Domestic and International Sectoral Portfolios: Network Structure and Contagion Effects

Natacha Valla, Romain Rancière, Jonas Heipertz

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Introduction: This paper

This paper uses a unique comprehensive dataset on French portfolio assets and liability holdings to

- Study the dynamics of domestic and international sectoral portfolios
- Understand their network structure
- Estimate a model of contagion through intersectoral security linkages.

Introduction: Key Questions

- What sectoral patterns are underlying the rapid deterioration of the net external portfolio position of France between 2008 and 2014 from a creditor position of 4.7 percent of GDP to a debtor position of -35.7 percent of GDP?
- How do shocks that originated in domestic sectors or the rest of the world propagate through the network structure formed by intersectoral asset and liability position (balance-sheet contagion)?

Results: Stylized Facts

- Change in net external portfolio position of France was driven by:
  - banking sector retranchment on the asset side, and foreign expansion on the liability side
  - increase in foreign liablities of the public and coporate sector
  - but was mitigated by the expansion the domestic and foreign assets portfolio of the insurance sector (in 2014 one third of total assets were held by the insurance sector)
- Banking, corporate sector, and public sector increase foreign debt liabilities three to four times more vis--vis Non-Eurozone countries than vis--vis Eurozone countries.

Results: Balance-sheet contagion model

- Financial sectors of the economy (banking sector, insurance sector, mutual funds) are strongly affected by financial contagion.
- The public sector and the corporate sector do not propage shocks through their balance-sheet.
- Through balance-sheet contagion the financial sectors are
  - Strongly exposed to foreign sector shocks
  - Increasingly exposed to public sector shocks

Roadmap

- Data
- Literature
- Stylized Facts
  - Sectoral external portfolios
  - Network
- Model

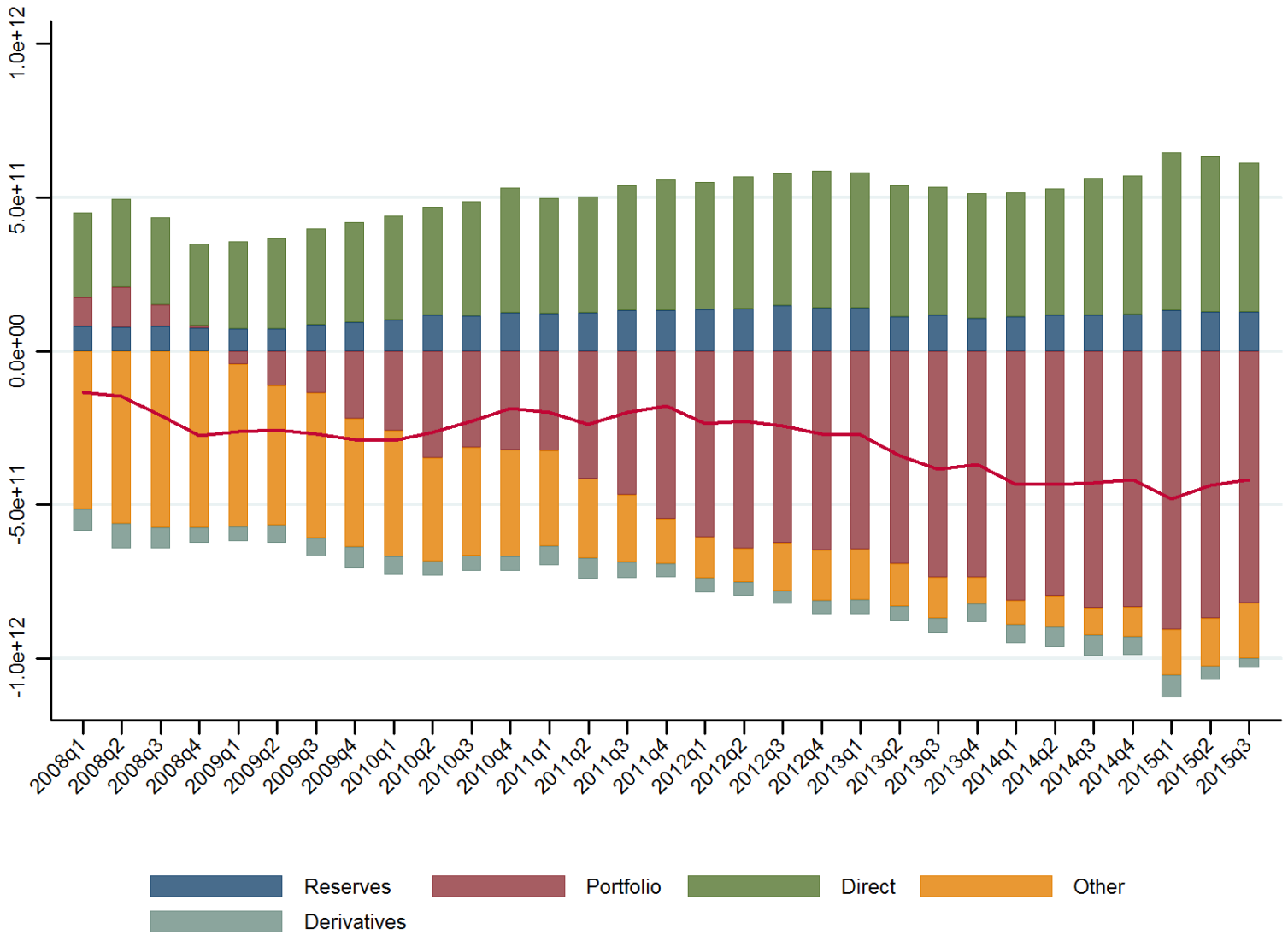
Data: Protide (Banque de France)

- Database on security holdings collected by the **Banque de France** from direct and custodian reportings
  - Exhaustive data on security holdings by French residents
  - Frequency is quarterly, from 2008Q1 to today (but we stop in 2014)
- High level of granularity
  - Security-by-security database, with information about the characteristics of each security (including instrument type, nationality of the issuer)
  - Aggregation at the sector-level
- Integrated Domestic and Foreign Portfolios with both Assets and Liabilities. Full characterization of changes in assets and liabilities by sector-instrument.
- Full range of cross-holding: across sectors, between sector / rest of the word, between domestic / foreign sectors (for EA countries only)
- **Compared to: CPIS**
  - Sectoral information on holder positions only, not issuers, for a small sample of countries, in recent years
  - Only international portfolios
- **Compared to: flow-of-funds**
  - No breakdown between domestic and foreign portfolio at the sector level

Literature

- Eisenberg and Noe (2001): Propagation of shocks to outside assets and liability through banks balance-sheets.
- Castrén and Kavonius (2009): Shock transmission through flow-of-funds based on accounting rule. No direct measure of bilateral exposure.
- Galstyan et al. (2016): International sectoral portfolio with CPIS data.

Net External Investment Position of France



Sectoral Breakdown: Change in Net External Portfolio

	Debt			Equity			Total
Sector	**A**	**L**	**Net**	**A**	**L**	**Net**	**Net**
Banking sector	−7.8%	+6.5%	−14.3%	0	0	0	−14.3%
Mutual funds	+1%	+2.2%	−1.2%	0	+2.4%	−2.4%	−3.6%
Insurance sector	+4.9%	0	+4.9%	+1.4%	−1%	+2.4%	+7.3%
Corporate sector	0	+6.5%	−6.5%	0	+1.6%	−1.6%	−.8.1%
Household sector	0	0	0	+2.4%	0	+2.4%	+2.4%
Public sector	0	+26%	−26%	0	0	0	−26%
Total	−1.8%	+41.2%	−43%	3.8%	+3%	+0.8%	−42.2%

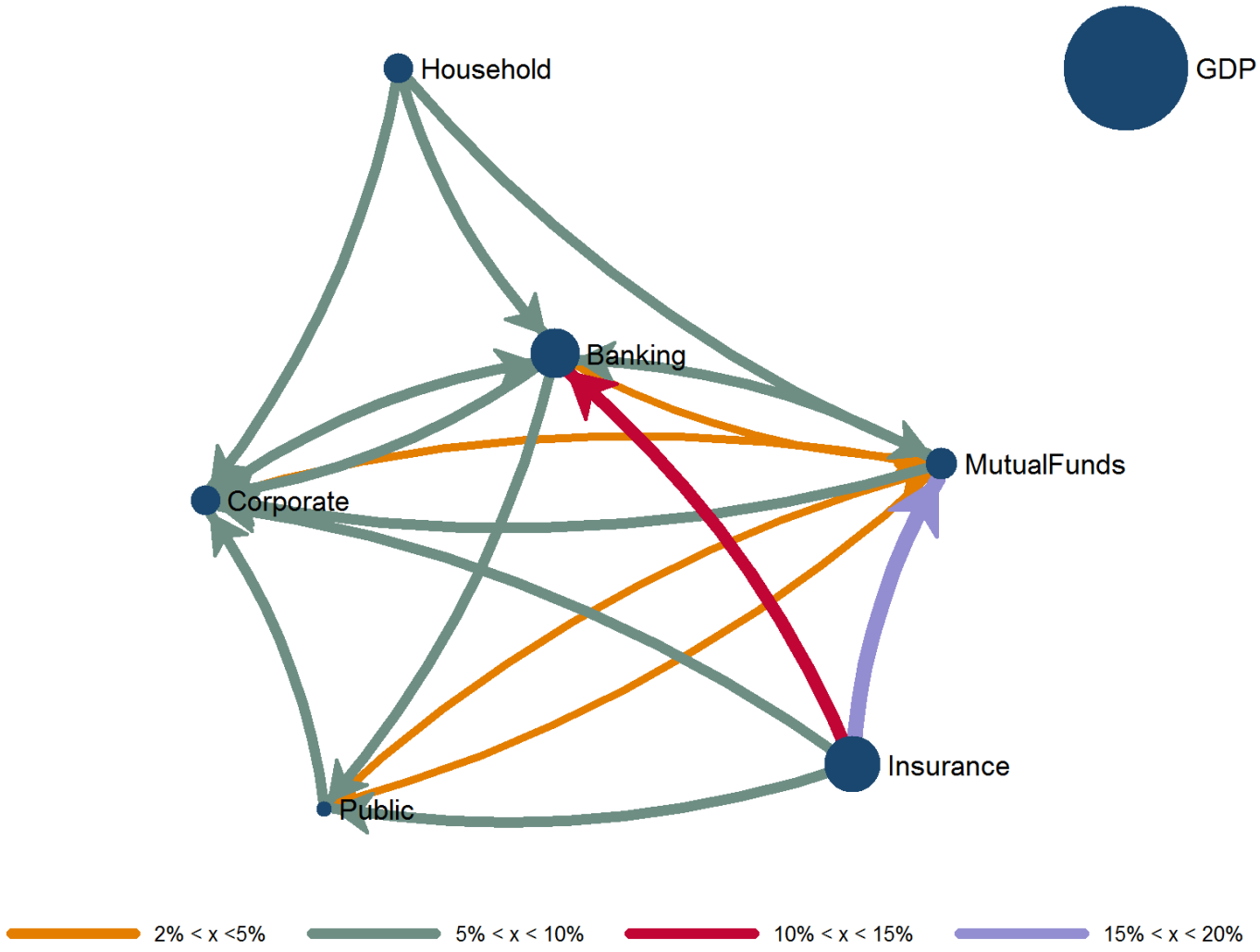
Table: **Contributions in % of GDP, <1% set to zero**

Financial Sector Breakdown: Domestic vs. Foreign

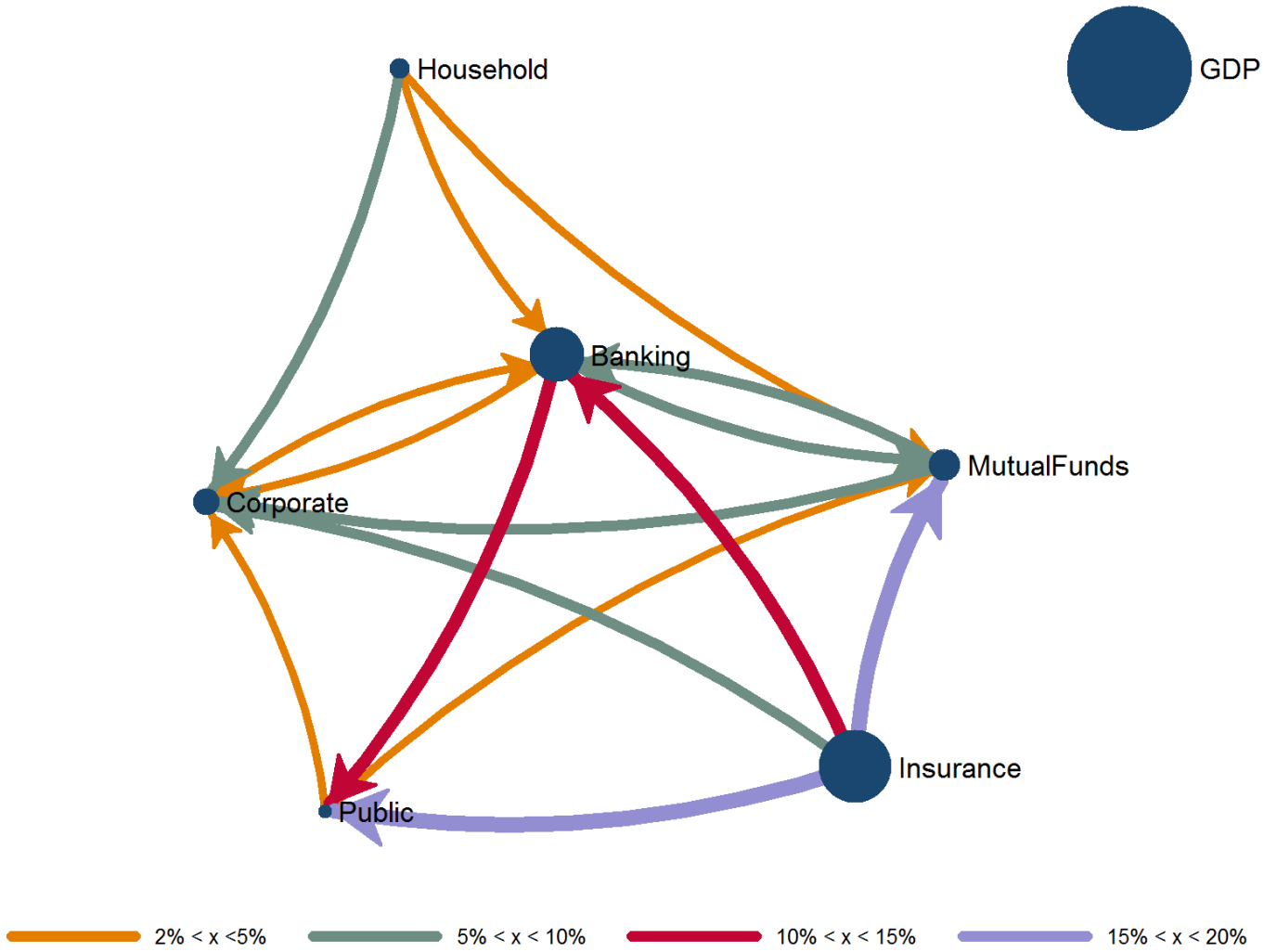
	2008.1			2014.1		
Sector	**A**	**L**	**Net**	**A**	**L**	**Net**
Panel A: Domestic						
Banking sector	38.8%	56.1%	-17.3%	43.2%	49.2%	-5.9 %
Mutual funds	24.3 %	39.4 %	-15.1 %	24.4 %	42.2 %	-17.8 %
Insurance sector	44.9%	2.6%	42.3%	58.1%	0.73%	57.4%
Panel B: Foreign						
Banking sector	41.1 %	25.5 %	15.6 %	31.9%	31.4%	0.5%
Mutual funds	26.8 %	5.0%	21.8%	28.4%	9.6%	18.8%
Insurance sector	26.8 %	1.9 %	24.9 %	33.1 %	0.6%	32.5 %
Panel C: Consolidated						
Banking sector	79.96%	81.61%	-1.64%	75.1%	80.5%	-5.4%
Mutual funds	51.1%	44.4%	6.7%	52.8%	51.8 %	1.0%
Insurance sector	71.77%	4.50%	67.27%	91.2%	1.3%	89.9%

Table: **in % of GDP**

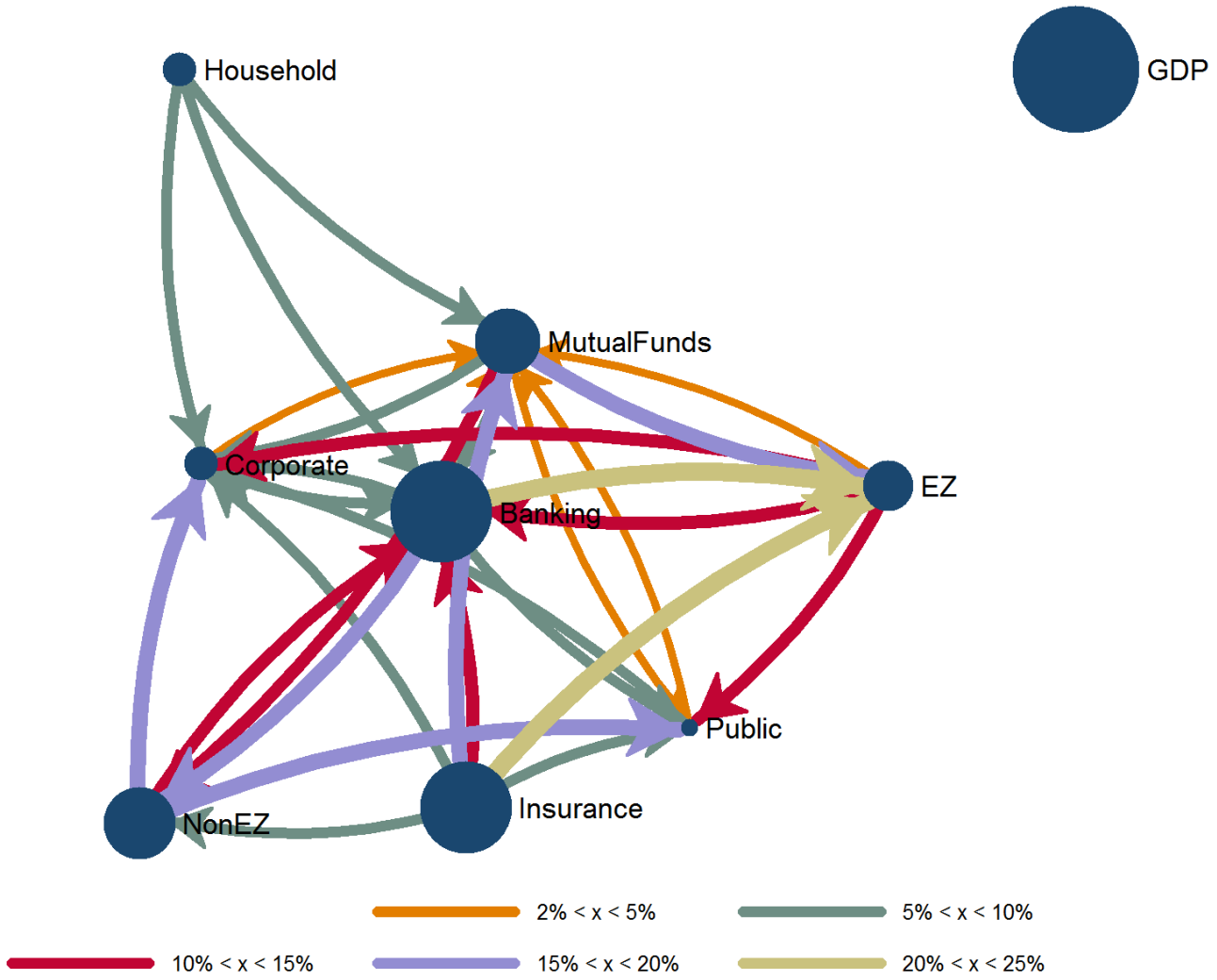
Domestic Sectoral Network - 2008.1



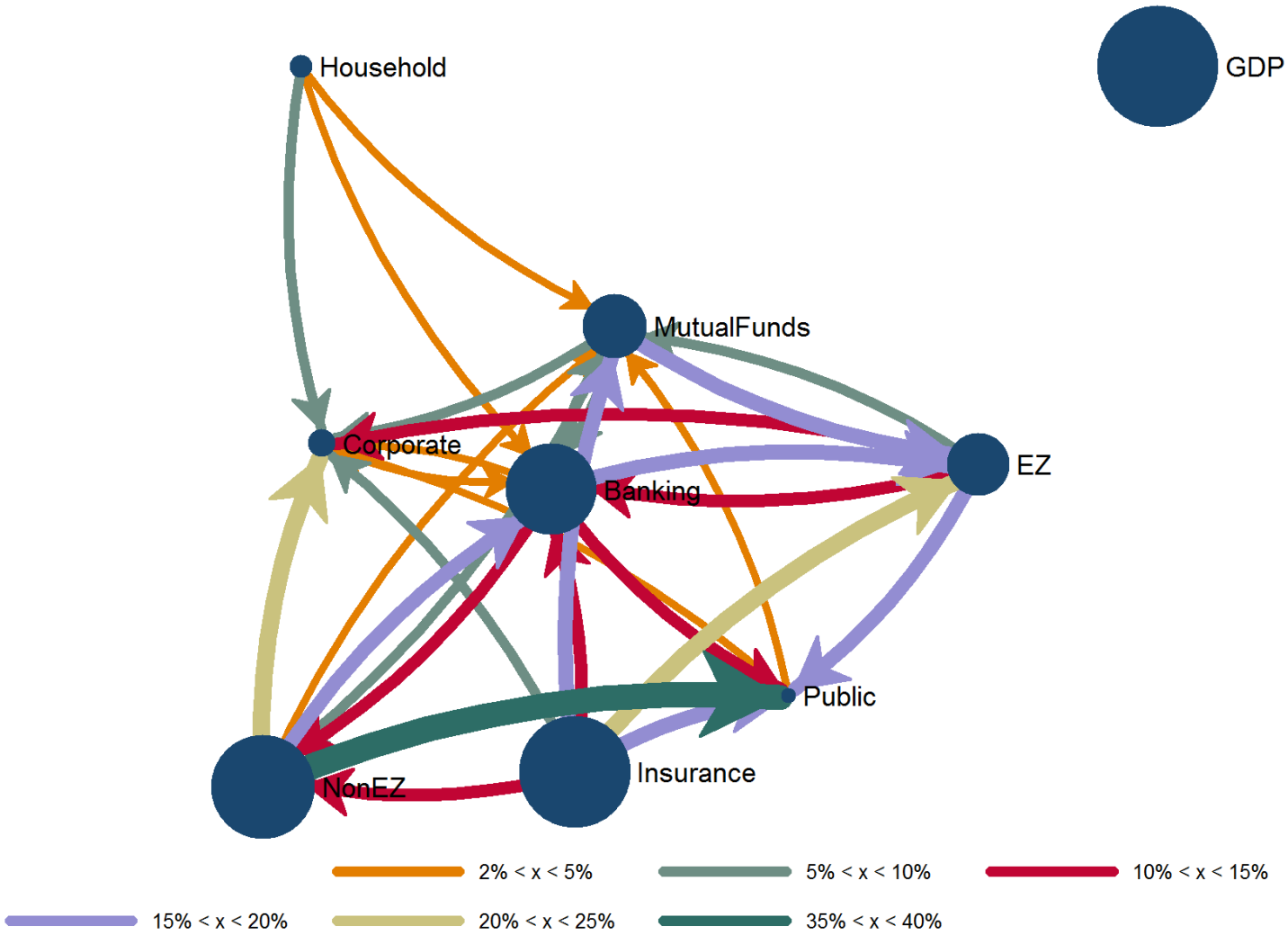
Domestic Sectoral Network - 2014.1



International Sectoral Network - 2008.1



International Sectoral Network - 2014.1



Contagion model - Specification

$$\gamma_{j,t} = \beta_{j,0} + \beta_{j,1}\left(\sum_{j'=1}^{J}\omega_{j,j',t}\gamma_{j',t} + \omega^{x}_{j,t}x_t\right) + \epsilon_{j,t}, \quad \text{for } j = 1, ..., J$$

$$\text{where } \mathbb{E}\left[\epsilon_{j,t}\right] = 0 \text{ for } j = 1, ..., J$$

$$\mathbb{C}ov\left[\epsilon_{j,t}, \epsilon_{j',t}\right] = \Sigma_{\epsilon} = diag\left[\sigma_1, \sigma_2, ..., \sigma_J\right]$$

- $\gamma_{j,t}$ denotes the return on assets emitted by sector j
- $x_{i,t}$ is the return on foreign assets
- $\omega_{j,j',t}$ is the portfolio-share on assets emitted by sector j'
- $\omega^{x}_{j,i,t}$ is the portfolio-share on outside assets
- $\epsilon_{j,t}$ is a sector j specific shock to the return
- $\beta_{j,1}$ is the balance-sheet contagion coefficient of sector j

Contagion model - Two Step GMM Estimation

First order and second-order moments:

$$\mathbb{E}\left[\left(I - \beta_1 \omega_t\right)\gamma_t - \beta_1 \omega_t^x x_t\right] - \beta_0 = 0$$

$$\mathbb{E}\left[\left(\left(I - \beta_1 \omega_t\right)\gamma_t - \beta_1 \omega_t^x x_t - \beta_0\right)\left(\left(I - \beta_1 \omega_t\right)\gamma_t - \beta_1 \omega_t^x x_t - \beta_0\right)'\right] - \Sigma_\epsilon = 0$$

Contagion model - Estimates

	$\hat{\beta}_0$	$\hat{\beta}_1$	$\hat{\sigma}_\epsilon$
Banking sector	0.003**	3.195***	0.008***
	(.00)	(.96)	(.00)
Insurance sector	-0.003	4.879***	0.026*
	(.01)	(.94)	(.00)
Mutual funds	-0.000	1.818***	0.007***
	(.00)	(.06)	(.00)
Corporate sector	-0.005	-0.261	0.068
	(.02)	(139.71)	(.07)
Public sector	0.006*	-0.371	0.012***
	(.00)	(.32)	(.00)

Significance: "***" at 1%; "**" at 5%; "*" at 10%

Table: **Two-Step GMM estimates of model parameters**

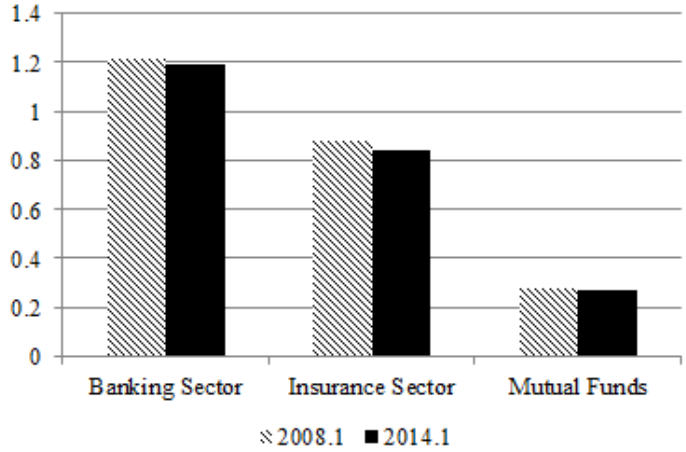
Contagion model - Sectoral vulnerability

To determine how shocks propagate through the network, we look at the reduced form (in particular the Leontief inverse)

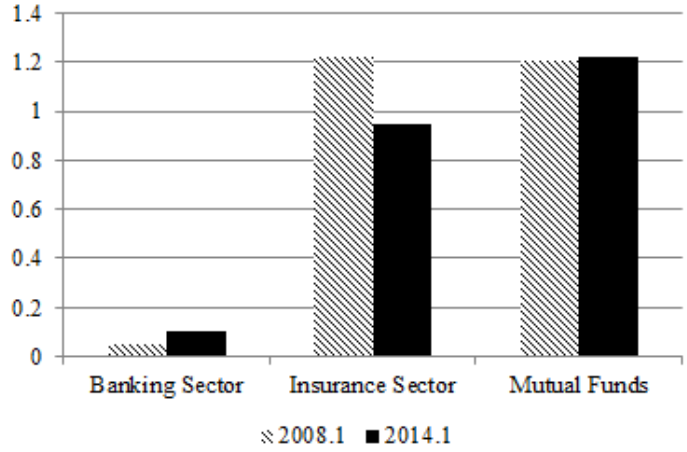
$$\gamma_t = [I - \beta_1 \omega_t]^{-1}(\beta_0 + \beta_1 \omega_t^x x_t + \epsilon_t)$$

The **diffusion of shock** varies over time, since bilateral exposures $\left(\omega_{j,j',t}\right)$ change.

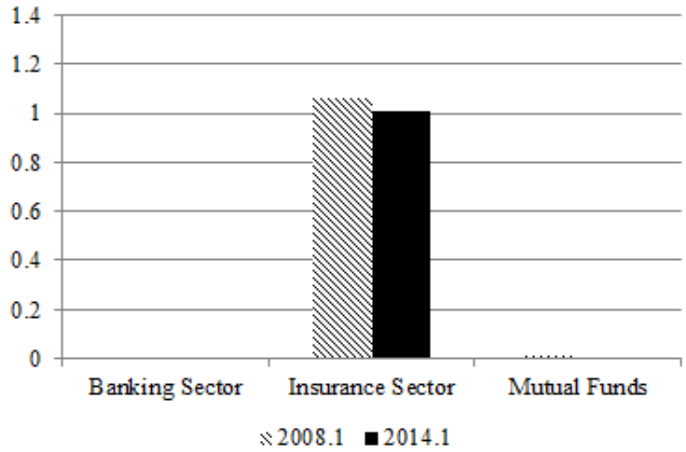
Contagion model - Sectoral vulnerabilities (2008.1 vs 2014.1) - Financial sector shocks



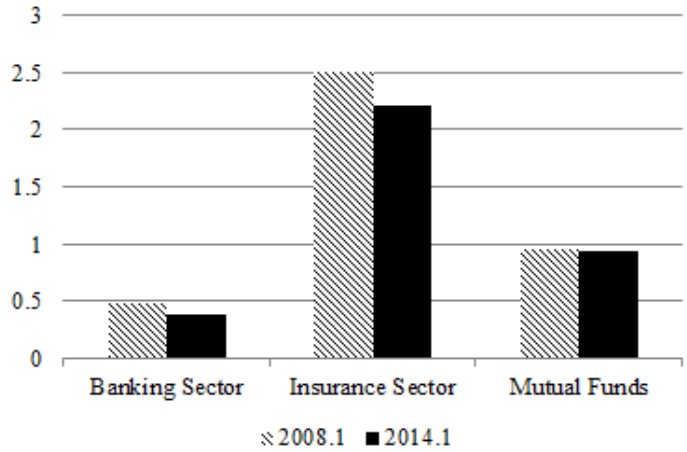
(a) Banking shock



(b) Mutual fund shock

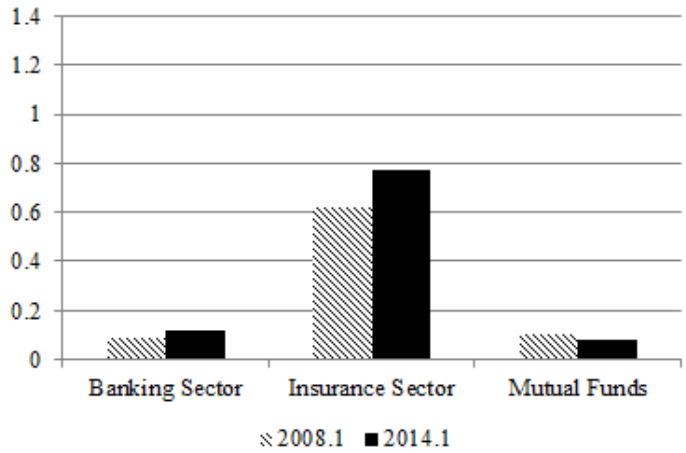


(c) Insurance shock

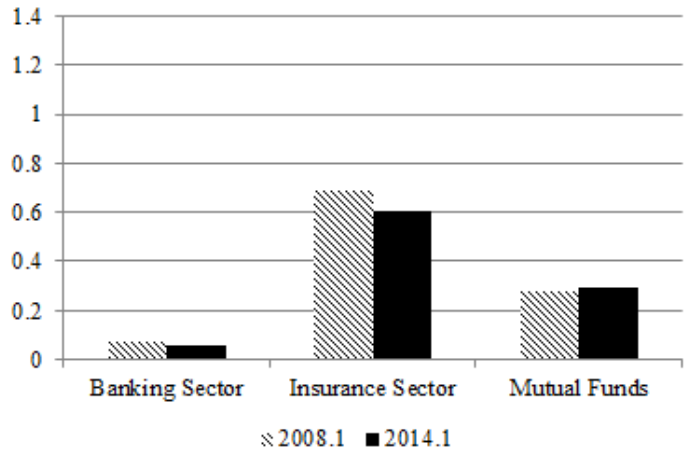


(d) Foreign shock

Contagion model - Sectoral vulnerabilities (2008.1 vs 2014.1) - Real sector shocks



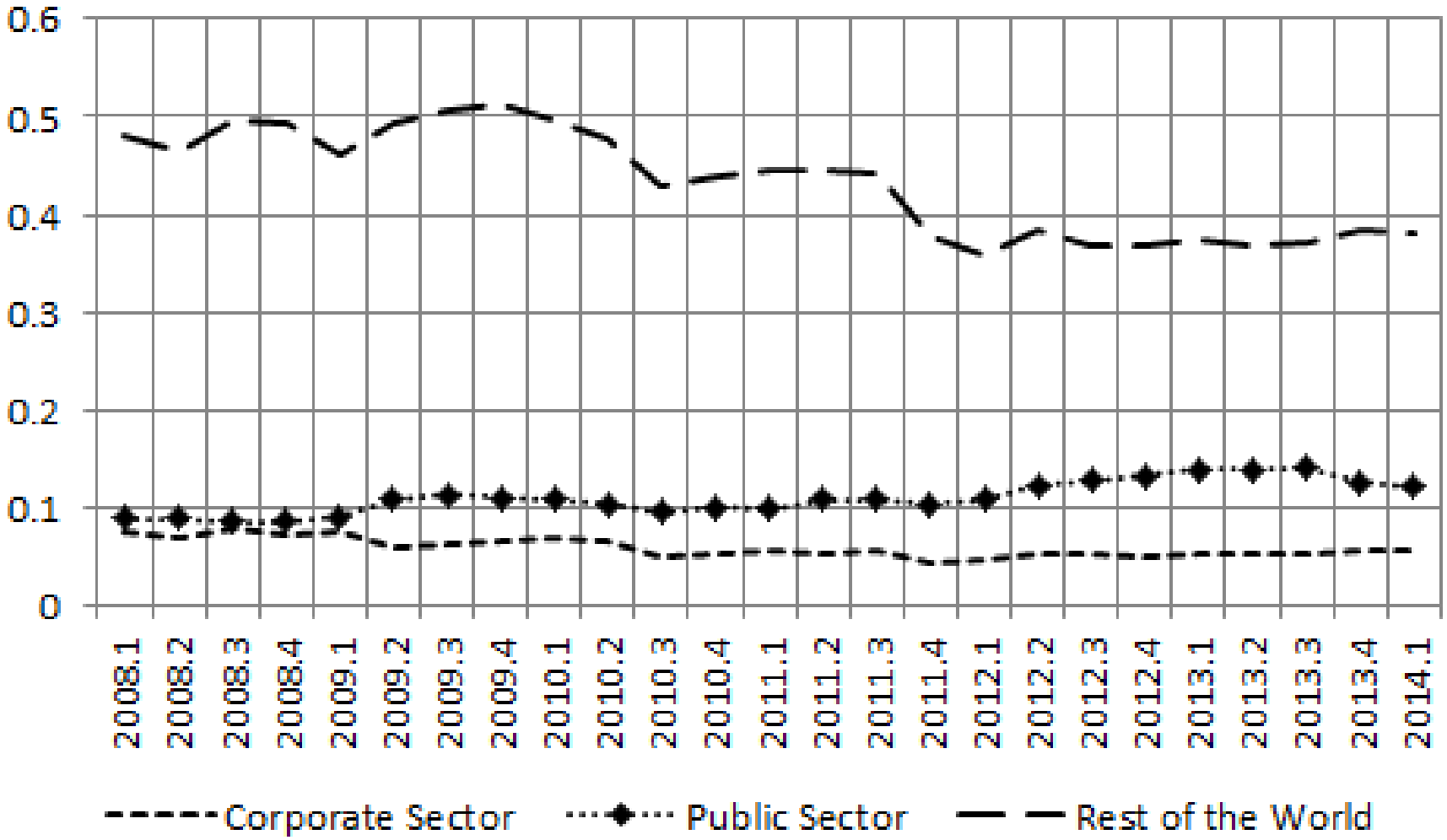
(e) Public shock



(f) Corporate shock

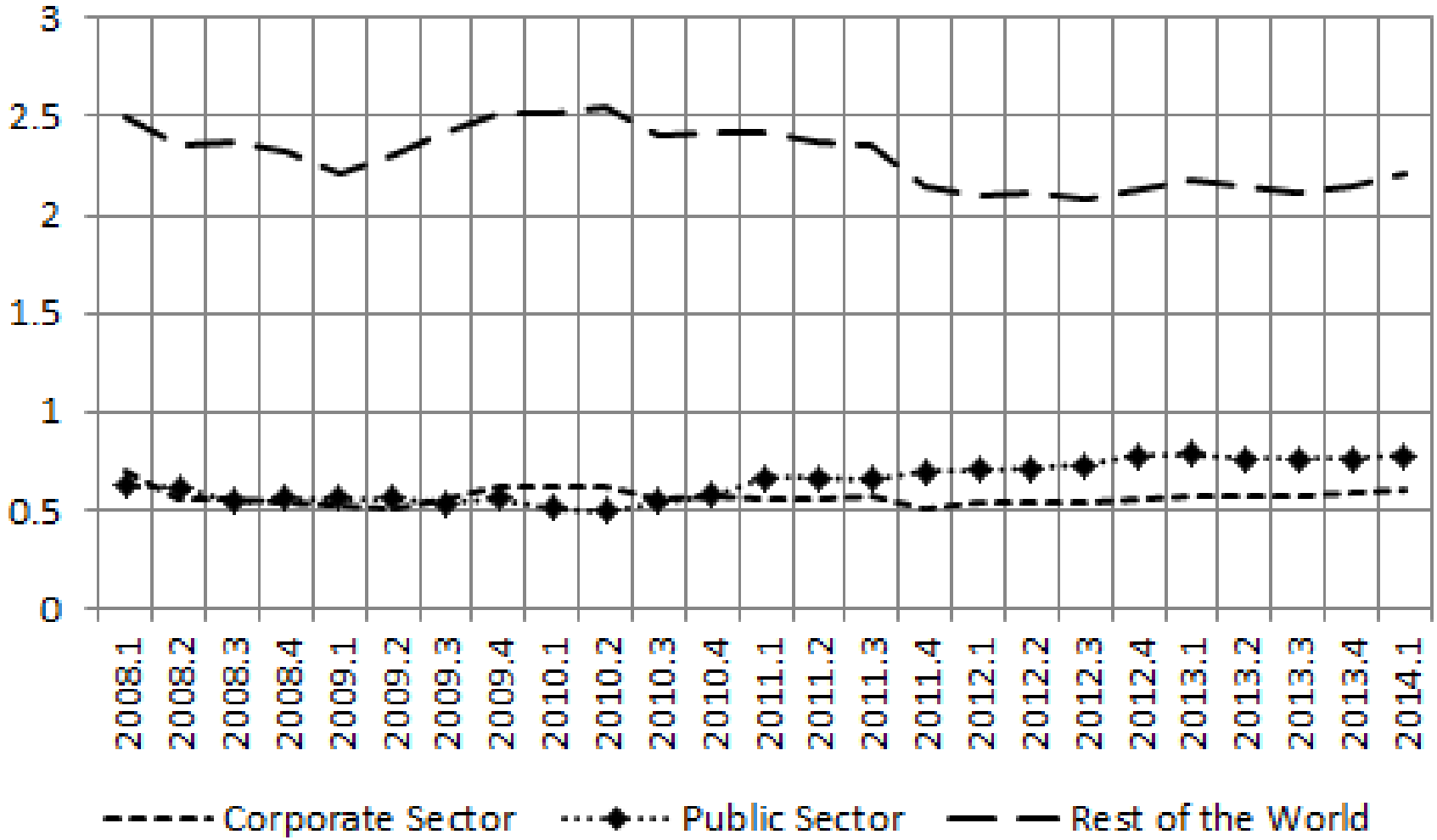
Contagion model - Sectoral vulnerabilities (Time series)

Banking sector



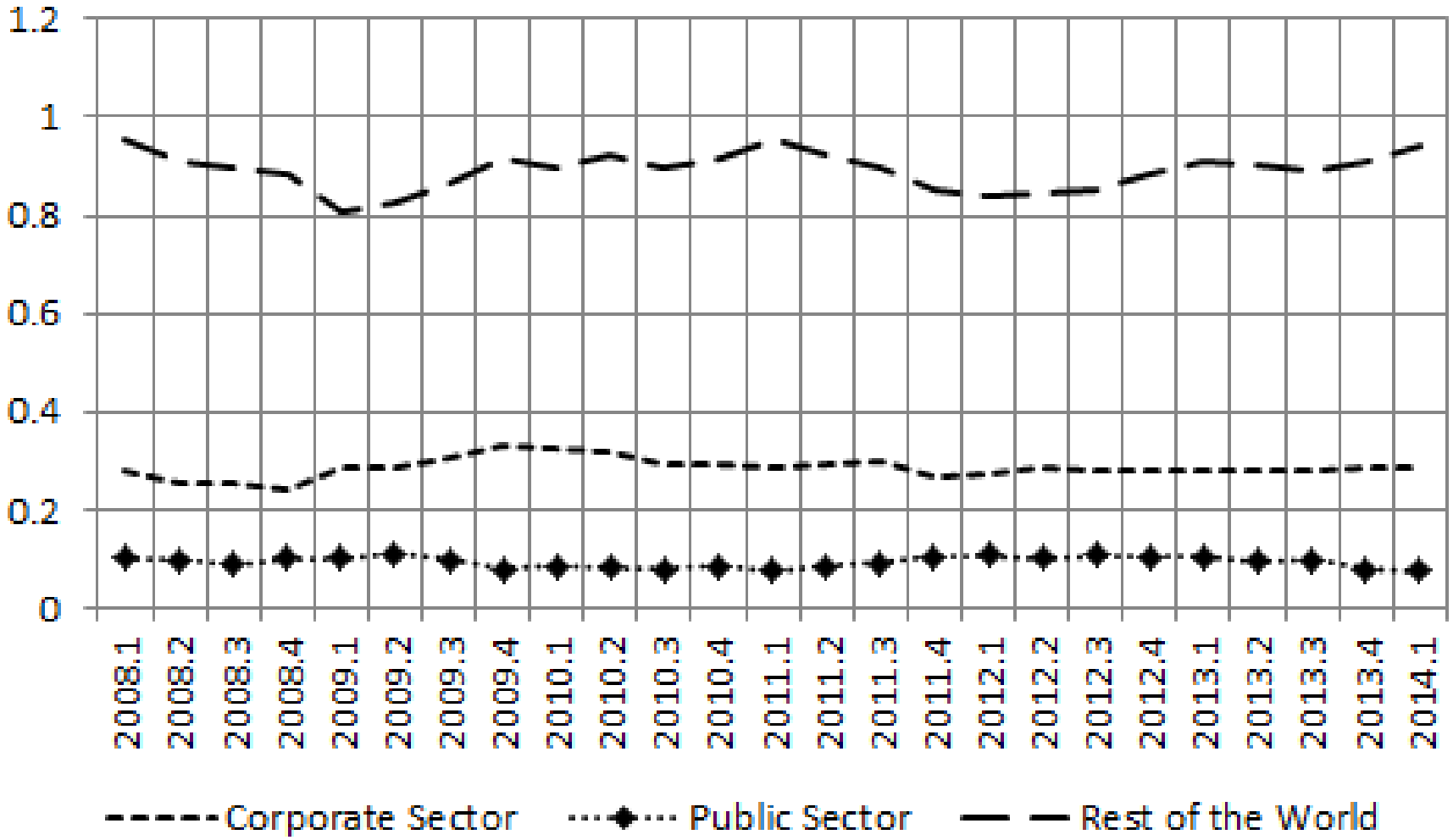
Contagion model - Sectoral vulnerabilities (Time series)

Insurance sector



Contagion model - Sectoral vulnerabilities (Time series)

Mutual funds



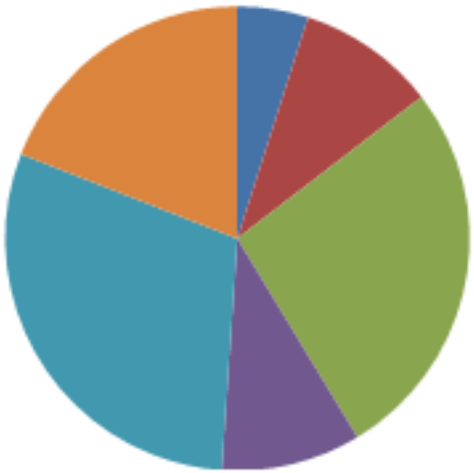
Conclusion

1. We have shown how sectoral portfolios explain the sharpe deterioration of the Net External Portfolio Position of France from 2008 to 2014.
2. The balance-sheet contagion model proposes a flexible way how to quantify balance-sheet contagion at the sector-level.
3. Future research: extent the contagion model to include sector-specific leverage targets in the financial sectors.

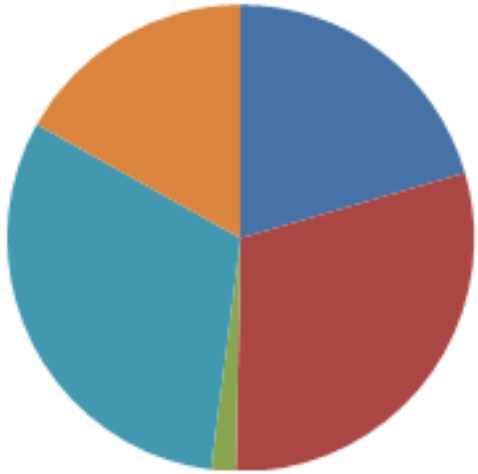
Extra slides

Sectoral Portfolios: the big picture (domestic + foreign)

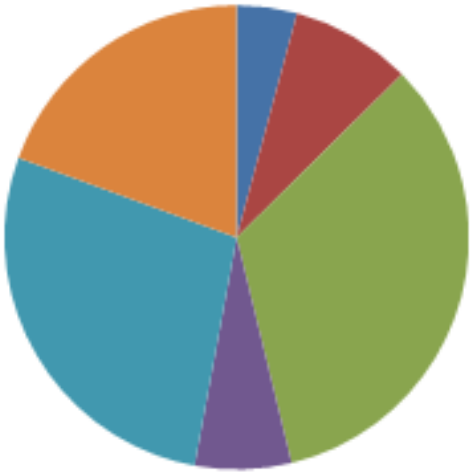
A: 2008.1 - 267.4% GDP



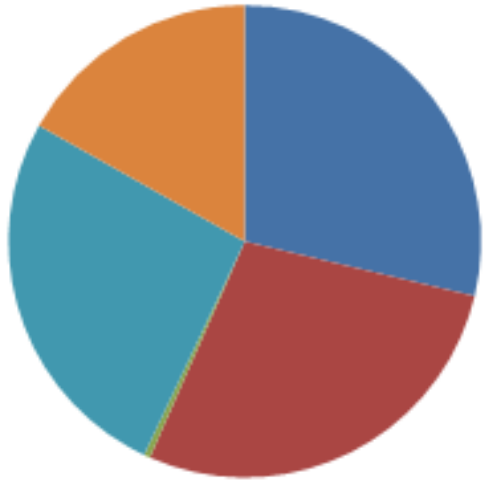
L: 2008.1 - 262.7% GDO



A: 2014.1 - 272.1% GDP

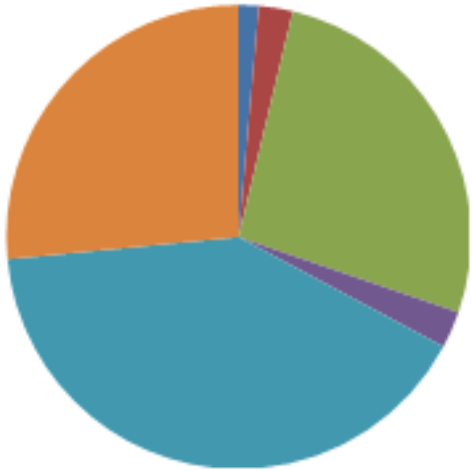


L: 2014.1 - 307.8% GDP



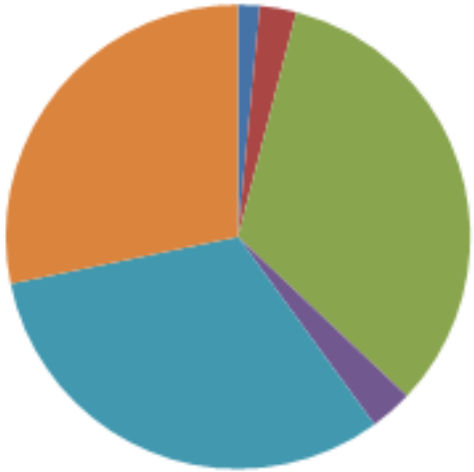
Extra slides
Sectoral Portfolios: the big picture (foreign only)

A: 2008.1 - 100.3% GDP



L: 2008.1 - 95.6% GDO

A: 2014.1 - 101.3% GDP



L: 2014.1 - 137.0% GDP