Western Europe (EU-9) plus

Switzerland over the period from 1997 to 2008. Our study is close in spirit to the empirical investigation of the nexus between interest rates, monetary policy decisions and bank risk-taking provided by Altunbas *et al.* (2010). However, to the best of our knowledge, this is the first study that empirically investigates the interaction between the 'risk taking channel' of monetary policy and the competitiveness of a country's banking market while employing the new empirical industrial organization approach to banking. In particular, using a unique dataset of bank-year observations in the EU-9 plus Switzerland over the period from 1997 to 2008, we calculate the Boone-indicator and the Lerner-index proposed by Boone (2008) and Lerner (1934), respectively, to proxy the competitiveness of a country's banking market. Moreover, referring to the structure-conduct-performance (SCP) paradigm, we extend our analysis by investigating the impact of the national banking market concentration on financial stability. Finally, we complement previous empirical studies by performing a large variety of robustness checks and sensitivity analyses.

The remainder of the paper is organized as follows. Section 11.2.1. presents the theoretical background, while Section 11.2.2. reports previous empirical studies on the relationship between monetary policy and banking stability. Section 11.3. introduces our empirical methodology. While Section 11.3.1. presents the data set, Section 11.3.2. describes our empirical model. The empirical results are presented and discussed in Section 11.4. and illustrated within Appendices A and B. Finally, Section 11.5. concludes.

11.2. Related Literature

11.2.1. Theoretical Background

Economic theory provides several predictions that *monetary policy decisions* are not neutral from a *financial-stability* perspective. In particular, recent theoretical and empirical studies suggest a trade-off between an extended period of low short-term interest rates and financial soundness (Delis and Kouretas, 2010; Altunbas *et al.*, 2010; Gambacorta, 2009; Diamond and Rajan, 2009, 2006; Adrian and Shin, 2009; Allen *et al.* 2009; Taylor, 2009; Calomiris, 2009; Borio and Zhu, 2008). In this context, Borio and Zhu (2008) introduce the so-called 'risk-taking channel' of monetary policy, defined as the short- and long-term impact of changes in monetary policy rates (short term interest rates) on either risk perception and/or risk tolerance in the banking industry, and finally on banks' overall risk exposure. In particular, their analysis of the 'risk-taking channel' of monetary policy focuses on three different aspects (see also Altunbas *et al.*, 2010; Gambacorta, 2009): (a) the impact of low levels of short-term interest rates on asset valuations, income and cash flows (see also Adrian and Shin, 2009), (b)

the nexus between low levels of short-term interest rates and the target rate of returns – the 'search for yield' – (see also BIS, 2004; Rajan, 2005) and (c) the communication policy and reaction function of the monetary authority.

Referring to the first aspect, it is well accepted that monetary policy decisions affect financing conditions and capital market expectations. Thus, it is emphasized that a low level of short-term interest rates stretching over an extended period of time may boost asset and collateral values as well as incomes. In turn, an increase in asset and collateral values may have a direct influence on the banks' estimates of probabilities of default, loss given default and implied market volatilities. As a consequence, an increase in asset and collateral values may thus lead to a reduction in risk perception and/or an increase in risk tolerance (Adrian and Shin, 2009).

The second aspect – the nexus between low levels of short-term interest rates and sticky target rate of returns – predominantly depends on the banks' investment policy, and in particular their incentive to bear more risk to fulfill capital market expectations and/or contractual agreements as well as regulatory and institutional constraints (Gambacorta, 2009). Accordingly, a number of psychological and behavioral aspects are assumed that determine the banks' 'search for yield' and risk-taking behavior (*e.g.*, the so called 'money illusion'). In this context, Rajan (2005) points out that an extended period of low short-term interest rates accompanied with an associated decline in the volatility of short-term interest rates, may release the banks' overall portfolio risk and hence encourages an increase in risk taking (behavior). Moreover, it is additionally emphasized that extended periods of low short-term interest rates provoke a decrease in spreads between the lending and deposit rates, which ultimately determines the banks' 'search for yield'. In this context, it is also underlined that a continuously increasing competitive pressure in banking markets in combination with a credit expansion, may force banks to increase profit margins by softening their lending standards and increasing their risk exposure to fulfill capital market expectations (Keeley, 1990; Dell' Ariccia and Marquez, 2006; Maddaloni and Peydró, 2009).

However, relevant theoretical and empirical studies are not conclusive about the relationship between *banking market competition* and *financial stability* (Schaeck and Čihák, 2008; Schaeck *et al.*, 2006; Beck *et al.*; 2006; Boyd and De Nicoló, 2006; Carletti and Hartmann, 2003). Theoretical predictions concerning the impact of the banking market structure on the 'search for yield' theory are in line with theoretical models and empirical findings predicting that in a more competitive environment with higher pressures on profits, banks may have higher incentives to take more excessive risks, finally resulting in higher financial fragility. In addition, banks are anticipated to earn fewer informational rents from their relationship with borrowers in competitive markets, which may reduce their

incentives to properly screen borrowers, also increasing the risk of fragility (*e.g.* Beck, 2008; Allen and Gale 2004, 2000). In contrast, however, a higher competitive pressure may also deter excessive risk-taking behavior by the bank's management (see, for example, the "*charter value hypothesis*", Keeley, 1990). Accordingly, to the extent that higher market competition keeps banks from operating in too risky lines of business, banking systems with a higher competitive level are assumed to be more stable (Boyd and De Nicoló, 2006; Carletti and Hartmann, 2003).

Moreover, relevant theoretical and empirical literature also provides countervailing predictions concerning the interaction between the "*risk taking channel*" of *monetary policy* and the *competitiveness* of a country's *banking market*. On the one hand, it is likely that the impact of monetary policy decisions and the corresponding changes in the short-term interest rates on bank soundness may itself depend on the underlying banking market structure and, in particular, the interaction between the banking market structure and the interest rate pass-through mechanism (process) of market rates (*e.g.* Leuvensteijn *et al.*, 2008; Gropp *et al.*, 2006; De Bond, 2005; Maudos and Fernández de Guevara, 2004; Corvoisier and Gropp, 2002; Borio and Fritz, 1995; Cottarelli and Kourelis, 1994). On the other hand, however, it is also emphasized that the causality running from the banking market structure to short-term interest rates and finally to banking stability is not clear since it is not obvious if the banking market structure itself depends on monetary policy decisions, interest rates and finally the bank's financial soundness (see also Amel and Liang, 1997). Hence, from a theoretical and empirical point of view it is obvious that the banking market structure may affect the monetary policy transmission mechanism and, in particular the interest rate pass-through process of market rates and finally financial fragility (see also Leuvensteijn *et al.*, 2008).

Finally, referring to the last aspect (c), the impact of monetary policy decisions on financial soundness depends on the communication policy and reaction function of the monetary authority and, in particular, the ability of central banks to manage inflation and short-term interest rate expectations. In this context, a higher transparency and predictability of monetary policy should reduce 'ex-ante' uncertainty concerning changes in inflation and short-term interest rates, which in turn should reduce uncertainty about intermediate- and long-term interest rates as well as financial market prices. However, relevant economic theory provides countervailing predictions concerning the relationship between the communication policy and reaction function of the monetary authority and banking stability. On the one hand, it is suggested that a higher transparency concerning the stance of monetary policy should strengthen a bank's ability to anticipate future inflation and interest rates, and finally strengthen a bank's capability to reprice assets and liabilities (Blinder *et al.*, 2008; Blattner *et al.*, 2008). On the other hand,

however, it is assumed that a low level of short-term interest rates in combination with a higher predictability of monetary policy decisions and, in particular, the market anticipation of an extended period of low short-term interest rates, could facilitate risk-taking incentives – the 'search for yield' (Borio and Zhu, 2008).

11.2.2. Empirical Evidence

Empirical literature with a special focus on the relationship between short-term interest rates, monetary policy decisions and financial stability is rather scarce. To begin with, using micro-level data of the Credit Register of the Bank of Spain for 350 commercial, savings and cooperative banks in Spain over the period from 1984 to 2006, Jeménez *et al.* (2009) provide empirical evidence that an extended period of expansionary monetary policy is inversely related to a bank's credit risk in the medium run supporting the 'search for yield' theory. Thus, the authors suggest that banks may increase their risk exposure by softening their lending standards during longer periods of low short-term interest rates. Moreover, and in contrast, they provide further evidence that low short-term interest rates reduce default rates of outstanding loans in the short-run.

Subsequently, Ioannidou *et al.* (2009) confirm empirical findings by Jimenéz *et al.* (2009) using micro-level data of the public credit register of Bolivia for Bolivian banks over the period from 1999 to 2003. In addition, they provide evidence that the 'risk-taking channel' not only affects the loan origination proxied by the quantity of new loans but also the pricing of new loans. In particular, their analysis reveals that expansionary monetary policy increases the risk-taking appetite of banks and the likelihood that banks do not adequately price these additional risks.

Using quarterly balance sheet data of 643 stock-listed bank holding companies in the EU-15 plus the U.S. between 1998 and 2008, Altunbas *et al.* (2010) provide empirical evidence that an extended period of low short-term interest rates and, in particular, a period of short-term interest rates below a benchmark level, has a positive impact on financial fragility, supporting the 'search for yield' theory. Moreover, their analysis reveals that the effectiveness of the 'risk-taking channel' of monetary policy still holds when they control for changes in business expectations, differences in the regulatory framework and finally changes in bank competition.

Finally, Delis and Kouretas (2010) examine the effect of low short-term interest rates on bank stability using a large dataset of quarterly and annual balance sheet data from Western European banks over the period from 2001 to 2008. In line with Altunbas *et al.* (2010), they find that low short-term interest rates increase bank risk-taking substantially. In addition, their empirical analysis

reveals that, ceteris paribus, the impact of the 'risk-taking channel' of monetary policy on financial soundness is larger for low-capitalized banks and that the increase of credit risk is significantly higher for banks with high off-balance-sheet items.

11.3. Empirical Methodology

11.3.1. Data and Sources

Notes on variables and data sources are presented in Table 1 (*Dynamic Panel Regression*) and Table 2 (*The Boone-indicator and the Lerner-index*). Tables 3 to 6 report descriptive statistics for the entire set of included variables. The corresponding correlation matrix is provided in Table 13.

11.3.1.1. Bank Soundness

Our empirical analysis focuses on consolidated balance sheet data from 65 stock-listed bank holdings[1] across the EU-9[2] plus Switzerland over the period from 1997 to 2008 following the introduction of the "*Single Banking License*" in 1997 in Europe. Banks' consolidated balance sheet data are retrieved from the Bank-Scope database, which is compiled by Fitch Ratings and provided by Bureau van Dijk.

We employ the banks' distance to insolvency as a proxy for financial soundness by including the *Expected Default Frequency* (Risk Neutral Default Probability) as our dependent variable. The *Expected Default Frequency* is the probability, expressed as a percentage, that the market value of a bank's assets will be lower than a distress barrier within a given time horizon. This indicator has become a popular measure of bank soundness in related empirical work on financial stability (*e.g.*, Huang *et al.*, 2010; Altunbas *et al.*, 2010).

We calculate the *Expected Default Frequency* using a step-by-step (two-step) approach. To begin with, we employ the *Merton framework* (1974, 1973) to calculate a bank's *Distance-to-Default* (DtD). The well-known *Distance-to-Default* measure is build from traditional accounting-based information and

[1] To ensure a high degree of comparability in accounting standards we exclusively include stock-listed banks (see also Altunbas *et al.* (2010)). Nevertheless, from a macroeconomic point of view our sample of 65 stock-listed banks is still highly relevant for Europe, as it represents around 46.5 percent of total lending and 44.3 percent of total assets as compared to the entire European banking sector.

[2] The initial sample comprises the EU-15 plus Switzerland. However, we exclude countries with less than 20 bank year observations, since the estimations of the Boone-indicator and the Lerner index require a minimum of 20 bank year observations. Accordingly, the EU-9 comprises Austria, Belgium, Denmark, France, Germany, Italy, Netherlands, Spain and the United Kingdom.

combines this information with current and future financial market prices to predict a bank's insolvency risk. The indicator is defined as follows:

$$DtD \equiv \frac{\ln\left(\frac{V_A}{DB}\right) + \left(\mu - \frac{1}{2}\sigma^2\right)T}{\sigma_A\sqrt{T}}, \tag{1}$$

where V_A is the current value of assets, σ_A is the standard deviation of assets, DB is the distress barrier, defined as the face value of short-term liabilities (maturity ≤ 1 year) plus half of the amount of long-term liabilities (maturity > 1 year), μ is the drift rate of assets and T is maturity of debt (time horizon). Obviously the *Distance-to-Default* decreases with (a) a decrease in bank asset value, (b) an increase in asset volatility and/or (c) an increase in bank leverage. Building the *Distance-to-Default* this way, it is designed to indicate the number of standard deviations the bank's asset value is away from the default point within a given time horizon (usually one year). The default point in turn is associated with the probability that the market value of a bank's assets falls below the market value of its debt (distress barrier). Thus, a higher (lower) *Distance-to-Default* ratio implies a lower (higher) probability of insolvency risk.

In a second step, we translate the derived *Distance-to-Default* (DtD) of bank i at time t into a time-variant *Expected Default Frequency* (EDF) based on the risk neutral valuation framework. Accordingly, the *Expected Default Frequency* (EDF) is defined as follows:

$$EDF \equiv N(-DtD) = N\left(-\frac{\ln\left(\frac{V_A}{DB}\right) + \left(\mu - \frac{1}{2}\sigma_A^2\right)T}{\sigma_A\sqrt{T}}\right) \tag{2}$$

with $N(\bullet)$ following a standard normal distribution. Therefore, a higher (lower) ratio of the *Expected Default Frequency* implies a higher (lower) probability of default. Further details and an in-depth technical discussion of the construction of these distance-to-default measures are provided in Appendix B.

11.3.1.2. The Monetary Policy Indicator

As discussed in greater detail in Section 11.2. (theoretical background), the direct relationship between monetary policy and bank risk-taking may be generally attributed to two different 'transmission channels'. First, the impact of *short-term interest rates* on the *quality of assets of domestic banks* and second, the influence of *short-term interest rates* on the "*search for yield*". Unfortunately, since it is impossible to separate the bank's investment policy and capital structure deci-

sions associated with changes in the stance of monetary policy from the general operating and strategic 'asset-liability-management' as well as the dynamics of bank's portfolio risks, we are not able to empirically control for respective transmission channels in a straight-forward fashion.

Therefore, we initially include the change in the three-month interbank offered rate at the country level (denoted as *interest rate*) to control for the direct impact of short-term interest rates on bank soundness. Subsequently, we employ the difference between the nominal short-term interest rate and the rate implied by different benchmark models to evaluate the stance of monetary policy (see also Altunbas *et al.* (2010) and Gambacorta (2009)).

In this context, the stance of monetary policy is proxied by three different measures of interest rate gaps. We estimate the different interest rate gaps for each country and each year in our sample for the period from 1997 to 2008. We employ three different interest rate gaps as follows:

(1) The difference between the three-month interbank offered rate and the rate implied by a Taylor rule with interest rate smoothing. Accordingly, the Taylor rule is defined as follows:

$$i_t = (1-\gamma)[\alpha + \beta_\pi(\pi_t - \pi^*) + \beta_y(y_t - y^*)] + \gamma i_{t-1}, \quad (3)$$

where i_t is the target interest rate (Taylor rate), γ characterizes the degree of interest rate smoothing, α is the natural interest rate[3], π_t is the inflation rate, π^* is the target inflation rate and $y_t - y^*$ is the output gap (the difference between the actual GDP and its long-term potential level). In line with Altunbas *et al.* (2010), we initially set γ to 0.85, $\beta_\pi = 1.5$ and $\beta_y = 0.5$, and finally π^* to 2.0 percent.

(2) The difference between the three-month interbank offered rate and the rate implied by the standard Taylor rule, which is defined as follows:

$$i_t = (1-\gamma)[\alpha + \beta_\pi(\pi_t - \pi^*) + \beta_y(y_t - y^*)] + \gamma i_{t-1}, \quad (4)$$

Following Taylor (2001, 1993), we set γ to 0.0, $\beta_\pi = 0.5$ and $\beta_y = 0.5$.

(3) The difference between the three-month interbank offered rate and the 'natural interest rate' ('benchmark level').

[3] The natural interest rate is estimated by means of a Hodrick-Prescott filter.

11.3.1.3. Measures of Competition

We employ two time-variant measures of banking market competition and two time-variant measures of banking market concentration. The competitiveness of a country's banking market is proxied by the Boone-indicator and the Lerner-index proposed by Boone (2008) and Lerner (1934), respectively. Moreover, we include the 5-bank concentration ratio and the Herfindahl-Hirschman index to proxy the banking market concentration. Notes on variables and data sources used to calculate the Boone-indicator and the Lerner-index are presented in Table 2. Table 5 reports descriptive statistics for the Boone-indicator, whereas Table 6 presents descriptive statistics for the Lerner-index. Moreover, Figures 1 and 2 more precisely illustrate the development of the Boone-indicator and the Lerner-index on a country level for the EU-9 and Switzerland over the sample period.

11.3.1.3.1. The Boone-Indicator

We initially employ the Boone-indictor to infer the degree of competition of a country's banking market and, in particular, a country's loan market. Boone (2008, 2001) postulates in several theoretical models that efficient firms gain higher market shares as well as higher profits and that this basic effect is positively correlated with the competitive environment in the respective market (*i.e.*, the basic effect is stronger in a more competitive environment with higher pressures on profits). In this context, Boone (2008) suggests the following specification to proxy the profit elasticity of a specific market:

$$\ln(\pi_{i,t}) = \alpha + \beta \ln\left(\frac{mc_{i,t}}{\sum_{j} mc_{j,t}}\right), \tag{5}$$

where $\pi_{i,t}$ is the profit of firm i at time t and $mc_{i,t}$ are the marginal costs of firm i at time t. β represents the profit elasticity (*i.e.*, the decrease in profits of firm i at time t, expressed as a percentage, as a result of a one percent increase in marginal costs of firm i at time t). Accordingly, the Boone-indicator (β) is negative and measures the elasticity of firms' profits toward firms' marginal costs. In this context, higher negative values of β indicate more competitive markets.

In line with Leuvensteijn *et al.* (2007) and Schaeck and Čihák (2008), we employ a step-by-step (two-step) approach to calculate the Boone-indicator for each country and each year from 1997 to 2008 using individual-bank year observations.

To begin with, the marginal costs of loans are obtained by differentiating a translog cost function with two outputs (total loans and other earning assets) by one

output (total loans). Following the methodology provided by Schaeck and Čihák (2008), we use a stochastic frontier model to estimate a translog cost function for each country based on individual bank observations with two outputs (total loans and other earning assets), three inputs (labor, funding and capital costs) and three netputs (fixed assets, deposits and equity capital). Hence, the translog cost function is defined as follows:

$$\begin{aligned}\ln C = \alpha_0 &+ \sum_{i=1}^{2} \alpha_i \ln Y_i + \frac{1}{2}\sum_{i=1}^{2}\sum_{j=1}^{2} \delta_{i,j} \ln Y_i \ln Y_j + \sum_{k=1}^{2} \beta_k W_k + \sum_{h=1}^{2} \mu_h \ln E_h \\ &+ \frac{1}{2}\sum_{k=1}^{2}\sum_{m=1}^{2} \gamma_{k,m} \ln W_k \ln W_m + \sum_{i=1}^{2}\sum_{k=1}^{2} \rho_{i,k} \ln Y_i \ln W_k + \sum_{i=1}^{2}\sum_{h=1}^{2} \varepsilon_{i,h} \ln Y_i \ln E_h \\ &+ \sum_{k=1}^{2}\sum_{m=1}^{2} \lambda_{k,h} \ln W_k \ln E_h + \frac{1}{2}\sum_{h=1}^{2}\sum_{n=1}^{2} \psi \ln E_h \ln E_n + \ln \nu_c + \ln \varepsilon_c\end{aligned} \tag{6}$$

where C are the total costs, Y is a vector of outputs (total loans and other earning assets), W is a vector of inputs (labor, funding and other costs), E is a vector of netputs (fixed assets, deposits and equity capital), ν is the inefficiency term and ε is the error term[4].

Subsequently, to obtain the marginal costs of loans, we differentiate equation (6) with respect to the bank's total loans L:

$$mc_{i,t} = \frac{\partial C}{\partial L} = [\alpha + \delta_1 \ln Y_1 + \delta_2 \ln Y_2 + \rho_1 \ln W_1 + \rho_2 \ln W_2 + \varepsilon_1 \ln E_1 + \varepsilon_2 \ln E_2] \frac{C_{i,t}}{L_{i,t}}. \tag{7}$$

Finally, we estimate the following linear relationship between an individual bank's market share in the loan market and the bank's marginal costs of loans:

$$\ln(s_{i,t}) = \alpha + \beta \ln\left(\frac{mc_{i,t}}{\sum_j mc_{j,t}}\right), \tag{8}$$

where $s_{i,t}$ is the market share in the loan market of bank i at time t and $mc_{i,t}$ are the marginal costs of bank i at time t. In this context, β represents the Boone-indicator.

According to relevant empirical literature, the causality running from bank's marginal costs of loans to bank's market share in the loan market is not clear since it is not obvious if the marginal costs of loans depends on the bank's market share in the loan market. Hence, reverse causality may arise as a particular case of endogeneity, for example, if a large (monopolistic) bank exhibits lower marginal

[4] Total costs and input prices are scaled by one other input price (labour cost) and by one other netput (equity capital).

costs due to the fact that larger banks may have comparative advantages in providing credit monitoring services and/or larger banks may be able to diversify loan portfolio risks more efficiently due to higher economies of scale and scope. As a consequence, and in line with Schaeck and Čihák (2008), we apply instrumental variable techniques using a GMM-style estimator and employ two-period lagged marginal costs of loans as an instrumental variable.

As both theoretical and empirical studies are not conclusive about the impact of banking market competition on financial stability (Schaeck and Čihák, 2008; Schaeck *et al.*, 2006; Beck *et al.*, 2006; Boyd and De Nicoló, 2006; Carletti and Hartmann, 2003), we expect an ambiguous effect of our competition measures on financial stability.

11.3.1.3.2. The Lerner-Index

Next to the Boone-indicator we further include the Lerner-index as a traditional measure of a bank's market power. The Lerner index measures the price-marginal-cost-difference as the inverse of the price elasticity of demand. In a perfectly competitive market, where the demand curve is perfectly elastic, the Lerner index equals zero. In a monopoly market, the bank will use its market power to set its profit-maximizing output in the inelastic portion of the demand curve and charges a price greater than the marginal cost. In this case, the Lerner index turns toward the value of one. Again, we expect an ambiguous effect of our competition measure on bank soundness.

We construct the time-variant Lerner-index on a country level as follows:

$$\text{Lerner-index}_{i,t} = \frac{p_{i,t} - mc_{i,t}}{p_{i,t}}, \tag{9}$$

where $p_{i,t}$ is the output price (interest and non-interest revenues divided by total assets) of bank i at time t and $mc_{i,t}$ are the marginal costs of bank i at time t. The marginal costs are obtained by differentiating a translog cost function with one output (total assets) by output. Following the methodology provided by Schaeck and Čihák (2008), we use a stochastic frontier model to estimate a translog cost function for each country based on individual bank observations with one output (total assets), three inputs (labor, funding and capital costs) and three netputs (fixed assets, deposits and equity capital). The translog cost function is defined as follows:

$$\ln C = \alpha_0 + \alpha_1 \ln Y + \frac{1}{2}\alpha_2 \ln Y^2 + \sum_{k=1}^{2} \beta_k W_k + \sum_{h=1}^{2} \mu_h \ln E_h + \frac{1}{2}\sum_{k=1}^{2}\sum_{m=1}^{2} \gamma_{k,m} \ln W_k \ln W_m + \sum_{k=1}^{2} \rho_k \ln Y \ln W_k + \sum_{h=1}^{2} \varepsilon_h \ln Y \ln E_h + \sum_{k=1}^{2}\sum_{h=1}^{2} \lambda_{k,h} \ln W_k \ln E_h + \frac{1}{2}\sum_{h=1}^{2}\sum_{n=1}^{2} \psi \ln E_h \ln E_n + \ln \nu_c + l, \varepsilon_c \quad (10)$$

where C are the total costs, Y is the output (total assets), W is a vector of inputs (labor, funding and other costs), E is a vector of netputs (fixed assets, deposits and equity capital), ν is the inefficiency term and ε is the error term[5].

Finally, to obtain the marginal cost, we differentiate equation (10) with respect to Y:

$$mc_{i,t} = \frac{\partial C}{\partial L} = [\alpha_1 + \alpha_1 \ln Y + \rho_1 \ln W_1 + \rho_2 \ln W_2 + \varepsilon_1 \ln E_1 + \varepsilon_2 \ln E_2] \frac{C_{i,t}}{Y_{i,t}}. \quad (11)$$

11.3.1.3.3. The Concentration-Measure

Referring to the traditional structure-conduct-performance (SCP) paradigm (Berger *et al.*, 2004, 2007), we further include two time-variant measures of banking market concentration. To begin with, the 5-bank concentration is constructed as the fraction of assets of the total banking system's assets held by the five largest domestic and foreign banks per country (Uhde and Heimeshoff, 2009). The Herfindahl-Hirschman Index (HHI) is computed as the sum of the squared market shares of a country's domestic and foreign banks. Calculating concentration ratios in this way addresses the fact that the banking industry is further globalizing and that banks compete not only within national boundaries but also across borders. As both theoretical and empirical studies are not conclusive about the impact of banking market concentration on financial stability (Uhde and Heimeshoff, 2009; Beck *et al.*, 2006; Schaeck *et al.*, 2006; De Nicoló *et al.*, 2004), we expect an ambiguous effect of our concentration measures on financial stability.

11.3.1.4. Control Variables

When examining the relationship between monetary policy, the banking market structure and bank soundness, it is imperative to control for macroeconomic and bank-specific factors as well as the institutional environment (*e.g.* cross-country differences in the capital market structure and the capital market development)

[5] Total costs and input prices are scaled by one other input price (labor cost) and by one other netput (equity capital).

that are likely to affect banking stability, monetary policy, the market structure, or the nexus between these variables, and thus help mitigate omitted-variable biases. We lagged some of the variables to avoid simultaneity.

Macroeconomic control variables are retrieved from the *World Development Indicator (WDI) database* provided by the *World Bank*. We include well-accepted macroeconomic control variables of rates of real *GDP growth* and *credit growth* to cover a country's macroeconomic development that is assumed to affect the quality of bank assets.

Due to the fact that characteristics of banks in our sample vary across the EU-9 plus Switzerland we employ further bank-specific variables. We employ the bank's one-period lagged *net interest margin* to control for a bank's profitability, the one-period lagged *non-performing loans* as a key measure for credit risk and loan-portfolio quality, the one-period lagged *cost-income ratio* to control for a bank's efficiency and finally, the one-period lagged log of *total assets* as a proxy for the bank's size. We expect a negative sign of the coefficients of *net interest margin* and *total assets* and a positive sign of the coefficients of *non-performing loans* and *cost-income ratio*.

To draw an accurate statistical inference concerning the relationship between monetary policy decisions, the banking market structure and bank soundness we further perform a selection of sensitivity analyses. Due to high correlations between these control variables, and, to avoid simultaneity we include them in turn in separate regressions. In this context, we finally employ the *stock market return* and changes in the *house price index* to control for cross-country differences regarding the capital market structure and the capital market development.

11.3.2. Empirical Model

To test the hypothesis that changes in the stance of monetary policy and the banking market structure affect bank soundness, we use the generalized method of moments (GMM) for dynamic panel data by Arellano and Bover (1995) and Blundell and Bond (1998). Accordingly, we estimate the following dynamic regression model on panel data:

$$y_{i,t} = \alpha + \beta y_{i,t-1} + \sum_{j=0}^{1} \delta_j Interest\ Rate_{k,t-j} + \sum_{j=0}^{1} \phi_j Taylor\ Gap_{k,t-j} + \varphi c_{k,t} + \sum \omega_j x_{i,k,t} + \varepsilon_{i,t} \quad (12)$$

where y_{it} represents the *Expected Default Frequency* (EDF) of bank holding *i* in a respective year *t*, $Interest\ Rate_{k,t}$ is the change in the country-specific three-month interbank lending offered rate at time *t*, $Taylor\ Gap_{k,t}$ is the country-specific difference between the three-month interbank lending offered rate and the rate implied by the different Taylor rules at time *t* (as defined in section

11.3.1.2.) and $c_{k,t}$ are country-specific banking market-structure indicators (competition and concentration measures) in a respective year t. The vector $x_{i,k,t}$ includes control variables as described above. ε_{it} is an error term and α is the intercept. $\beta, \delta, \phi, \varphi$ and ω denote the parameters to be estimated. We further include one-lag of all macroeconomic variables to account for the fact that a country's macroeconomic development may influence the quality of assets of domestic banks with a certain delay. Finally, we further set time dummies to control for time-specific effects.

Estimating a dynamic panel data model, by employing the generalized method of moments (GMM) for dynamic panel data is a consequent strategy for two reasons[6]. First, there are several theoretical and empirical studies indicating a significant level of persistence in bank risk (see, for example, Delis and Kouretas, 2010). If there is persistence in bank risk, a static model may be biased, and the application of a dynamic panel regression model is more appropriate. Second, from a theoretical as well as an empirical point of view, the direction of causality between monetary policy, banking market structure and financial soundness is not clear but is rather assumed to suffer from endogeneity, especially reverse causality. In this context, the GMM-estimator ensures efficiency and consistency, given that the estimated dynamic regression model is not subject to second-order serial correlation and that the instruments employed are valid (see also Delis and Kouretas, 2010). We use the second lags of the dependent variable, the macroeconomic variables, the banking market structure variables and the control variables as instruments in the GMM regression specification. The validity of the instruments is tested using the Hansen's J test statistic of over identifying restrictions, which is robust to heteroskedasticity and autocorrelation. The null hypothesis of the Hansen's J test statistic is that instruments used are not correlated with residuals, *i.e.* the over identifying restrictions are valid. Moreover, we employ the Arellano-Bond test to control for serial correlation in the first differenced residuals. In this context, the null hypothesis of the Arellano-Bond test statistic is that residuals in the first difference regression do not exhibit serial correlation of order two.

11.4. Empirical Results

We present main empirical results, robustness checks and sensitivity analyses in Table 7 (*Monetary policy, the Boone-indicator and Bank soundness*) and Table 8 (*Monetary policy, the Lerner-index and Bank soundness*). Regression specification (1) reports our baseline regression result assessing the impact of low short-term interest rates, the stance of monetary policy and banking market competi-

[6] Bond (2002) is an excellent survey on dynamic panel data regression models.

tion on bank soundness. Regression specifications (2) and (3) comprise different concentration measures to control for the impact of the banking market concentration on the 'risk-taking channel' of monetary policy. Regression specification (4) uses a different monetary policy indicator to control for the robustness of our main empirical results. Regression specifications (5) and (6) present empirical results from a selection of sensitivity analyses. Further robustness checks are reported in Table 9 and Table 12. The corresponding correlation matrix is reported in Table 13.

11.4.1. Baseline Findings and Robustness Checks

11.4.1.1. Monetary Policy, Market Structure and Bank Soundness: Boone-Indicator Estimations

In order to identify possible interactions between the 'risk-taking channel' and the competitiveness of a country's banking market the following baseline equation is employed to assess the impact of low short-term interest rates, monetary policy decisions and banking market competition on a bank's financial soundness:

$$EDF = \alpha + \beta EDF_{i,t-1} + \sum_{j=0}^{1} \delta_j Interest\ Rate_{k,t-j} + \sum_{j=0}^{1} \phi Taylor\ Gap1_{k,t-j} + \sum_{j=0}^{1} \gamma_j GDPgrowth_{k,t-j} + \sum_{j=0}^{1} \omega_j Creditgrowth_{k,t-j} + \varphi Boone - Indicator_{k,t} + \nu C_{k,i,t} + \varepsilon_{i,t} \quad (13)$$

where $C_{k,i,t}$ are further control variables.

First, the overall level of short-term interest rates is likely to implicitly influence asset quality. While a passing through of increasing short-term interest rates to deposit rates will raise the banks' funding costs, a handing down to lending rates should raise profitability but might let loan repayment be more difficult for borrowers, which may result in higher loan default rates and decreasing asset quality.

As Table 7 reports, the *interest rate* variables enter regression specification (1) significantly positive at the one-percent level respectively, indicating that an increase in short-term interest rates has a negative impact on Western European banks' financial soundness, which is in line with empirical evidence provided by previous empirical literature (Altunbas *et al.*, 2010; Jeménez *et al.*, 2009). In line with Jeménez *et al.* (2009) we suggest that low short-term interest rates indeed reduce the loan default rates of banks outstanding loans.

The *Taylor gap 1* variables – the difference between the three-month interbank offered rate and the rate implied by a Taylor rule with interest rate smoothing – enter the regression significantly negative at the one-percent level, suggesting that an extended period of expansionary monetary policy and, in particular, an

extended period of short-term interest rates below a theoretical benchmark level lead to a reduction in risk perception and/or an increase in risk tolerance. Hence, our result confirms previous empirical findings on this effect provided by Altunbas *et al.* (2010) and Gambacorta (2009).

Introducing the *Boone-indicator*, this variable enters the regression significantly negative at the ten-percent level, indicating that Western European banks operating under increasing credit market competition are more prone to financial fragility. This result is in line with theoretical models and empirical findings predicting that in a more competitive environment with higher pressures on profits, banks may have higher incentives to take more excessive risks, resulting in an increase in financial fragility. In addition, banks are anticipated to earn fewer informational rents from their relationship with borrowers in competitive markets, which may reduce their incentives to properly screen borrowers, again increasing the risk of financial fragility (*e.g.*, Beck, 2008). Taking this into account and referring to the 'risk-taking channel' of monetary policy our result may verify the 'search for yield' theory provided by Rajan (2005) and the transmission channel proposed by Dell' Ariccia and Marquez (2006) as well as Maddaloni and Peydró (2009).

Among the macroeconomic control variables, *GDP growth* enters the regression significantly negative at the one-percent level, suggesting that banks' investment opportunities are positively correlated with the business cycle (Laeven and Majoni, 2003). In addition, our results indicate that the banks' investment opportunities rise under economic booms and that borrowers' solvency should be higher under an increasing economic performance. Moreover, the *credit growth* variable exhibits a significantly positive sign in the regression at the one-percent level, suggesting that an excessive credit lending is associated with decreasing capital ratios, which ultimately increases financial fragility (Dell'Ariccia and Marquez, 2006).

With regard to bank-specific control measures the one-period lagged *cost-income ratio* enters the regression significantly positive at the one-percent level, suggesting that a higher operational efficiency has a positive impact on financial soundness. Introducing the one-period lagged *net interest margin*, this variable is significantly negative at the one-percent level in the regression specification, indicating that Western European banks exhibiting a higher level of profitability are more stable. As expected, one-period lagged *non-performing loans* enter the regression significantly positive at the one-percent level, suggesting that a higher asset quality has a positive impact on financial soundness. Finally, the one-period lagged *total assets* variable is significantly negative at the one-percent level in the respective regression specification. Hence, we suggest that larger banks may be able to diversify loan portfolio risks more efficiently due to comparative advantages in providing credit monitoring services (Carletti and Hartmann, 2003; Demsetz and

Strahan, 1997) and higher economies of scale and scope in general (Berger *et al.*, 2007; Allen and Liu, 2007).

Referring to the traditional structure-conduct-performance (SCP) paradigm, we further investigate the robustness of our main findings by analyzing the nexus between the banking market concentration and bank soundness in regression specifications (2) and (3). Therefore, we include the 5-bank concentration ratio in regression specification (2) and the HHI in regression specification (3).

As Table 7 reports, both concentration measures enter respective regressions significantly negative at the one-percent level, indicating that banks in more concentrated banking markets are less prone to financial fragility. Corresponding with theoretical arguments and empirical findings provided by related literature on the 'concentration-stability' issue, we suggest that larger banks may engage in 'credit rationing' more heavily, as fewer high-quality credit investments will increase the return of the singular investment and thus foster financial soundness. Moreover, larger banks may exhibit comparative advantages in providing credit monitoring services and may be able to diversify loan portfolio risks more efficiently due to higher economies of scale and scope.

We are convinced that the *Taylor gap 1* variable is an adequate proxy for the stance of monetary policy. Nevertheless, since we are unable to empirically control for the respective transmission channel of monetary policy in a straight-forward fashion, we substitute the *Taylor gap 1* variable by the difference between the three-month interbank offered rate and the rate implied by the standard Taylor rule (denoted as *Taylor gap 2*) in regression specification (4).

As shown in Table 7, the *Taylor gap2* variables enter regression specification (4) significantly negative at the one-percent level, whereas the significance of the *interest rate* variables and the competition measure as well as the control variables remain robust reflecting that baseline results are reconfirmed, even when controlling for a different measure of the stance of monetary policy.

11.4.1.2. Monetary Policy, Market Structure and Bank Soundness: Lerner-Index Estimations

To draw accurate statistical inference concerning the relationship between low short-term interest rates, monetary policy decisions, banking market competition and bank soundness, we perform a selection of robustness checks. To begin with, instead of the Boone-indicator we include the Lerner-index as a traditional measure of a bank's market power. In contrast to the Boone-indicator, which primarily sets a focus on interest-bearing activities and especially the competitiveness of the loan market, the traditional Lerner-index proxies the competitiveness of a country's total banking market, including interest and non-interest bearing activities.

Accordingly, we use the following regression specification to assess the impact of low short-term interest rates, monetary policy decisions and banking market competition on bank soundness:

$$EDF = \alpha + \beta EDF_{i,t-1} + \sum_{j=0}^{1} \delta_j Interest\ Rate_{k,t-j} + \sum_{j=0}^{1} \phi Taylor\ Gap1_{k,t-j} + \sum_{j=0}^{1} \gamma_j GDPgrowth_{k,t-j} + \sum_{j=0}^{1} \omega_j Creditgrowth_{k,t-j} + \varphi Lerner - Index_{k,t} + \nu C_{k,i,t} + \varepsilon_{i,t} \quad (14)$$

where $C_{k,i,t}$ are further control variables.

As Table 8 reports, our main findings of a negative impact of an increase in short-term interest rates and an extended period of expansionary monetary policy on bank soundness are reiterated even when employing a different competition measure. The *interest rate* variables enter regression specification (1) significantly positive at the one-percent level, while the *Taylor gap* variables enter the regression significantly negative at the one-percent level. In addition, signs of control variables remain robust. Thus, our estimation results reconfirm our baseline findings that low short-term interest rates indeed reduce loan default rates of banks outstanding loans and that an extended period of short-term interest rates below a theoretical benchmark level leads to a reduction in risk perception and/or an increase in risk tolerance.

However, in contrast to our regression (1) in Table 7, the *Lerner-index* enters regression specification (1) significantly positive at the one-percent level, indicating that Western European banks operating under increasing market competition are less prone to financial fragility. With regard to the 'risk-taking channel' of monetary policy, it is suggested that banks operating in a more competitive environment with higher pressures on profits (which finally results in a reduced franchise value) may have higher incentives to 'search for yield', resulting in a higher risk exposure and thus financial fragility. However, applying traditional industrial organization theory to banking, an explanation for the positive relationship between banking market competition and bank soundness may be that competition in the banking market deters excessive risk-taking behavior by the bank's management (see for example, the "*charter value hypothesis*", Keeley, 1990). Accordingly, to the extent that higher market competition keeps banks from operating in too risky lines of business (*e.g.*, complex structured finance instruments like CDOs of CDOs (CDOs-squared)), banking systems with a higher competitive level are assumed to be more stable (Boyd and De Nicoló, 2006; Carletti and Hartmann, 2003)[7]. Therefore,

[7] Additionally, we cautiously suggest that banks moving from traditional lending into fee-earning activities are more prone to financial fragility. Our result is in line with empirical findings provided by Smith *et al.* (2003) as well as Staikouras *et al.* (2000) and does not confirm the conventional wisdom in banking that earnings from fee-based business may be more stable than loan-based earnings, and that fee-based activities may reduce bank risk through diversification.

against this background, we suggest that the different results concerning the impact of increasing banking market competition on financial stability might be traced back to the fact that the Boone-indicator primarily sets a focus on interest-bearing activities whereas the Lerner-index combines interest-bearing as well as non-interest-bearing activities.

We further investigate the robustness of our main findings by analyzing the nexus between the banking market concentration and bank soundness in regression specifications (2) and (3), Table 8. Therefore, we include the 5-bank concentration ratio in regression specification (2) and the HHI in regression specification (3).

As Table 8 reports, both concentration measures enter respective regressions significantly negative at the one-percent level, indicating that banks in more concentrated banking markets are less prone to financial fragility. This result corresponds to regression specifications (2) and (3), in Table 7, employing the Boone-indicator as a measure of the banking market contestability. Thus, the Lerner-index regressions confirm our baseline result suggesting that an increasing banking market concentration has a positive impact on European banks' financial soundness ('concentration stability view', Boyd *et al.* 2004; Keeley, 1990).

Finally, we further substitute the *Taylor gap 1* variable (regression specification (2), Table 8) by the *Taylor gap 2* variable in regression specification (4), in Table 8, as a robustness check to avoid possible biases resulting from our definition of the proxy for the stance of monetary policy (see also section 11.3.1.2.).

As shown in Table 8, the *Taylor gap 2* variables enter regression specification (4) significantly negative at the one-percent level, whereas the significance of the *interest rate* variables and the competition measure as well as the control variables remain robust reflecting that baseline results are reconfirmed, even when controlling for a different measure of the stance of monetary policy.

11.4.2. Robustness Checks

By means of regressions (1)-(3), in Table 9, and regressions (1)-(6), in Table 12, we further investigate the robustness of our main regression results. To begin with, we initially investigate the robustness of our main findings by analyzing the relationship between monetary policy decisions, interest rates and bank risk taking. In this context, it is emphasized that the negative impact of an increase in short-term interest rates as well as an extended period of expansionary monetary policy on the banks' financial soundness is likely to suffer from endogeneity between monetary policy decisions, interest rates and the underlying banking market structure with regard to our baseline regression specification (1), in Table 7 and 8 (see also section 11.2.1.). Hence, we first of all address this statis-

tical problem by eliminating the banking market structure variables in regression (1) to control for market structure-specific endogeneity. As shown, even though banking market structure specific variables are excluded, our main finding of a positive impact of an increase in short-term interest rates as well as an extended period of expansionary monetary policy on financial fragility is reconfirmed. Hence, we rule out that our results are driven by market structure-specific endogeneity. Thus, our results finally confirm previous empirical findings on this effect provided by Altunbas *et al.* (2010) and Delis and Kouretas (2010).

By means of regressions (2) and (3) in Table 9 we further try to validate our hypotheses from our baseline regressions (2) and (3), in Table 7 and 8, suggesting that an increasing banking market concentration has a positive impact on European banks' financial soundness ('concentration stability view'). A priori, the causality running from banking market competition and banking market concentration to banking stability is not clear with regard to our baseline regression specifications (2) and (3), in Table 7 and 8, since it is not obvious if the banking market competition itself depends on the banking market concentration. Hence, to address a likely dependence between the banking market concentration and the banking market competition variable, we again eliminate the banking market competition variable in regression specifications (2) and (3), in Table 9, and include the 5-bank concentration ratio in regression specification (2) and the HHI in regression specification (3). As shown in Table 9, the banking market concentration variables enter regressions (2) and (3) significantly negative at the one-percent level while signs and significances of the monetary policy variables, the interest rate variables and the respective control variables remain robust reflecting that baseline results are reconfirmed even when controlling for a likely dependence between banking market concentration and banking market competition. Thus, we finally suggest that an increasing banking market concentration has a positive impact on European banks' financial soundness (Boyd *et al.* 2004; Keeley, 1990).

Finally, referring to the different results concerning the impact of increasing banking market competition on financial stability (Regression specifications (1)-(3) in Tables 7 and 8), the competitiveness of a country's banking market is further proxied by the H-Statistic proposed by Panzar and Ross (1987). We estimate the H-Statistic on a bank-level cross-sectionally for each country in our sample and each year for the period from 1997 to 2008. Following Claessens and Laeven (2004) and Schaeck *et al.* (2006), the H-Statistic is based on revenue equations and measures the degree of market competitiveness by means of the bank's elasticity of interest-bearing and non-interest-bearing revenues with respect to its input factor prices while controlling for a long-run market equilibrium. Therefore, an increase in factor prices (a) will be mirrored by an equal-proportional increase in the interest-bearing and non-interest-bearing revenue under perfect

competition (H = 1), (b) will be mirrored by an underproportional increase in the interest bearing and non-interest bearing revenue under monopolistic competition (0 < H < 1) and (c) will not at all be reflected by an increase in the bank's interest bearing and non-interest bearing revenue in the monopoly case (H ≤ 0). Similar to the H-Statistic based on interest- and non-interest-bearing activities, we further include a second modified H-Statistic restricted on interest-bearing activities as a further robustness check[8].

Introducing the H-Statistic restricted to interest-bearing activities (denoted as *H-Statistic (1)*), this variable enters the regression specifications (1)-(3), in Table 12, significantly positive. This result corresponds with regression specifications (1)-(3), in Table 7, employing the Boone-indicator as a measure of banking market contestability. In contrast, the H-Statistic based on interest- and non-interest-bearing activities (denoted as *H-Statistic (2)*) enters the regression specifications (4)-(6), in Table (12), significantly negative indicating that Western European banks operating under increasing market competition are less prone to financial fragility. Hence, the H-Statistic regressions confirm our results concerning the different impact of increasing total banking market competition and loan market competition on financial stability.

11.4.3. Sensitivity Analyses

Finally, we perform a selection of sensitivity analyses. As a general result, our main findings and implications hold even when controlling for cross-country differences concerning the capital and housing market development. Due to high correlations between single control variables (Table 13) and in order to avoid simultaneity, we include them in turn in separate regressions (regression specifications (5)-(6)) in Tables 7 and 8.

To begin with, we finally control for cross-country differences concerning the capital and housing market development by employing the annual return of country-specific national blue-chip indices (denoted as *stock market return*) and the annual change in real estate markets (denoted as *house-price index*). We retrieved the history of stock market prices from the *Datastream Database* provided by *Thomson Financial Services*, while country specific house-price indices are obtained from a *Financial Structure Dataset* provided by the *Bank for International Settlements*. As Tables 7 and 8 report, both measures are significantly negative in regression specifications (5) and (6), indicating that a boost in asset prices has a positive impact on Western European banks soundness. Moreover, our

[8] Notes on variables and data sources used to calculate the H-Statistic (1) and (2) are presented in Table 10. Table 11 reports descriptive statistics for the H-Statistic (1) and (2). Moreover, Figures 3 and 4 more precisely illustrate the development of the H-Statistic (1) and (2) on a country level for the EU-9 and Switzerland over the sample period.

results correspond with previous theoretical and empirical literature providing evidence that a boost in asset prices indeed spurs collateral values and thus may finally results in a lower financial fragility (Delis and Kouretas, 2010; Altunbas *et al.* 2010; Borio and Zhu, 2008). However, with regard to the 'risk-taking channel' of monetary policy, it is also suggested that an increase in asset and collateral values may lead to a reduction in risk perception and/or an increase in risk tolerance in the long run (Adrian and Shin, 2009).

11.5. Conclusion

Using a sample of stock-listed bank holding companies located in Western Europe over the period from 1997 to 2008 this paper provides empirical evidence that an increase in short-term interest rates as well as an extended period of expansionary monetary policy has a negative impact on European stock-listed banks' soundness as measured by the Expected Default Frequency (EDF) while controlling for macroeconomic and bank-specific factors.

In this context, estimation results indicate that low short-term interest rates reduce loan default rates of Western European banks outstanding loans and that an extended period of short term interest rates below a theoretical benchmark level leads to a reduction in risk perception and/or an increase in risk tolerance. Hence, empirical findings support theoretical arguments of the 'risk-taking channel' of monetary policy view provided by Borio and Zhu (2008) and confirm empirical evidence from previous panel data analysis by Altunbas *et al.* (2010) and Delis and Kouretas (2010) as well as Gambacorta (2009).

In order to identify possible interactions between the 'risk-taking channel' and the competitiveness of a country's banking market this paper further investigates the nexus between the 'risk-taking channel', banking market structures and financial soundness. We find that Western European banks operating under increasing loan market competition – proxied by the Boone-indicator – are more prone to financial fragility. Our result is in line with theoretical models and empirical findings predicting that in a more competitive loan market with higher pressures on profits, banks have higher incentives to take more excessive risks, resulting in higher fragility. Moreover, referring to the 'risk-taking channel' of monetary policy our result seems to verify the 'search for yield' theory provided by Rajan (2005) and the transmission channel proposed by Dell'Ariccia and Marquez (2006) as well as Maddaloni and Peydró (2009). In contrast, our results further indicate that an increase in competition in the total banking market – proxied by the Lerner-index – reduces financial fragility. Accordingly, we suggest that a higher banking market competition keeps banks from operating in too risky lines of business.

In addition, referring to the structure-conduct-performance (SCP) paradigm, we extend our analysis by investigating the impact of national banking market concentration on financial stability. Our results indicate that banks in more concentrated banking markets are less prone to financial fragility. Hence, our findings are consistent with the 'concentration-stability view' and confirm empirical findings by Schaeck and Čihák (2008) and Schaeck *et al.* (2006) as well as Beck *et al.* (2006a, 2006b).

Against the background of our empirical results we underline recent empirical results provided by Altunbas *et al.* (2010) as well as Delis and Kouretas (2010) indicating that monetary policy decisions are not neutral from a financial stability point of view. Moreover, our results suggest that the banking market structure may affect the monetary policy transmission mechanism and, in particular the interest rate pass-through process of market rates and finally financial fragility. Accordingly, we stress the necessity of establishing the aspect of the interactions between the 'risk-taking channel' of monetary policy and the competitiveness of a country's banking market within the stance of monetary policy. This postulation is clearly underlined by the recent U.S. subprime crisis, which has disclosed some important insights regarding the effect of the 'risk-taking taking' channel of monetary policy on financial stability.

References

ADRIAN, T., SHIN, H.S., 2009, "Money, Liquidity and Monetary Policy", *American Economic Review* 99, 600-605.

AMEL, D.F., LIANG, J.N., 1997, "Determinants of Entry and Profits in Local Banking Markets", *Review of Industrial Organization* 12, 59-78.

ALLEN, F., BABUS, A., CARLETTI, E., 2009, *Financial Crisis: Theory and Evidence*, Working Paper.

ALLEN, F., GALE, D., 2000, *Comparing financial systems*, Cambridge, MA: MIT Press.

ALLEN, F., GALE, D., 2004, "Competition and financial stability", *Journal of Banking and Finance* 36, 433-480.

ALLEN, F., LIU, Y., 2007, "Efficiency and economies of scale of large Canadian banks", *Canadian Journal of Economics* 40, 225-244.

ALTUNBAS, Y., GAMBACORTA, L., MARQUES-IBANEZ, D., 2010, *Does Monetary Policy Affect Bank Risk-Taking?*, BIS Working Paper No. 298.

ARELLANO, M., BOVER, O., 1995, "Another Look at the Instrumental Variable Estimation of Error-Components Models", *Journal of Econometrics* 68, 29-51.

BANK FOR INTERNATIONAL SETTLEMENTS (BIS), 2004, Annual Report.

BANK FOR INTERNATIONAL SETTLEMENTS (BIS), 2007, Quarterly Review.

BANK OF ENGLAND (BoE), 2007, Financial Stability Report.

BECK, T., DEMIRGÜÇ-KUNT, A., LEVINE, R., 2006, "Bank Concentration, Competition, and Crises: First Results", *Journal of Banking and Finance* 30, 1581-1603.

BECK, T., 2008, *Competition and Stability: Friends or Foes?*, World Bank Working Paper No. 4656.

BERGER, A.N., DEMIRGÜÇ-KUNT, A., LEVINE, R., HAUBRICH, G.J., 2004, "Bank Concentration and Competition: An Evolution in the Making", *Journal of Money, Credit and Banking* 36, 433-450.

BERGER, A.N., DICK, A.A., GOLDBERG, L.G., WHITE, L.J., 2007, "Competition from Large, Multimarket Firms and the Performance of Small, Single-Market Firms: Evidence from the Banking Industry", *Journal of Money Credit and Banking* 39, 331-368.

BLATTNER, T. CATENARO, M., EHRMANN, M., STRAUCH, R. TURUNEN, J., 2008, *The Predictability of Monetary Policy*, ECB Working Paper No. 83.

BLINDER, A.S., EHRMANN, M., FRATZSCHER, M., DE HAAN, J., JANSEN, D.J., 2008, *Central Bank Communication and Monetary Policy: A Survey of Theory and Evidence*, ECB Working Paper No. 898.

BLUNDELL, R., BOND, S., 1998, "Initial Conditions and Moment Restrictions in Dynamic Panel Data Models", *Journal of Econometrics* 87, 115-143.

BOND, S., 2002, "Dynamic Panel Data Models: A Guide to Micro Data Methods and Practice", *Portugese Economic Journal* 1, 141-162.

BOONE, J., 2001, "Intensity of Competition and the Incentive to Innovate", *International Journal of Industrial Organization* 19, 705-726.

BOONE, J., 2008, "A New Way to Measure Competition", *Economic Journal* 118, 1245 -1261.

BORIO, C., FRITZ, W., 1995, *The response of short-term bank lending rates to policy rates: a cross-country perspective*, BIS Working Paper No. 27.

BORIO, C., ZHU, H., 2008, *Capital Regulations, Risk-Taking and Monetary Policy: A Missing Link in the Transmission Channel*, BIS Working Paper No. 268.

BOYD, J.H., DE NICOLÓ, G., SMITH, B.D., 2004, "Crises in competitive versus monopolistic banking systems", *Journal of Money, Credit and Banking* 36, 487-506.

BOYD, J.H., DE NICOLÓ, G., 2006, "The theory of bank risk-taking and competition revisited", *Journal of Finance* 60, 1329-1343.

CALOMIRIS, C.W., 2009, *The Subprime Crisis: What's Old, What's New, and What's Next?*, Working Paper.

CARLETTI, E., HARTMANN, P., 2003, *Competition and Stability: What's Special About Banking*, ECB Working Paper No. 146.

CLAESSENS, S., LAEVEN, L., 2004, "What Drives Bank Competition? Some International Evidence", *Journal of Money, Credit and Banking* 36, 563-583.

CORVOISIER, S., GROPP, R., 2002, "Bank concentration and retail interest rates", *Journal of Banking and Finance* 26, 2155-2189.

COTTARELLI, C., KOURELIS, A., 1994, *Financial structure, bank lending rates and the transmission of monetary policy*, IMF Working Paper, 670-700.

DE BONDT, G.J., 2005, "Interest rate pass-through: empirical results for the euro area", *German Economic Review* 6, 37-78.

DELIS, M.D., KOURETAS, G., 2010, *Interest Rates and Bank Risk taking*, MPRA Working Paper No. 20132.

DELL'ARICCIA, G., MARQUEZ, R., 2006, "Lending Booms and Lending Standards", *Journal of Finance* 61, 2511-2546.

DEMSETZ, R.S., STRAHAN, P., 1997, "Diversification, size, and risk at bank holding companies", Journal of Money Credit and Banking 29, 300-313.

DE NICOLÓ, G., BARTHOLOMEW, P., ZAMAN, J., ZEPHIRIN, M., 2004, *Bank Consolidation, Internalization, and Conglomerization*, IMF Working Paper.

DIAMOND, D.W., RAJAN, R., 2006, "Money in Theory of Banking", *American Economic Review* 96, 30-53.

DIAMOND, D.W., RAJAN, R., 2009, *Illiquidity and Interest Rate Policy*, NBER Working Paper No. 15197.

GAMBACORTA, L., 2009, "Monetary Policy and the Risk Taking Channel", *BIS Quarterly Review*.

GROPP, R., KOK-SØRENSEN, C., LICHTENBERGER, J., 2006, *The dynamics of bank spreads and financial structure*, European Central Bank Working Paper No. 714.

HUANG, X., ZHOU, H., ZHU, H., 2010, *Assessing the Systemic Risk of a Heterogeneous Portfolio of Banks During the Recent Financial Crisis*, ECB Working Paper No. 296.

INTERNATIONAL MONETARY FUND (IMF), 2007, *Global Financial Stability Report: Financial Market Turbulence: Causes, Consequences, and Policies*, Washington DC.

INTERNATIONAL MONETARY FUND (IMF), 2008, *Global Financial Stability Report: Financial Stress and Deleveraging Macro-Financial Implications and Policy*, Washington DC.

INTERNATIONAL MONETARY FUND (IMF), 2008a, *Global Financial Stability Report: Containing Systemic Risks and Restoring Financial Soundness*, Washington DC.

INTERNATIONAL MONETARY FUND (IMF), 2009, *Global Financial Stability Report: Responding to the Financial Crisis and Measuring Systemic Risks*, Washington DC.

INTERNATIONAL MONETARY FUND (IMF), 2009a, *Global Financial Stability Report: Navigating the Financial Challenges Ahead*, Washington DC.

INTERNATIONAL MONETARY FUND (IMF), 2010, *Global Financial Stability Report: Meeting New Challenges to Stability and Building a Safer System*, Washington DC.

IOANNIDOU, V., ONGENA, S. and PEYDRÒ, J.L., 2009, *Monetary Policy and Subprime Lending: A Tall Tale of Low Federal Funds Rates, Hazardous Loan, and Reduced Loans Spreads*, European Banking Center Discussion Paper No. 2009-04S.

JIMÉNEZ, G., ONGENA, S., PEYDRÒ-ALCALDE, J.L. and SAURINA, J., 2009, *Hazardous Times for Monetary Policy: What do Twenty-Three Million Bank Loans Say About the Effects of Monetary Policy on Credit Risk-Taking?*, Banco de España Working Paper No. 0833.

KEELEY, M., 1990, "Deposit insurance, risk and market power in banking", *American Economic Review* 80, 1183-1200.

LAEVEN, L., MAJONI, G., 2003, "Loan Loss Provisioning and Economic Slowdowns: Too Much, Too Late?", *Journal of Financial Intermediation* 12, 178-197.

LERNER, A.P., 1934, "The Concept of Monopoly and the Measurement of Monopoly Power", *The Review of Economic Studies* 1, 157-175.

LEUVENSTEIJN, M., KOK SØRENSEN, C., BIKKER, J.A., RIXTEL, A.A.R.J.M., 2008, *Impact of Bank Competition on the Interest Rate Pass-through in the Euro Area*, DNB Working Paper No. 171, De Nederlandsche Bank, Amsterdam / ECB Working Paper No. 885, European Central Bank, Frankfurt.

LEUVENSTEIJN, M., BIKKER, J.A., RIXTEL, A.A.R.J.M., KOK SØRENSEN, C., 2007, *A New Approach to Measuring Competition in the Loan Markets of the Euro Area*, DNB Working Paper No. 143.

MERTON, R.C., 1973, "Theory of rational option pricing", *Bell Journal of Economics and Management Science* 4, 141-183.

MERTON, R.C., 1974, "On the pricing of corporate debt: The risk structure of interest rates", *Journal of Finance* 29, 449-470.

MAUDOS, J., FERNÁNDEZ DE GUEVARA, J., 2004, "Factors explaining the interest rate margin in the banking sectors of the European Union", *Journal of Banking and Finance* 28, 2259-2281.

PANZAR, J.C., ROSSE, J.N., 1987, "Testing for monopoly equilibrium", *Journal of Industrial Economics* 35, 443-456.

PEYDRÓ, J.L., MADDALONI, A., 2010, "Bank Risk-Taking, Securitization, Supervision, and Low Interest Rates: Evidence from Lending Standards", *Review of Financial Studies* 24, 2121-2165.

RAJAN, R., 2005, *Has Financial Development Made the World Riskier?*, NBER Working Paper No. 11728.

SCHAECK, K., ČIHÁK, M., WOLFE, S., 2006, *Competition, Concentration and Bank Soundness: New Evidence from the Micro-Level*, IMF Working Paper.

SCHAECK, K., ČIHÁK, M., 2008, *How Does Competition Affect Efficiency and Soundness in Banking?*, ECB Working Paper No. 932.

SMITH, R., STAIKOURAS, C., WOOD, G.E., 2003, *Non-interest income and total income stability*, Bank of England Working Paper No. 198; Cass Business School Research Paper, London.

STAIKOURAS, C., WOOD, G.E., DENNEY, R., 2000, *Bank non-interest income: A source of stability?*, Cass Business School Research Paper, London.

TAYLOR, J.B., 1993, *Discretion versus Policy Rules in Practice*, Carnegie-Rochester Conference Series on Public Policy 39, 195-214.

TAYLOR, J.B., 2001, *Monetary Policy Rules*, NBER Studies in Business Cycles, University of Chicago.

TAYLOR, J.B., 2009, *The Financial Crisis and the Policy Responses: An Empirical Analysis of What Went Wrong*, NBER Working Paper No. 14631.

UHDE, A., HEIMESHOFF, U., 2009, "Consolidation in banking and financial stability in Europe: Empirical evidence", *Journal of Banking and Finance* 33, 1299-1311.

Appendix A: Tables and figures

Table 1: Notes on variables and data sources (Dynamic Panel Regression)

Variable	Description	Data Sources
EDF	Expected default frequency of bank *i* in a respective years *t*. Further details and an in-depth technical discussion of the construction of this ratio are provided in Appendix B.	BankScope, Datastream, authors' calc.
Interest rate	Short term interest rate: 3-month interbank offered rate.	Datastream
Taylor gap 1	Difference between the 3-month interbank offered rate and the rate implied by a Taylor rule with interest rate smoothing.	Datastream, World Development Indicators (WDI), IMF, authors' calc.
Taylor gap 2	Difference between the 3-month interbank offered rate and the rate implied by the standard Taylor rule.	Datastream, World Development Indicators (WDI), IMF, authors' calc.
GDP growth	Rate of real GDP cap growth at constant 2000 prices (annual percentage change).	World Development Indicators (WDI)
Credit growth	Proxy for external funding constraints (liquidity-proxy). Delta of the ratio of domestic credit provided by banks to GDP.	World Development Indicators (WDI)
Boone-indicator	Indicator that measures the elasticity of bank's market shares in the loan market toward bank's marginal costs. Higher values indicate less competitive banking markets.	BankScope, authors' calc.
Lerner-index	Indicator that measures the price-marginal-cost-difference. Index ranges from 0 to 1, with larger values indicating less competitive banking markets.	BankScope, authors' calc.
H-Statistic	H-Statistic estimated on a bank-level cross-sectionally for each country in our sample and each year for the period from 1997 to 2008. Higher values indicate more competitive banking markets.	BankScope, authors' calc.
Concentration ratio 5	EU-9 plus Switzerland concentration ratios: Fraction of assets of a country's total banking system's assets held by the largest 5 domestic and foreign banks.	ECB statistics, national central banks, authors' calc.
HHI	Herfindahl-Hirschman index computed as the sum of the squared market shares of a country's domestic and foreign banks.	ECB statistics, national central banks, authors' calc.
Net interest margin	Proxy for the bank's profitability. Accounting value of a bank's net interest revenue as a share of its interest-bearing (total earning) assets.	BankScope CN 2035
Cost income ratio	Proxy for the bank's efficiency. Accounting value of the ratio of a bank's overhead costs to its total revenue.	BankScope CN 4029
Non-performing loans	Proxy for the bank's asset quality. Log of the accounting value of a bank's non-performing loans as a share of its total assets.	BankScope CN 2170
Total Assets	Proxy for the bank's size. Log of the accounting value of a bank's total assets.	BankScope CN 2025
Stock market return	Proxy for the first financial accelerator. Annual return of the stock market (national blue-chip index).	Datastream, authors' calc.
House price index	Proxy for the second financial accelerator. Annual change of real estate prices.	BIS

Table 2: Notes on variables and data sources (Boone-indicator and Lerner-index)

Variable	Description	Data Sources
Boone-indicator	Indicator that measures the elasticity of bank's market shares in the loan market toward bank's marginal costs. Higher values indicate less competitive banking markets.	BankScope, authors' calc.
Lerner-index	Indicator that measures the price-marginal-cost-difference. Index ranges from 0 to 1, with larger values indicating less competitive banking markets.	BankScope, authors' calc.
Total assets	Proxy for the bank's output (Lerner-index). Accounting value of a bank's total assets.	BankScope CN 2025
Gross loans	Proxy for the bank's first output (Boone-indicator). Accounting value of a bank's gross loans.	BankScope CN 5190
Other earning assets	Proxy for the bank's second output (Boone-indicator). Accounting value of a bank's other earning assets.	BankScope CN 2005
Funding costs	Proxy for the bank's first input factor. Accounting value of the ratio of a bank's interest expenses to its total borrowed funds.	BankScope CN 6520, 2030
Labor costs	Proxy for the bank's second input factor. Accounting value of a bank's personnel expenses as a share of its total assets.	BankScope CN 6650, 2025
Other costs	Proxy for the bank's third input factor. Accounting value of the ratio of a bank's other operating expenses to its fixed assets.	BankScope CN 6670, 2015
Fixed assets	Proxy for the bank's first netput. Accounting value of a bank's fixed assets.	BankScope CN 2015
Total deposits	Proxy for the bank's second netput. Accounting value of a bank's total borrowed funds.	BankScope CN 2030
Equity capital	Proxy for the bank's third netput. Accounting value of a bank's equity capital.	BankScope CN 2055

Table 3: Descriptive statistics (Dynamic Panel Regression)

Variable	N	Mean	SD	Min	Max
EDF	595	0.7439	2.7097	0.0001	32.0776
Interest rate	780	3.5536	1.2719	0.26	7.625
Taylor Gap 1	780	-0.3800	1.1092	-3.3557	1.6126
Taylor Gap 2	780	-0.4679	1.1406	-3.9875	2.0824
GDP growth	780	5.1706	7.9122	-13.3519	22.6879
Credit growth	685	4.8416	8.4462	-11.4261	87.2626
Boone-indicator	780	-1.4244	0.9376	-6.0204	-0.0202
Lerner-index	780	0.2070	0.0541	0.0649	0.5557
H-Statistic (1)	780	0.4195	0.1821	0.0099	0.9684
H-Statistic (2)	780	0.6379	0.1752	0.1184	0.9853
Concentration ratio 5	768	40.7070	19.6571	17	87
Herfindahl-Hirschman-Index	768	569.4974	526.252	114	2168
Net interest margin	743	1.9190	0.9434	-0.2	6.7
Cost income ratio	743	0.6491	0.2033	0.2326	3.3108
Non-performing loans	637	4220.0	5094.1	17.2	38309.4
Total assets	743	284414.8	375309.1	2891.0	2591558.0
Stock market return	780	5.2711	25.7713	-61.2045	60.8951
House price index	780	209.5276	89.4023	78.94	413.08

Table 4: Descriptive statistics (Country level – Dynamic Panel Regression)

Variable	EDF	Interest rate	Taylor gap 1	Taylor gap 2	Natural rate gap	GDP growth	Credit growth	Boone-indicator	Lerner-index	H-Statistic (1)	H-Statistic (2)	Concentration ratio 5	HHI	Net interest margin	Cost income ratio	Non-performing loans	Total assets	Stock market return	House price index
Austria (3)	0.0514	3.2899	-0.0142	-0.0258	-0.1171	4.8843	0.5855	-1.0512	0.2066	0.3182	0.5391	43.32	538	1.7742	0.6626	3897	102856	8.9879	220.94
Belgium (2)	0.8829	3.3201	-0.1738	-0.2436	-0.1266	5.1050	-2.6130	-2.1832	0.1693	0.4752	0.5355	77.40	1697	1.1721	0.6110	2210	314616	4.1448	259.45
Denmark (3)	0.1287	3.7103	-0.1955	-0.9661	-0.0311	5.2333	14.1142	-2.3040	0.2885	0.1856	0.3755	66.92	1191	2.1456	0.6046	410	93766	8.8237	170.14
France (5)	1.3210	3.2831	-0.1920	-0.2806	-0.1279	4.8387	2.4776	-1.1589	0.1861	0.4140	0.4969	47.02	604	0.9708	0.7143	7467	563780	6.5767	178.19
Germany (9)	1.0447	3.2734	0.0929	0.5532	-0.1202	3.8258	-1.0343	-1.3328	0.1615	0.4351	0.5687	20.73	161	0.9766	0.7265	5960	378209	9.0023	95.27
Italy (16)	0.3661	3.4806	-0.6826	-0.6138	-0.2425	5.0373	3.9224	-1.0247	0.2011	0.3958	0.4985	27.50	245	2.6204	0.6468	4658	109064	1.7363	177.73
Netherlands (5)	1.2737	3.2776	-0.3351	-0.5982	-0.1071	6.1241	5.9750	-1.9331	0.1970	0.6500	0.7182	83.40	1799	1.5874	0.7280	4670	414912	2.6707	264.73
Spain (9)	0.2384	3.3413	-0.8232	-1.7612	-0.2205	5.4937	10.0608	-1.7550	0.2380	0.3806	0.4601	41.20	467	2.7279	0.5280	1116	122273	8.3682	282.14
Switzerland (3)	1.2694	1.5081	0.0228	0.5123	-0.2016	3.7319	0.5358	-0.6963	0.2614	0.3725	0.4895	76.00	1508	0.8719	0.8446	3767	551786	7.7069	105.75
UK (10)	1.1101	5.0792	-0.4310	-0.3401	-0.1425	6.5042	8.1813	-1.6422	0.2120	0.4695	0.5747	31.79	326	1.9762	0.5856	5507	443328	2.2712	315.50
Total (65)	0.7439	3.5536	-0.3900	-0.4679	-0.1669	5.1706	4.8416	-1.4244	0.2070	0.4195	0.6379	40.70	569	1.9190	0.6491	4220	284415	5.2711	209.53

Table 5: Descriptive statistics (Boone-indicator)

Variable	Observations	Boone-indicator	Marginal costs	Gross loans	Other earning assets	Funding costs	Labor costs	Other costs	Fixed assets	Total Deposits	Equity capital
Austria	1728	-1.0512	4.9316	1588046	1420953	3.2941	1.9457	115.5115	32579	2187195	143935
Belgium	536	-2.1832	5.9363	8236654	10334636	4.2052	1.5374	284.3104	169406	16240794	667743
Denmark	839	-2.3040	6.6701	3012970	1764438	3.0253	2.8793	193.2448	30494	2576674	236317
France	2694	-1.1589	8.3801	7913930	11449381	6.3695	3.5846	389.8579	148069	13908503	876410
Germany	19308	-1.3328	6.5425	1271702	1217242	3.5115	1.7715	126.6131	26058	1754207	97593
Italy	2210	-1.0247	5.8652	5634627	3035969	3.7827	2.6822	228.2877	147688	5980787	581412
Netherlands	320	-1.9331	8.9115	30945496	20555845	6.0754	1.6328	236.9896	568633	38265500	1980456
Spain	1192	-1.7550	7.3888	9037001	5143392	3.3996	2.0803	147.8585	311845	11334927	911414
Switzerland	3102	-0.6963	5.4834	1582832	2749137	2.5697	2.7564	211.3736	44599	3509162	197724
UK	852	-1.6422	8.4502	20319651	14531171	5.0220	3.8629	484.3226	407107	27247297	1738311
Total	32781	-1.4244	6.5595	3383377	3177113	3.7232	2.1730	177.9682	74433	4852200	309622

Table 6: Descriptive statistics (Lerner-index)

Variable	Observations	Lerner-index	Marginal costs	Total assets	Funding costs	Labor costs	Other costs	Fixed assets	Total Deposits	Equity Capital
Austria	2080	0.2066	5.0161	3569229	5.7451	1.4856	163.2042	34231	2402767	181225
Belgium	488	0.1693	5.2837	25262854	4.4868	1.1322	294.5782	218413	19228594	819783
Denmark	882	0.2885	5.7328	7011846	3.7926	2.0741	270.7370	31154	3260092	309749
France	2644	0.1861	6.1883	27446231	6.1583	1.6727	475.7845	173778	15958455	1079791
Germany	19304	0.1615	5.4120	3079608	3.3798	1.4973	138.5376	25849	1936675	111307
Italy	3226	0.2011	4.9861	8242510	3.8288	1.5233	267.2537	111345	4836455	518420
Netherlands	352	0.1970	5.9179	72418443	6.6295	1.1133	357.9176	606431	47857257	2506140
Spain	1322	0.2380	4.4825	17724343	3.1978	1.2971	159.8586	301437	12059143	1059182
Switzerland	3436	0.2614	4.2888	6052973	2.2321	1.4872	230.5204	41020	3866602	220574
UK	962	0.2120	6.5146	53357020	5.0612	1.5831	570.3501	448228	32976447	2148361
Total	34696	0.2070	5.3033	8807758	3.7601	1.5118	207.3593	78021	5482931	369878

Figure 1: Development of the Boone-indicator during the sample period

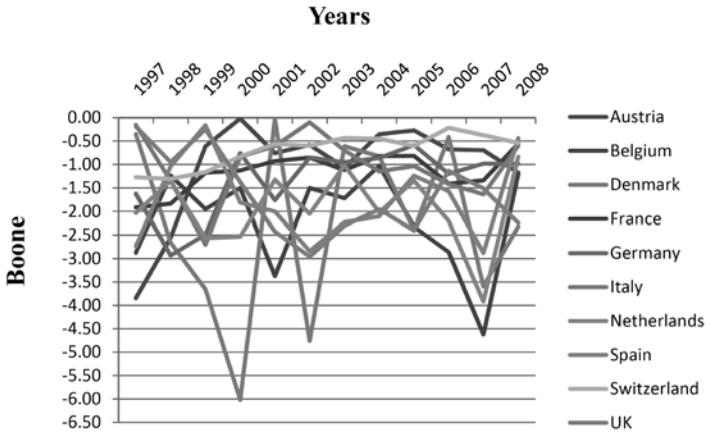


Figure 2: Development of the Lerner-index during the sample period

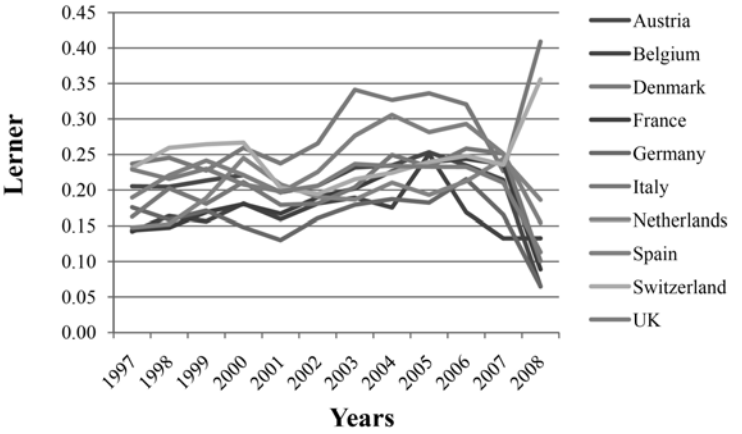


Table 7: Monetary policy, the Boone-indicator and EDF

	(1) EDF	(2) EDF	(3) EDF	(4) EDF	(5) EDF	(6) EDF
EDF (t-1)	0.1381***	0.1066***	0.1219***	0.2077***	0.1188***	0.1292***
	(0.0205)	(0.0196)	(0.0217)	(0.0278)	(0.0213)	(0.0238)
Interest rate	1.0054***	1.3459***	0.9681***	0.5672***	1.6405***	2.4120***
	(0.3020)	(0.3290)	(0.3266)	(0.0600)	(0.3234)	(0.4231)
Interest rate (t – 1)	1.5640***	1.7345***	1.7726***	0.6314***	1.1275***	1.5715***
	(0.2434)	(0.2581)	(0.2607)	(0.1031)	(0.3023)	(0.2287)
Taylor gap 1	-2.6613***	-3.0183***	-2.6168***		-3.2182***	-3.6298***
	(0.3698)	(0.3918)	(0.3933)		(0.3749)	(0.4965)
Taylor gap 1 (t – 1)	-1.7421***	-1.8295***	-1.8860***		-1.3538***	-1.6284***
	(0.2587)	(0.2577)	(0.2655)		(0.3257)	(0.2523)
Taylor gap 2				-1.2107***		
				(0.1230)		
Taylor gap 2 (t – 1)				-1.3882***		
				(0.1232)		
GDP growth	-0.0699***	-0.0595***	-0.0679***	-0.0743***	-0.0455***	-0.0337***
	(0.0143)	(0.0148)	(0.0151)	(0.0155)	(0.0139)	(0.0099)
GDP growth (t – 1)	-0.0129	-0.0187*	-0.0187*	-0.0416***	-0.0214**	-0.0386***
	(0.0088)	(0.0103)	(0.0096)	(0.0091)	(0.0088)	(0.0086)
Credit growth	0.0128***	0.0154***	0.0126***	0.0280***	0.0155***	0.0122***
	(0.0047)	(0.0042)	(0.0043)	(0.0045)	(0.0047)	(0.0035)
Credit growth (t – 1)	0.0187**	0.0129	0.0182**	0.0186	0.0179**	0.0093
	(0.0072)	(0.0080)	(0.0077)	(0.0065)***	(0.0080)	(0.0085)
Boone-indicator	-0.0740*	-0.0989**	-0.1008**	-0.2892***	-0.1384***	-0.0887**
	(0.0386)	(0.0422)	(0.0420)	(0.0494)	(0.0461)	(0.0408)
Concentration ratio 5		-0.0528***		-0.0283***	-0.0548***	-0.0449***
		(0.0075)		(0.0063)	(0.0092)	(0.0071)
HHI			-0.0145***			
			(0.0030)			
Net interest margin (t – 1)	-1.1627***	-1.3564***	-1.2878***	-1.1593***	-1.3478***	-1.3075***
	(0.1962)	(0.1683)	(0.1789)	(0.1370)	(0.1446)	(0.1265)
Cost income ratio (t – 1)	4.8941***	5.3781***	5.1616***	2.9243***	4.8028***	3.4647***
	(0.7379)	(0.6209)	(0.7813)	(0.9652)	(0.5912)	(0.8230)
Non-performing loans (t – 1)	0.0001***	0.0001***	0.0001***	0.0001***	0.0001***	0.0001***
	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)
Total assets (t – 1)	-0.3145***	-0.1041	-0.1574	-0.0721**	-0.0829	-0.1225
	(0.1031)	(0.1135)	(0.1226)	(0.1188)	(0.1125)	(0.1308)
Stock market return					-0.5254***	
					(0.1914)	
House price index						-0.0593***
						(0.0184)
Time dummies	yes	yes	yes	yes	yes	yes
No. of obs.	439	437	437	437	430	430
Sargan test (2nd step)	0.231	0.384	0.291	0.151	0.356	0.441
AR (1)	0.051	0.034	0.042	0.070	0.021	0.046
AR (2)	0.861	0.895	0.870	0.619	0.793	0.828

The dynamic panel model estimated is $EDF_{i,t\ (i = \text{bank},\ j = \text{time},\ k = \text{country},\ c = \text{control variables})} = \alpha + \beta_1\ EDF_{i,t-1} + \beta_2\ interest\ rate_{k,t} + \beta_3\ interest\ rate_{k,t-1} + \beta_4\ Taylor\ gap\ 1_{k,t} + \beta_5\ Taylor\ Gap\ 1_{k,t-1} + \beta_6\ GDP\ growth_{k,t} + \beta_7\ GDP\ growth_{k,t-1} + \beta_8\ Credit\ growth_{k,t} + \beta_9\ Credit\ growth_{k,t-1} + \beta_{10}\ Boone\text{-}indicator_{k,t} + \varepsilon_{i,t}$. Specification (2) includes the *Concentration ratio 5* while Specification (3) includes the *HHI*. *Taylor Gap 1* is substituted by *Taylor gap2* in specification (4). Specifications (5) and (6) are further sensitivity analyses concerning the capital market environment. Constant term included but not reported. Standard errors are reported in parenthesis. ***, **, *: statistically significant at the 1, 5 and 10% level.

Table 8: Monetary policy, Lerner-index and EDF

	(1) EDF	(2) EDF	(3) EDF	(4) EDF	(5) EDF	(6) EDF
EDF (t-1)	0.1211***	0.0882***	0.0963***	0.2368***	0.1187***	0.0818***
	(0.0218)	(0.0238)	(0.0216)	(0.0279)	(0.0268)	(0.0142)
Interest rate	0.7660***	1.2007***	0.8022***	0.4264***	1.6702***	2.3148***
	(0.2662)	(0.2856)	(0.2883)	(0.0703)	(0.2919)	(0.4209)
Interest rate (t – 1)	1.9696***	2.1515***	2.2231***	0.6943***	1.8971***	1.9215***
	(0.2592)	(0.2836)	(0.2867)	(0.0820)	(0.3423)	(0.2309)
Taylor gap 1	-2.3671***	-2.8632***	-2.4942***		-3.3669***	-3.6193***
	(0.3813)	(0.3759)	(0.4183)		(0.4154)	(0.4902)
Taylor gap 1 (t – 1)	-2.1408***	-2.2481***	-2.3478***		-1.6080***	-2.0803***
	(0.2678)	(0.2697)	(0.2835)		(0.3467)	(0.2318)
Taylor gap 2				-1.2169***		
				(0.1169)		
Taylor gap 2 (t – 1)				-1.2761***		
				(0.1314)		
GDP growth	-0.0721***	-0.0585***	-0.0670***	-0.0613***	-0.0495***	-0.0271**
	(0.0130)	(0.0150)	(0.0146)	(0.0129)	(0.0143)	(0.0110)
GDP growth (t – 1)	-0.0872	-0.0034	-0.0048	-0.0096	-0.0089	-0.0169**
	(0.0122)	(0.0111)	(0.0110)	(0.0081)	(0.0103)	(0.0085)
Credit growth	0.0205***	0.0218***	0.0202***	0.0018	0.0282***	0.0148***
	(0.0046)	(0.0046)	(0.0046)	(0.0047)	(0.0046)	(0.0038)
Credit growth (t – 1)	0.0145**	0.0044	0.0092	0.0032	0.0026	0.0015
	(0.0065)	(0.0070)	(0.0073)	(0.0054)	(0.0063)	(0.071)
Lerner-Index	0.0933***	0.0834***	0.0838***	0.0972***	0.1227***	0.0622***
	(0.0281)	(0.0163)	(0.0239)	(0.0218)	(0.0218)	(0.0139)
Concentration ratio 5		-0.0582***		-0.0343***	-0.0654***	-0.0493***
		(0.0084)		(0.0079)	(0.0098)	(0.0073)
HHI			-0.0145***			
			(0.0003)			
Net interest margin (t – 1)	-1.0786***	-1.3865***	-1.2806***	-1.0318***	-1.4710***	-1.2825***
	(0.2277)	(0.2177)	(0.2309)	(0.1219)	(0.2188)	(0.1374)
Cost income ratio (t – 1)	5.8390***	6.0518***	6.3480***	3.3644***	4.5449***	5.7225***
	(0.8624)	(1.2336)	(1.0438)	(1.1221)	(1.1315)	(0.6992)
Non-performing loans (t – 1)	0.0001***	0.0001***	0.0001***	0.0001***	0.0001*	0.0001***
	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)
Total assets (t – 1)	-0.3007***	-0.0873	-0.1430	-0.1239*	-0.1519	-0.1923
	(0.1152)	(0.1351)	(0.1404)	(0.1409)	(0.1302)	(0.1418)
Stock market return					-0.9021***	
					(0.1675)	
House price index						-0.0591***
						(0.0193)
Time dummies	yes	yes	yes	yes	yes	yes
No. of obs.	439	437	437	437	430	430
Sargan test (2nd step)	0.104	0.226	0.178	0.099	0.376	0.331
AR (1)	0.072	0.071	0.066	0.095	0.058	0.062
AR (2)	0.659	0.701	0.675	0.680	0.544	0.490

The dynamic panel model estimated is $EDF_{i,t}$ (i = bank, t = time, k = country, c = control variables) = $\alpha + \beta_1 EDF_{i,t-1} + \beta_2$ *interest rate*$_{k,t} + \beta_3$ *interest rate*$_{k,t-1} + \beta_4$ *Taylor gap 1*$_{k,t} + \beta_5$ *Taylor Gap 1*$_{k,t-1} + \beta_6$ *GDP growth*$_{k,t} + \beta_7$ *GDP growth*$_{k,t-1} + \beta_8$ *Credit growth*$_{k,t} + \beta_9$ *Credit growth*$_{k,t-1} + \beta_{10}$ *Lerner-index*$_{k,t} + \varepsilon_{i,t}$. Specification (2) includes the *Concentration ratio 5* while Specification (3) includes the *HHI*. *Taylor Gap 1* is substituted by *Taylor gap2* in specification (4). Specifications (5) and (6) are further sensitivity analyses concerning the capital market environment. Constant term included but not reported. Standard errors are reported in parenthesis. ***, **, *: statistically significant at the 1, 5 and 10% level.

Table 9: Monetary policy, the Lerner-index and EDF

	(1) EDF	(2) EDF	(3) EDF
EDF (t – 1)	0.1162***	0.0862***	0.0988***
	(0.0166)	(0.0162)	(0.0163)
Interest rate	0.9292***	1.2493***	0.9074***
	(0.2937)	(0.3151)	(0.3129)
Interest rate (t – 1)	1.7459***	1.9536***	2.0051***
	(0.2388)	(0.2627)	(0.2634)
Taylor gap 1	-2.7452***	-3.1040***	-2.7707***
	(0.3745)	(0.3881)	(0.3963)
Taylor gap 1 (t – 1)	-1.9757***	-2.1128***	-2.179***
	(0.2402)	(0.2548)	(0.2528)
GDP growth	-0.0708***	-0.0609***	-0.0696***
	(0.0142)	(0.0153)	(0.0153)
GDP growth (t – 1)	-0.0145	-0.0162	-0.0171*
	(0.0900)	(0.0104)	(0.0098)
Credit growth	0.0155***	0.0180***	0.0160***
	(0.0047)	(0.0043)	(0.0044)
Credit growth (t – 1)	0.0142**	0.0051	0.0099
	(0.0055)	(0.0059)	(0.0063)
Concentration ratio 5		-0.0522***	
		(0.0077)	
HHI			-0.0135***
			(0.0003)
Net interest margin (t – 1)	-1.1699***	-1.4017***	-1.3391***
	(0.2123)	(0.2051)	(0.2131)
Cost income ratio (t – 1)	5.6967***	5.9752***	5.9209***
	(0.5086)	(0.7883)	(0.6005)
Non-performing loans (t – 1)	0.0001***	0.0001***	0.0001***
	(0.0001)	(0.0001)	(0.0001)
Total assets (t – 1)	-0.3330***	-0.0695	-0.1312
	(0.1107)	(0.1357)	(0.1406)
Time dummies	yes	yes	yes
No. of obs.	439	437	437
Sargan test (2nd step)	0.197	0.374	0.313
AR (1)	0.050	0.044	0.047
AR (2)	0.749	0.741	0.734

The dynamic panel model estimated is $EDF_{i,t}$ (i = bank, j = time, k = country, c = control variables) $= \alpha + \beta_1 EDF_{i,t-1} + \beta_2$ *interest rate*$_{k,t} + \beta_3$ *interest rate*$_{k,t-1} + \beta_4$ *Taylor gap 1*$_{k,t} + \beta_5$ *Taylor Gap 1*$_{k,t-1} + \beta_6$ *GDP growth*$_{k,t} + \beta_7$ *GDP growth*$_{k,t-1} + \beta_8$ *Credit growth*$_{k,t} + \beta_9$ *Credit growth*$_{k,t-1} + \beta_{10}$ *Banking market structure variable*$_{k,t} + \varepsilon_{i,t}$. Specification (1) is estimated without any banking market structure variables. Specification (2) includes the *Concentration ratio 5* while Specification (3) includes the *HHI*. Constant term included but not reported. Standard errors are reported in parenthesis. ***, **, *: statistically significant at the 1, 5 and 10% level.

Table 10: Notes on variables and data sources (H-Statistic (1) and (2))

Variable	Description	Data Sources
H-Statistic (1)	H-Statistic estimated on a bank-level cross-sectionally for each country in our sample and each year for the period from 1997 to 2008. Higher values indicate more competitive banking markets. H-Statistic (1) comprises bank's interest bearing revenues.	BankScope, authors' calc.
H-Statistic (2)	H-Statistic estimated on a bank-level cross-sectionally for each country in our sample and each year for the period from 1997 to 2008. Higher values indicate more competitive banking markets. H-Statistic (2) comprises bank's interest and non-interest bearing revenues.	BankScope, authors' calc.
Interest Revenues	Proxy for the bank's output (H-Statistic (1)). Accounting value of the ratio of a bank's interest income to its total assets.	BankScope CN 2080
Total Revenues	Proxy for the bank's output (H-Statistic (2)). Accounting value of the ratio of a bank's interest and non-interest income to its total assets.	BankScope CN 2080, 2085
Funding costs	Proxy for the bank's first input factor. Accounting value of the ratio of a bank's interest expenses to its total borrowed funds.	BankScope CN 6520, 2030
Labor costs	Proxy for the bank's second input factor. Accounting value of a bank's personnel expenses as a share of its total assets.	BankScope CN 6650, 2025
Other costs	Proxy for the bank's third input factor. Accounting value of the ratio of a bank's other operating expenses to its total assets.	BankScope CN 6670, 2025
Deposits	Proxy for the bank's first netput. Accounting value of a bank's total deposits.	BankScope CN 2031, 2185
Deposits and money market funding	Proxy for the bank's second netput. Accounting value of a bank's total borrowed funds.	BankScope 2030
Net Loans	Proxy for the bank's third netput. Accounting value of a bank's net loans.	BankScope CN 11090
Equity capital	Proxy for the bank's forth netput. Accounting value of a bank's equity capital.	BankScope CN 2055
Total Assets	Accounting value of a bank's total assets.	BankScope 2025

Table 11: Descriptive statistics (H-Statistic (1) and (2))

Variable	Observations	H-Statistic (1)	H-Statistic (2)	Total Revenues	Interest Revenues	Funding Costs	Labor costs	Other costs	Total Deposits	Deposits and Money Market Funding	Net Loans	Equity Capital	Total Assets
Austria	2080	0.3182	0.5391	199057	174543	5.7451	1.4856	1.2096	2177208	2402767	2005377	181225	3569229
Belgium	488	0.4752	0.5355	1744722	1587766	4.4868	1.1322	0.9952	18798276	19228594	10071998	819783	25262854
Denmark	882	0.1856	0.3755	338847	301043	3.7926	2.0741	1.5922	3250178	3260092	4156408	309749	7011846
France	2644	0.4140	0.4969	1461225	1168760	6.1583	1.6727	1.5089	14110531	15958455	15057328	1079791	27446231
Germany	19304	0.4351	0.5687	139516	132622	3.3798	1.4973	1.1472	1911248	1936675	1825367	111307	3079608
Italy	3226	0.3958	0.4985	465913	369672	3.8288	1.5233	1.4026	4627343	4836455	5188474	518420	8242510
Netherlands	352	0.6500	0.7182	3845259	3295562	6.6295	1.1133	0.9342	45090621	47857257	36901394	2506140	72418443
Spain	1322	0.3806	0.4601	926356	867243	3.1978	1.2971	1.0082	9621427	12059143	11364717	1059182	17724343
Switzerland	3436	0.3725	0.4895	301613	208609	2.2321	1.4872	1.2210	3499454	3866602	4289126	220574	6052973
UK	962	0.4695	0.5747	2440079	1974715	5.0612	1.5831	1.8633	30204925	32976447	23218240	2148361	53357020
Total	34696	0.4195	0.6379	449215	379562	3.7601	1.5118	1.2311	5054539	5482931	4888909	369878	8807758

Figure 3: Development of the H-Statistic (1) during the sample period

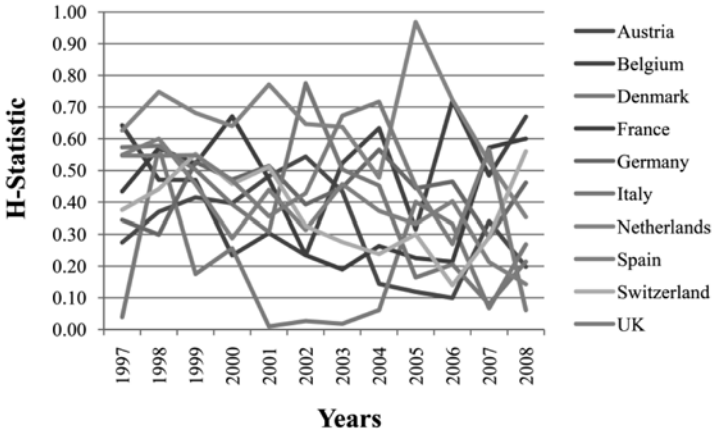


Figure 4: Development of the H-Statistic (2) during the sample period

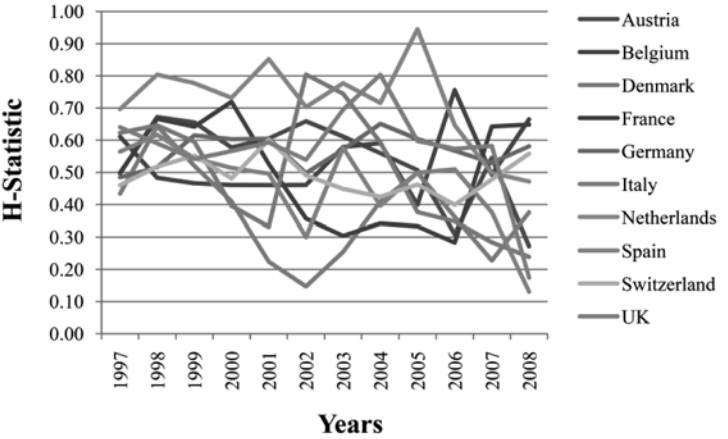


Table 12: Monetary policy, the H-Statistic and EDF

	(1) EDF	(2) EDF	(3) EDF	(4) EDF	(5) EDF	(6) EDF
EDF (t-1)	0.1055***	0.0788***	0.1121***	0.1028***	0.0829***	0.0747***
	(0.0199)	(0.0221)	(0.0269)	(0.0219)	(0.0239)	(0.0232)
Interest rate	0.9813***	1.3292***	1.1656***	1.0499***	1.2947***	1.0473***
	(0.2992)	(0.3215)***	(0.3307)	(0.3106)	(0.3257)	(0.3217)
Interest rate (t – 1)	1.7428***	1.9513	1.7272***	1.5744***	1.7877***	1.8717***
	(0.2350)	(0.2597)	(0.2720)	(0.2395)	(0.2479)	(0.2525)
Taylor gap 1	-2.8380***	-3.1808***	-3.0451***	-2.5658***	-2.8694***	-2.6150***
	(0.4031)	(0.3995)	(0.4269)	(0.4171)	(0.4189)	(0.4250)
Taylor gap 1 (t – 1)	-1.9029***	-2.0518***	-1.7833***	-1.6622***	-1.8394***	-1.8933***
	(0.2411)	(0.2627)	(0.3006)	(0.2419)	(0.2459)	(0.2477)
GDP growth	-0.0693***	-0.0579***	-0.0605***	-0.0660***	-0.0571***	-0.0633***
	(0.0135)	(0.0151)	(0.0149)	(0.0138)	(0.0147)	(0.0148)
GDP growth (t – 1)	-0.0192**	-0.0215**	-0.0338***	-0.0026	-0.0016	-0.0044
	(0.0086)	(0.0103)	(0.0106)	(0.0069)	(0.0084)	(0.0083)
Credit growth	0.0182***	0.0186***	0.0414**	0.0225***	0.0219***	0.0242***
	(0.0044)	(0.0041)	(0.0075)	(0.0052)	(0.0046)	(0.0052)
Credit growth (t – 1)	0.0133**	0.0610	0.0195***	0.0133**	0.0072	0.0082
	(0.0054)	(0.0061)	(0.0055)	(0.0053)	(0.0063)	(0.0067)
H-Statistic (1)	0.4326*	0.3769**	0.6862***			
	(0.2284)	(0.1872)	(0.2377)			
H-Statistic (2)				-1.1705***	-1.0838***	-1.4747***
				(0.3043)	(0.2970)	(0.2664)
Concentration ratio 5		-0.0587***			-0.0485***	
		(0.084)			(0.0073)	
HHI			-0.0440***			-0.0147***
			(0.0012)			(0.0003)
Net interest margin (t – 1)	-1.1638***	-1.4521***	-1.1300***	-1.2351***	-1.4350***	-1.4285***
	(0.2175)	(0.2038)	(0.2166)	(0.2323)	(0.2267)	(0.2374)
Cost income ratio (t – 1)	5.9490***	5.9358***	5.8776***	5.4480***	5.6314***	5.7114***
	(0.7174)	(1.1661)	(1.0970)	(0.8501)	(1.1211)	(1.0539)
Non-performing loans (t – 1)	0.0001***	0.0001***	0.0001***	0.0001***	0.0001***	0.0001***
	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)
Total assets (t – 1)	-0.2934***	-0.0011	-0.2425*	-0.2833**	-0.1376	-0.1660
	(0.1125)	(0.1445)	(0.1249)	(0.1129)	(0.1304)	(0.1280)
Time dummies	yes	yes	yes	yes	yes	yes
No. of obs.	439	437	437	439	437	437
Sargan test (2nd step)	0.136	0.352	0.200	0.116	0.282	0.192
AR (1)	0.049	0.054	0.058	0.042	0.097	0.095
AR (2)	0.634	0.646	0.499	0.601	0.577	0.510

The dynamic panel model estimated is $EDF_{i,t}$ (i = bank, j = time, k = country, c = control variables) $= \alpha + \beta_1 EDF_{i,t-1} + \beta_2$ *interest rate*$_{k,t} + \beta_3$ *interest rate*$_{k,t-1} + \beta_4$ *Taylor gap* $1_{k,t} + \beta_5$ *Taylor Gap* $1_{k,t-1} + \beta_6$ *GDP growth*$_{k,t} + \beta_7$ *GDP growth*$_{k,t-1} + \beta_8$ *Credit growth*$_{k,t} + \beta_9$ *Credit growth*$_{k,t-1} + \beta_{10}$ *H-Statistic (1)*$_{k,t} + \varepsilon_{i,t}$. Specification (2) includes the *Concentration ratio 5* while Specification (3) includes the *HHI*. *H-Statistic (1)* is substituted by *H-Statistic (2)* in specifications (4)-(6). Constant term included but not reported. Standard errors are reported in parenthesis. ***, **, *: statistically significant at the 1, 5 and 10% level.

Table 13: Correlation matrix

	Interest rate	Taylor gap 1	Taylor gap 2	GDP growth	Credit growth	Boone-indicator	Lerner-index	H-Statistic (1)	H-Statistic (2)	Concentration Ratio 5	HHI	Net interest margin	Cost income ratio	Non-performing loans	Total assets	Stock market return	House price index
Interst rate	1.00																
Taylor gap 1	0.31***	1.00															
Taylor gap 2	0.22***	0.62***	1.00														
GDP growth	-0.23***	-0.10***	-0.23***	1.00													
Credit growth	0.19***	0.04	-0.29***	-0.07*	1.00												
Boone-indicator	-0.09**	-0.12***	0.04	0.10***	-0.23***	1.00											
Lerner-index	-0.02	0.28***	-0.10***	0.19***	0.17***	-0.09**	1.00										
H-Statistic (1)	0.13***	-0.05	0.16***	0.03	-0.25***	0.03	-0.14***	1.00									
H-Statistic (2)	0.02	0.16***	0.31***	0.17***	-0.21***	0.03	0.01	0.53***	1.00								
Concentration ratio 5	-0.23***	0.02	-0.18***	0.12***	0.12***	-0.19***	0.22***	0.07**	0.05	1.00							
HHI	-0.22***	0.03	-0.12***	0.11***	0.04	-0.19***	0.15***	0.12***	0.09**	0.94***	1.00						
Net interest margin	0.18***	-0.23***	-0.24***	-0.01	0.10**	-0.01	0.11***	0.04	-0.06*	-0.21***	-0.24***	1.00					
Cost income ratio	-0.21***	-0.13***	0.02	0.02	-0.15***	0.12***	-0.14***	0.07**	0.06*	0.10***	0.13***	-0.22***	1.00				
Non-performing loans	-0.01	-0.02	0.12	-0.01	-0.06	0.09**	-0.23***	0.03	0.00	-0.14***	-0.12***	-0.25***	0.12***	1.00			
Total assets	0.01	0.13***	0.11***	0.08**	-0.04	0.00	-0.14***	0.02	-0.01	0.09**	0.10***	-0.31***	0.17***	0.31***	1.00		
Stock market return	0.03	0.34***	0.40***	-0.08**	0.02	-0.09**	0.30***	0.15***	0.34***	-0.08**	-0.08**	0.03	-0.15***	-0.12***	-0.10***	1.00	
House price index	0.19***	-0.04	-0.45***	0.23***	0.47***	-0.27***	0.25***	-0.03	-0.07*	0.26***	0.20***	0.11***	-0.26***	-0.04	0.11***	-0.10***	1.00

Appendix B: Calculation of the Expected Default Frequency (EDF)

The *Expected Default Frequency* (EDF) is the probability that the market value of a bank's assets will be less than a firm specific distress barrier within a given time horizon. Accordingly, we calculate the theoretical *Expected Default Frequency* (*Risk Neutral Default Probability*) using a step by step (two-step) approach. The procedure used is as follows:

(1) calculation of the *Distance-to-Default* (DtD) per bank holding *i* at time *t*;
(2) translation of the derived theoretical *Distance-to-Default* of bank *i* at time *t* into a time variant *Expected Default Frequency* (EDF) based on the risk neutral valuation framework.

1. Calculation of the Distance-to-Default (DtD)

According to the Merton framework (1973, 1974) the market value of a bank's equity capital can be modeled as a contingent claim on the residual value of its assets. In the event of a default, the bank shareholder receives no returns if the market value of bank assets falls below the market value of bank liabilities. Otherwise the bank shareholder receives the difference between the market value of assets and liabilities. Hence, the contingent claim on the residual value of bank assets can be modeled as a call option on the underlying bank using standard option-pricing models. Corresponding to Black and Scholes (1973), the market value of a bank's assets is assumed to follow a geometric Brownian motion:

$$dV_A = \mu V_A dt + \sigma_A V_A dz \tag{15}$$

where dV_A is the change in the value of assets, V_A is the current value of assets, μ is the drift rate of assets, σ_A is standard deviation of assets and finally, dz is a Wiener process.

More precisely, the market value of assets follows a stochastic process of the following form:

$$\ln V_A^T = \ln V_A + \left(r - \frac{1}{2}\sigma_A^2\right)T + \sigma_A\sqrt{T}\varepsilon \tag{16}$$

where V_A^T denotes the asset value at time T (maturity of debt), r is the risk free (one-month interbank offered rate)[9] interest rate and ε is a random component (standard normal distributed) of a firm's return on assets. The distance from the default point ($V_A = DB$) can be expressed as follows:

[9] We retrieve the one-month interbank offered rate from *Datastream Database* provided by *Thomson Financial Services*.

$$D = \ln V_A^T - \ln DB = \ln V_A + \left(r - \frac{1}{2}\sigma_A^2\right)T + \sigma_A\sqrt{T}\varepsilon - \ln DB\,. \tag{17}$$

DB represents the distress barrier defined as the face value of short term liabilities (maturity ≤ 1 year) plus half of the amount of long term liabilities (maturity > 1 year).

Rearranging equation (17), we attain

$$\frac{D}{\sigma_A\sqrt{T}} = \frac{\ln\left(\frac{V_A}{DB}\right) + \left(r - \frac{1}{2}\sigma_A^2\right)T}{\sigma_A\sqrt{T}} + \varepsilon\,, \tag{18}$$

and finally obtain the following definition of the *Distance-to-Default*:

$$DtD \equiv \frac{D}{\sigma_A\sqrt{T}} - \varepsilon = \frac{\ln\left(\frac{V_A}{DB}\right) + \left(r - \frac{1}{2}\sigma_A^2\right)T}{\sigma_A\sqrt{T}}\,. \tag{19}$$

The *Distance-to-Default* is designed to indicate the number of standard deviations that the bank is away from the default point within a given time horizon (one year). The unobservable parameters V_A and σ_A can be calculated from the observable market value of equity capital (V_E) as well as the standard deviation of share price returns (σ_E) using Ito's lemma and the following system of equations[10]:

$$V_E = V_A N(d_1) - DBe^{-rT}N(d_2)\,, \tag{20}$$

$$\sigma_E = N(d_1)\frac{V_A}{V_E}\sigma_A\,, \tag{21}$$

$$d_1 \equiv \frac{\ln\left(\frac{V_A}{DB}\right) + \left(r - \frac{1}{2}\sigma_A^2\right)T}{\sigma_A\sqrt{T}} = \frac{\ln\left(V_A\exp\left(\left(r - \frac{1}{2}\sigma_A^2\right)T\right)\right) - \ln DB}{\sigma_A\sqrt{T}}\,, \tag{22}$$

$$d_2 \equiv d_1 - \sigma_A\sqrt{T} = \frac{\ln\left(\frac{V_A}{DB}\right) + \left(r - \frac{1}{2}\sigma_A^2\right)T}{\sigma_A\sqrt{T}} = \frac{\ln\left(V_A\exp\left(\left(r - \frac{1}{2}\sigma_A^2\right)T\right)\right) - \ln DB}{\sigma_A\sqrt{T}} \tag{23}$$

[10] We retrieve the history of banks' stock prices from *Datastream Database* provided by *Thomson Financial Services*.

2. Calculation of the Expected Default Frequency (EDF)

The *Expected Default Frequency* (risk neutral default probability) is the probability that the market value of a bank's assets will be less than the distress barrier (DB) within a given time horizon (1 year). The current probability (p_t) that the market value of assets does not reach the default barrier at time t is:

$$p_T = Pr\{V_A^T \leq DB | V_A^0 = V_A\} = Pr\{\ln V_A^T \leq \ln DB | V_A^0 = V_A\}. \tag{24}$$

Integrating equations (16) into the equation (24) we obtain:

$$p_T = Pr\left\{\ln V_A + \left(r - \frac{1}{2}\sigma_A^2\right)t + \sigma_A\sqrt{T}\varepsilon \leq \ln DB\right\}. \tag{25}$$

Rearranging equation (25), we attain:

$$p_T = Pr\left\{\varepsilon \leq \frac{\ln\left(\frac{V_A}{DB}\right) + \left(r - \frac{1}{2}\sigma_A^2\right)T}{\sigma_A\sqrt{T}}\right\}. \tag{26}$$

Corresponding to Black and Scholes (1973), ε is standard normally distributed. Hence, we obtain the following definition of the *Expected Default Probability*:

$$p_T \equiv N\left(-\frac{\ln\left(\frac{V_A}{DB}\right) + \left(r - \frac{1}{2}\sigma_A^2\right)T}{\sigma_A\sqrt{T}}\right). \tag{27}$$

12. Challenges for the EU Fiscal Framework: Fiscal Sustainability, Government Debt and Monetary Policy

Philipp C. Rother

Public finances in Europe and other advanced economies are in a precarious condition. Public deficits and debt have reached unprecedented peacetime levels and the dynamics are clearly unsustainable. Moreover, the economically and financially interlinked environment in which the debt has been amassed makes the magnitude of the obligations that governments face more uncertain. This creates both significant long-term and short-term risks.

12.1. Fiscal Situation

Against the background of a deterioration in publics finance in many countries, it is useful to take stock of government liabilities and the adjustment needed in the euro area and other G7 economies. The findings suggest a much more vulnerable position for fiscal sustainability in the euro area and other countries existed in 2010-11 than at any time in recent decades.

There is little doubt that public finances in most advanced economies are unsustainable when government deficits, debt dynamics and additional contingent and implicit liabilities for the budget (such as from the financial sector or population aging) are taken into account. Deficits in the euro area are estimated at around 6 per cent of GDP in 2010 and with deficit peaks near or above 10 per cent in several member countries (Table 1, p. 234). Except for Canada, the situation in other G7 countries is no better: both the United States and the United Kingdom posted double-digit deficits for the year ending in 2010.

Gross public debt ratios have increased rapidly. From 66 per cent in 2007, debt is estimated at 85 per cent of GDP in the euro area in 2010 with levels near or (far) above 100 per cent in four countries. Gross debt to GDP in the United Kingdom and the United States rose to similar ratios, but their much lower starting positions only three years ago point to more adverse underlying debt dynamics. For Japan, a debt ratio of around 220 per cent of GDP is recorded, while average G7 debt exceeded 110 per cent of GDP in 2010.

In addition, significant implicit liabilities from social security systems are expected to burden future budgets. By optimistic European Commission/Economic Policy Committee (EPC) estimates, public expenditure on health, pension

Table 1: Public finances
(% of GDP unless otherwise stated)

	Budget balance	Gross debt			Increase in ageing costs (percentage points of GDP)	Fiscal adjustment needed
	2010	1999	2007	2010	2007-2060	2010-2020
Belgium	-4.1	113.7	84.2	96.8	6.9	3.1
Germany	-3.3	60.9	64.9	83.2	4.8	2.2
Estonia	0.1	6.0	3.7	6.6	0.4	-3.5
Ireland	-32.4	48.5	25.0	96.2	8.9	12.4
Greece	-10.5	94.0	105.4	142.8	15.9	10.5
Spain	-9.2	62.3	36.1	60.1	9.0	8.2
France	-7.0	58.8	63.9	81.7	2.7	6.2
Italy	-4.6	113.7	103.6	119.0	1.6	3.2
Cyprus	-5.3	51.8	58.3	60.8	10.8	n.a.
Luxembourg	-1.7	6.4	6.7	18.4	18.0	n.a.
Malta	-3.6	57.1	62.0	68.0	10.2	n.a.
Netherlands	-5.4	61.1	45.3	62.7	9.4	4.2
Austria	-4.6	67.2	60.7	72.3	3.1	2.4
Portugal	-9.1	49.6	68.3	93.0	3.4	6.4
Slovena	-5.6	24.3	23.1	38.0	12.8	3.7
Slovakia	-7.9	47.8	29.6	41.0	5.2	7.0
Finland	-2.5	45.7	35.2	48.4	6.3	0.9
Euro area	-6.0	71.6	66.2	85.4	5.2	4.6
Canada	-5.5	91.4	66.5	84.0	–	4.4
Japan	-9.5	133.8	187.7	220.3	–	13.3
United Kingdom	-10.4	43.7	44.5	80.0	5.1	9.3
United States	-10.6	60.8	62.2	91.6	–	11.3
G7 average	-8.7	78.9	81.9	112.5	–	9.3

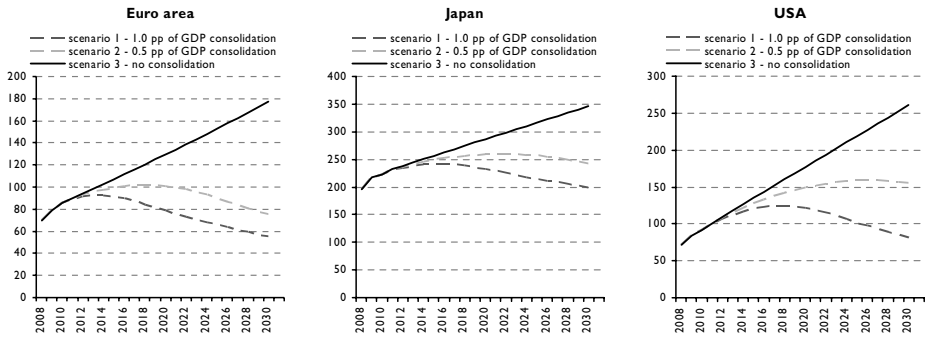
Sources: European Commission's spring 2011 economic forecast (AMECO database) and IMF World Economic Outlook (April 2011) in the case of Canada, Japan and the United States. The weights for the calculation of the G7 aggregate and the fiscal adjustment for the euro area are based on GDP data from IMF World Economic Outlook (April 2011). The fiscal adjustment needed comes from the IMF Fiscal Monitor (April 2011). The increase in ageing costs data are taken from the European Commission's 2009 Ageing Report.

and long-term care will on average rise by 5.2 per cent of GDP over the next decades until 2060. Some assessments by other institutions point to much higher future burdens[1].

Looking to the future, a continuation of past deficits would imply explosive debt paths as illustrated in Chart I (p. 235). The 'no consolidation' line in the chart underestimates the likely development of the debt ratio, if continued fiscal imprudence undermines economic confidence and thus erodes the basis for a return to

[1] See also van Riet (ed.) (2010) for a survey of fiscal burdens.

Chart I: Medium-term projections for the average government debt-to-GDP ratio
(2010-30; % of GDP)



Source: ECB calculations.

Notes: All three scenarios use the European Commission's spring 2011 economic forecast for general government debt and primary balance up to 2010 as a starting point. Fiscal developments as of 2011 are determined by three alternative scenarios: Scenario 1 assumes a more rapid fiscal consolidation process, with the primary balance improving by 1.0 percentage point of GDP per year until an overall balanced budget is reached. Scenario 2 assumes a less ambitious consolidation path, with the primary balance improving by only 0.5 percentage point of GDP per year until an overall balanced budget is reached. Scenario 3 assumes that no consolidation efforts are made. The primary balance remains constant at the forecast value for 2010 over the whole simulation period. Additional fiscal burdens (e.g. due to ageing or support to banks) are assumed to be offset so that the primary balance remains unchanged. The macroeconomic assumptions underlying the three scenarios are as follows: the nominal GDP growth comes from IMF World Economic Outlook (April 2011) up to 2015 and afterwards it is constant and equal to the latest value. The nominal implicit interest rate on government debt is assumed constant at the value recorded in 2008 (as the values for the period 2009-10 could be distorted by the financial crisis).

sound and sustainable economic growth. With GDP growth faltering, public debt ratios would rise even more steeply. With a limited adjustment effort of 0.5 pp of GDP per year the average euro area debt ratio and the Japanese debt ratio would continue to rise for the coming years, before only gradually stabilising and slowly returning to a downward trend. For the US, such modest consolidation effort would just suffice to stabilise the debt ratio in the 2020s. Only more ambitious consolidation of 1 pp p.a. would generate visibly declining debt ratios that would return to pre-crisis level within the projection horizon.

High and rising fiscal imbalances risk to undermine growth prospects[2], erode macroeconomic stability and pose dangers for the conduct of stability-oriented monetary policies. In particular, political pressure on central banks could rise to keep interest rates at inappropriately low levels to limit government financing costs. In addition, government attempts to generate additional demand for government bonds via financial repression may undermine the financial transmission channels which are crucial for monetary policy to work effectively. Finally, as has been discussed in the literature, governments may be tempted to reduce their real debt burden by means of unexpected inflation increases at the risk of unanchoring price stability expectations.

[2] Public debt ratios above a level of around 90% of GDP have been found to be detrimental to GDP growth. See Checherita and Rother (2010).

With these debt levels and fiscal prospects, the IMF (2011) has identified the fiscal adjustment needed over the next decade to bring public debt ratios back to sustainable levels (defined as achieving a debt ratio of around 60% of GDP by 2030). For the average of the euro area the adjustment would have to be around 5 per cent of GDP, for the average of the G7 around 9 per cent of GDP and for some countries including the UK and the US around 9 and 11 per cent (see again Table 1).

12.2. Fiscal Adjustment Experiences

History provides interesting examples of how the correction of fiscal imbalances can contribute to macroeconomic stabilisation. In 1993, fiscal data for Sweden point to severe imbalances. The deficit ratio amounted to 11.2% of GDP, the expenditure ratio was close to 20 pp of GDP above the average of the current euro area countries and the debt ratio had risen by almost 39% of GDP over the preceding three years. This had happened in an adverse economic environment of a severe financial crisis requiring substantial government intervention in the financial sector and with real GDP contracting by more than 4% over the same period. According to these parameters, the situation in Sweden in 1993 was not much different from that of today's crisis countries in the euro area.

A look at the current situation in Sweden shows how much appropriate fiscal policies, in combination with wide ranging structural and institutional reforms, including in the field of monetary policy, can achieve. According to the European Commission Spring 2011 forecast, Sweden will show a fiscal surplus in 2011, the only county to achieve this without recourse to one-off measures, and rank fifth in terms of its debt ratio. It achieved primary fiscal surpluses in excess of 5% of GDP over the period 1997-2001. These remarkable achievements rest on the foundation of sound and comprehensive set of fiscal rules that is constantly being adapted.

Judging from past experience in euro area countries, large reductions in government debt require a firm longer-term commitment to fiscal consolidation, a strong focus on spending reduction and parallel structural reforms to support potential growth. In particular Belgium, Ireland, Spain, the Netherlands and Finland since the mid-1990s have in the past implemented substantial budgetary adjustments, often complemented by structural reforms, and successfully reduced their government debt-to-GDP ratios. For example, sizeable reductions in the debt ratio (although generally not continuous) range from an overall decline of around 24 percentage points over the period from 1995 to 2008 in Finland to an overall decline of more than 69 percentage points over the period from 1994 to 2006 in Ireland.

Table 2: Periods of sizeable government debt reduction in selected euro area countries (general government, % of GDP)

Country/period of sizeable debt reduction	Debt		Expenditure		Revenue		Primary expenditure	
	Peak	Trough	Peak	Trough	Peak	Trough	Peak	Trough
Belgium (1994-2007	134.2	84.2	54.9	48.4	47.5	48.1	44.2	44.6
Ireland (1994-2006)	94.1	24.8	44.6	34.5	41.9	37.4	38.0	33.5
Spain (1997-2007)	67.4	36.1	43.2	39.2	38.4	41.1	38.0	37.6
Netherlands (1994-2007)	78.5	45.3	55.7	45.2	52.9	45.4	49.6	43.1
Finland (1995-2008)	57.7	34.1	63.5	49.3	56.8	53.5	59.4	47.9
Sweden (1997-2008)	73.3	38.8	62.8	51.7	59.6	53.9	57.5	50.0

Source: European Commission's spring 2011 economic forecast.
Note: The peak of the respective fiscal aggregate refers to the year prior to the start of the period of sizeable debt reduction.

Significant primary surpluses contributed mostly to the successful debt reductions. The budgetary adjustment in the above-listed countries mainly occurred on the expenditure side. The periods of large debt reductions in Ireland, the Netherlands and Finland were accompanied by decreases in the respective government expenditure ratios of more than 10 percentage points. While part of this decline may be explained by the reduction in interest payments, primary expenditure ratios also fell markedly over these periods. These sharp declines even allowed countries to reduce their revenue ratios and still achieve budgetary improvements over the respective debt reduction periods. In Belgium and Spain, expenditure ratios also declined, but fiscal adjustment consisted of increases in revenue ratios, too.

12.3. Governance[3]

The Treaty on the Functioning of the European Union (TFEU) specifies a clear division of responsibilities between European and national policy-makers in EMU. Monetary policy is inherently indivisible in a monetary union, and in the euro area it is thus conducted at the supranational level. By contrast, economic policies, such as fiscal and structural policies, have remained largely the competence of national governments and reflect national political preferences.

With the introduction of Economic and Monetary Union in 1999, euro area countries agreed to conduct their fiscal policies in accordance with the rules of the TFEU and the Stability and Growth Pact (SGP). Member States are under an obligation to avoid excessive government deficits (a limit of 3% of GDP) and debt (which should not exceed 60% of GDP unless it is diminishing at a satisfactory pace). Additionally, the SGP establishes the details of a multilateral surveillance

[3] See ECB (2011).

framework to prevent and, where necessary, correct fiscal policies that do not comply with this obligation. However, in 2005 the Member States agreed on a revision of the SGP, which, among other changes, introduced more discretion and flexibility into the surveillance procedures[4].

The provisions of the SGP were only implemented half-heartedly. Peer pressure among the Member States – potentially a strong tool of mutual fiscal surveillance – was weak as countries did not attach sufficient importance to their joint responsibility for the stability of the euro area. The procedural tools for addressing instances of non-compliance lacked automaticity and left a great deal of room for discretion. Both the European Commission and the ECOFIN Council were reluctant to use these tools and there was a lack of urgency in the follow-up measures requested from non-compliant countries. Sanctions, in the form of financial penalties imposed in the event of persistent failure to correct an excessive deficit, which were foreseen as the ultimate step in the long course of the EDP, were in fact never applied.

The governance framework was also unable to prevent the emergence of excessive macroeconomic imbalances in the euro area. Some countries experienced significant internal and external economic imbalances, and inflation rates persistently above the euro area average. Increases in labour compensation in some countries, driven in most cases by high public sector wage increases, exceeded productivity gains by a significant margin, leading to increases in unit labour costs in excess of those seen in other euro area countries and the euro area average, and thus a gradual erosion of competitiveness. At the same time, growth in the unregulated financial sector and unsustainably strong domestic demand growth, coupled in some cases with excessive credit growth and large and sustained increases in real estate prices, resulted in large current account deficits and high levels of private and external debt.

The euro area lacks appropriate mechanisms to identify and correct excessive macroeconomic imbalances. The coordination of economic policies in the EU is mainly conducted within the framework of the Broad Economic Policy Guidelines, the Employment Guidelines and the Europe 2020 strategy (formerly the Lisbon strategy), which set out policy recommendations to national policy-makers on macroeconomic, structural and labour market policies. The framework lacks sufficient surveillance instruments to monitor the implementation of policy recommendations, which are not binding and were thus all but ignored by Member States. While macroeconomic imbalances were frequently criticised in ECOFIN Council opinions on stability and convergence programmes, these opinions did not carry enough weight to persuade the Member States concerned to change their economic policies.

[4] MORRIS, R., ONGENA, H. and SCHUKNECHT, L. (2006) and ECB (2005).

In response to the identified problems with the existing governance framework, the European Council initiated changes in a number of core areas. In particular, fiscal governance in the EU is to be strengthened via improvements in national budgetary frameworks as well as through changes in the EU fiscal governance framework. In addition, macroeconomic surveillance is to be stepped up including mechanisms to ensure the prevention and the correction of excessive macroeconomic imbalances.

In the fiscal area, there is agreement that national budgetary frameworks should be geared towards ensuring compliance with the SGP. This includes in particular the setting of effective medium-term budgetary objectives and the establishment of numerical fiscal rules. Changes in these areas should strengthen policy makers' incentives to conduct sound policies as domestic governance frameworks should lead to increased monitoring of policies by the electorate. In this regard they could develop into an important complement and anchor to the rules at the EU level. The EU fiscal rules are to be strengthened by increasing the focus on government debt and sustainability and reinforcing compliance with the principles of sound fiscal policies. Regarding the former, the debt criterion which is already contained in the TFEU is to be quantified so that can be monitored in concrete terms. Regarding the latter, new reputational and financial incentive measures and sanctions are foreseen that could be applied early when fiscal imbalances are detected. Moreover, the decision on such measures is to become more automatic.

On the macroeconomic side, a new surveillance framework aims to identify and address macroeconomic imbalances. It foresees an alert mechanism to provide an initial indication of the existence or potential risk of macroeconomic imbalances. This would be based on a scoreboard with a limited set of macroeconomic indicators to be supplemented by expert judgement. Upon indication of significant macroeconomic imbalances or risks an in-depth analysis of risks to macroeconomic stability would be conducted. On that basis, the ECOFIN Council could address a recommendation to the respective Member State including concrete measures to address the imbalances. In severe cases, a so-called excessive imbalance procedure could be launched similar to the provisions under the SGP on the fiscal side.

Even the strengthened governance mechanisms outlined above might not suffice to rule out with certainty that individual countries might experience a confidence crisis. For such events, a permanent crisis management framework – designed to safeguard the stability of the euro area as a whole, while very significantly strengthening incentives for sound public finances – would enable such matters to be addressed in a systematic, rule-based manner.

12.4. Conclusion and Outlook

Experience provides several examples of advanced economies successfully correcting severe fiscal imbalances by implementing prudent fiscal policies over extended time periods. From this perspective, also the correction of the current fiscal imbalances should in principle be possible. At the same time, it is clear that the situation today differs in several aspects from that of previous consolidation experiences. One major aspect is the global scale of the fiscal imbalances which affect most advanced economies. Moreover, the outlook for potential output growth is uncertain and future growth rates might well turn out below historical averages. One contributing factor is demographic ageing which by itself will also put additional pressure on public finances in many countries via public health and pension systems. Furthermore, global interest rates are still at a historically low level and could rise.

For the euro area, the governance framework for economic policies is being strengthened in response to the shortcomings identified in relation to the crisis. Incentives for sound budgetary polices will be strengthened via domestic fiscal frameworks as well as through improvements in the EU provisions for fiscal policy coordination. In addition, macroeconomic surveillance is being reinforced and mechanisms to address emerging imbalances are being put in place. A permanent crisis resolution framework complements the framework.

The outlook for the soundness of economic policies in the euro area is uncertain. On the downside, given past experience, also the envisaged new rules and procedures may prove insufficient to ensure sound policies in all countries. At the same time, vulnerability to adverse macroeconomic shocks or changes in financial market perceptions is expected to remain high for the foreseeable future. On the upside, national fiscal and economic policies will be under much closer scrutiny than they were in the past, notably during the first ten years since the introduction of the euro. Having witnessed the spillover risks from imbalances in individual Member States, euro area governments have all incentive to apply peer pressure early on when economic imbalances are detected. In addition, financial market participants have become acutely aware of the risks related to inappropriate economic and fiscal policies. Market reactions are therefore likely to play a more important signalling role for national policy makers than in the past.

References

CHECHERITA, C. and ROTHER, P., 2010, *The Impact of High and Growing Government Debt on Economic Growth: An Empirical Investigation for the Euro Area*, ECB Working Paper Series No. 1237.

ECB, 2011, "Fiscal Developments", *Monthly Bulletin*, March.

ECB, 2005, "The reform of the Stability and Growth Pact", *Monthly Bulletin*, August.

IMF, 2011, *Fiscal Monitor*, Washington DC, April.

MORRIS, R., ONGENA, H. and SCHUKNECHT, L., 2006, "The reform and implementation of the Stability and Growth Pact", *Occasional Paper Series* No. 47, ECB, Frankfurt am Main, June.

VAN RIET, A. (ed.), 2010, "Euro area fiscal policies and the crisis", *ECB Occasional Paper Series* No. 109.

SUERF – Société Universitaire Européenne de Recherches Financières

SUERF is incorporated in France as a non-profit-making Association. It was founded in 1963 as a European-wide forum with the aim of bringing together professionals from both the practitioner and academic sides of finance who have an interest in the working of financial markets, institutions and systems, and the conduct of monetary and regulatory policy. SUERF is a network association of central bankers, bankers and other practitioners in the financial sector, and academics with the purpose of analysing and understanding European financial markets, institutions and systems, and the conduct of regulation and monetary policy. It organises regular Colloquia, lectures and seminars and each year publishes several analytical studies in the form of *SUERF Studies*.

SUERF has its full-time permanent Executive Office and Secretariat located at the Austrian National Bank in Vienna. It is financed by annual corporate, personal and academic institution membership fees. Corporate membership currently includes major European financial institutions and Central Banks. SUERF is strongly supported by Central Banks in Europe and its membership comprises most of Europe's Central Banks (including the Bank for International Settlements and the European Central Bank), banks, other financial institutions and academics.

SUERF Studies

1997-2011

For details of SUERF Studies published prior to 2011 (Nos. 1 to 22 and 2003/1-2010/5) please consult the SUERF website at www.suerf.org.

2011

2011/1 *The Future of Banking in CESEE after the Financial Crisis*, edited by Attilla Csajbók and Ernest Gnan, Vienna 2011, ISBN 978-3-902109-56-9

2011/2 *Regulation and Banking after the Crisis*, edited by Frank Browne, David T. Llewellyn and Philip Molyneux, Vienna 2011, ISBN 978-3-902109-57-6

2011/3 *Monetary Policy after the Crisis*, edited by Ernest Gnan, Ryszard Kokoszczynski, Tomasz Łyziak and Robert McCauley, Vienna 2011, ISBN 978-3-902109-58-3

2011/4 *Divergence of Risk Indicators and the Conditions for Market Discipline in Banking*, Vienna 2011, ISBN 978-3-902109-59-0

2011/5 *Roles, Missions and Business Models of Public Financial Institutions in Europe*, Vienna 2011, ISBN 978-3-902109-60-6