BIG NOTE, SMALL NOTE: CENTRAL BANK DIGITAL CURRENCY AND CASH

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June 2018

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Overview

• Review what we do (and do not) know about the evolution of demand for banknotes
  • By denomination group
  • For US as well as a group of about 15 other countries
  • For US: also review [estimated] domestic demand separately from foreign demand

• Then hazard some guesses about how demand for banknotes might be altered by the existence of a CBDC
  • Generally seems as though it would not be appealing
  • But we know very little about how and why banknotes are held and used
U.S. Currency Demand: A Long View (Figure 1)

- Figure 1 shows currency in circulation scaled by GDP, by denomination group

- Features that stand out
  - General trend down from 1960 through mid-1980s (and also 2000-2008)
  - Upswing driven by large denominations ($50s and $100s), with smaller denominations ($1s - $20s) trending down

- Much of the upswing since the mid-1980s likely the result of foreign demand
  - Demand episodes coincide with crisis: 1990s and post-2008
Figure 1: US Currency to Nominal GDP Ratios, 1960-2017
Recent developments: The September 2008 turning point

• The strong growth of currency demand in the 1990s ended in the early 2000s
  o Many transitioning economies began to stabilize
  o Cash euro introduced—substitution away from dollar?

• But resurgence of demand in September 2008—concentrated in large denominations

• Red lines in panels of Figure 2 are 2008
  o Note sharp turning point in September
  o And also lack of change for smaller denominations
Figure 2: Annual Cumulative Increases in U.S. Currency in Circulation

- **All Denominations**
- **$100s**
- **$20s**
- **$10s and smaller**
U.S.: Foreign and domestic demand

• As discussed in my and others’ work, external demand for U.S. banknotes is an important—possibly dominant factor---for the U.S.
  - Figure 3 shows a breakdown that separates foreign and domestic demand
  - Assume that most foreign demand is in large denominations

• Indeed, foreign demand (gray bars) has been rising

• And domestic demand is flat or falling for all denomination groups
Figure 3: U.S. Currency in Circulation with Estimated Domestic Components

Source. U.S. Treasury and Department of Commerce.
Growth rates

• Figure 4 shows the same data as earlier, but in growth rate terms relative to nominal GDP
  o Overall demand trending down until the 1980s
  o Domestic demand for large denominations negative except for 2008
  o Demand for $20s and smaller denominations (mostly $20s, not shown) was negative through 2007 but has been very slightly positive since 2009
Figure 4: Growth of currency/GDP by denomination group

Average Annual Growth in Currency in Circulation / GDP by Denomination

A. Total

B. $50s and $100s: Total

C. $50s and $100s: Est. domestic

D. $20s and smaller

Source: U.S. Treasury and Department of Commerce and author’s estimates.
Regressions: Does currency behave like other monetary aggregates?

- Table 1 shows some very simple regressions
  - Standard set of dependent variables: trend (qqnum), change in short-term interest rate, GDP growth
  - And also a proxy for foreign demand: shipments

- Notable results
  - For large denominations and total, only trend and shipments are strongly and consistently significant
  - For smaller denominations, nothing significant

- Conclusion: other factors matter for currency
Table 1: Currency demand regressions by denomination group

OLS Currency model by denom, 1988-2017. Shipment variable is netshipadj. Dep var is dlcurr.  

<table>
<thead>
<tr>
<th>Denomination Group</th>
<th>Curr comp</th>
<th>All</th>
<th>100</th>
<th>Big</th>
<th>20</th>
<th>Sml20</th>
<th>Sml</th>
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<tbody>
<tr>
<td>qqnum</td>
<td>-0.830*</td>
<td>-0.990*</td>
<td>-2.129*</td>
<td>-1.840*</td>
<td>-0.055</td>
<td>-0.018</td>
<td>-0.006</td>
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<td>(-3.4)</td>
<td>(-2.6)</td>
<td>(-5.9)</td>
<td>(-5.2)</td>
<td>(-0.1)</td>
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<td>D.(mean) rtbe</td>
<td>0.184</td>
<td>0.274</td>
<td>0.253</td>
<td>0.255</td>
<td>0.298</td>
<td>0.260</td>
<td>0.132</td>
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<tr>
<td></td>
<td>(1.5)</td>
<td>(1.5)</td>
<td>(1.5)</td>
<td>(1.5)</td>
<td>(0.9)</td>
<td>(0.9)</td>
<td>(0.7)</td>
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<tr>
<td>dlgdp</td>
<td>-0.128</td>
<td>-0.296*</td>
<td>-0.272*</td>
<td>-0.284*</td>
<td>-0.345</td>
<td>-0.278</td>
<td>-0.050</td>
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<td></td>
<td>(-1.4)</td>
<td>(-2.1)</td>
<td>(-2.1)</td>
<td>(-2.2)</td>
<td>(-1.4)</td>
<td>(-1.3)</td>
<td>(-0.4)</td>
</tr>
<tr>
<td>ship</td>
<td>66.398*</td>
<td>61.511*</td>
<td>86.943*</td>
<td>77.128*</td>
<td>19.687</td>
<td>17.976</td>
<td>12.130</td>
</tr>
<tr>
<td></td>
<td>(10.8)</td>
<td>(6.5)</td>
<td>(9.7)</td>
<td>(8.7)</td>
<td>(1.2)</td>
<td>(1.2)</td>
<td>(1.3)</td>
</tr>
<tr>
<td>Constant</td>
<td>5.332*</td>
<td>6.383*</td>
<td>12.348*</td>
<td>10.844*</td>
<td>1.378</td>
<td>1.062</td>
<td>0.575</td>
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<tr>
<td></td>
<td>(4.0)</td>
<td>(3.1)</td>
<td>(6.4)</td>
<td>(5.6)</td>
<td>(0.4)</td>
<td>(0.3)</td>
<td>(0.3)</td>
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<td>120</td>
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<tr>
<td>$R^2$</td>
<td>0.58</td>
<td>0.37</td>
<td>0.58</td>
<td>0.53</td>
<td>0.05</td>
<td>0.04</td>
<td>0.02</td>
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<tr>
<td>Adjusted $R^2$</td>
<td>0.56</td>
<td>0.35</td>
<td>0.57</td>
<td>0.51</td>
<td>0.01</td>
<td>0.01</td>
<td>-0.01</td>
</tr>
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</table>

$t$ statistics in parentheses  
* $p < 0.10$, † $p < 0.05$
Broader view: currency demand in other countries

• Figure 5 shows currency demand since 2004 (shorter time series) scaled by GDP and grouped by denomination
  o US is last two panels—one for total and one for domestic
  o Here the y-axis scales vary for each country

• General patterns
  o Almost all countries seeing rising demand (India’s currency demand has now recovered after the 2016 reform)
  o In almost all countries, largest 2 denominations dominate
Figure 5: Currency in circulation by country and denomination group

CIC / GDP Total and by Denomination Group

Australia | Brazil | Canada | EuroArea | HongKong
---|---|---|---|---
India | Japan | Mexico | Russia | S_Africa
S_Arabia | S_Korea | Singapore | Sweden | Switzerland
Turkey | UK | USA | USA_Domestic

Source: BIS.
Currency across countries: more

• Notwithstanding the commonalities in growth and denominations, currency demand relative to GDP varies widely

• Figure 6 shows the same data as Figure 5, but with uniform y-axis
  o Very wide variation
  o As shown in Figure 7, no apparent correlation with income level

• Of note: The U.S. is NOT an outlier—currency holdings are high around the world!
Figure 6: Currency by country, single scale

Source: BIS.
Figure 7: Currency / GDP and per-capita GDP, 2016

Currency in circulation as a share of GDP and per-capita GDP, 2016

Source: BIS and author estimates.

June 2018
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CBDC and currency demand

• Assuming—as I do here—that a CBDC would exist alongside physical cash, who might opt for CBDC?
  o Depends on who is now using currency and why
  o External users: presumably would have no/limited access to CBDC
  o Large denominations
    ▪ U.S. consumer studies indicate considerably lower holdings than circulation data
    ▪ Greene et al find ~1 $100, but circulation data suggest ~$1,000
    ▪ We know very little about how/why large denominations are held and used in the U.S.
Large denominations

- Possible uses
  - Precautionary saving (fears about financial stability)
  - Privacy concerns: have always existed but might be increasing in recent years
  - Gray/black market

- We know very, very little about the relative weights of these factors
  - But: it seems unlikely that users driven by any of these three motives would find a CBDC appealing
Smaller denominations

• Demand is trending down, but slowly

• Demand in the US (and other countries) also seems high
  - For US: $20s in circulation are over $500/person
  - And $10s and smaller are about $140/person
  - Again, we know very, very little about how/why these quantities of cash are being held and used.

• Would a CBDC be appealing relative to other payments media that are replacing cash?
Tentative conclusions

• In considering a CBDC, countries face MANY design questions

• Focusing narrowly on the interaction of CBDC with cash, this review of cash demand suggests:
  
  o It seems unlikely that CBDC would be viewed as an appealing substitute for large denominations, which dominate in most countries

  o Currency holdings are generally surprisingly high relative to what consumer surveys find

  o We know far too little about the relative significance of factors driving currency demand