Estimating a country’s currency circulation within a monetary union

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Motivation

How many of us... carry cash when traveling abroad?

Over the last decade, cash in circulation increased in CPMI countries* (Bech et al., 2018)

Despite pressure for the fading out of cash, demand for USD is growing (Judson, 2017)

79% of the number of payments in the euro area are settled in cash (Esselink & Hernández, 2017)

Cash is (still) king!

Stock of cash in circulation is an important input for central banks!

* The 24 CPMI jurisdictions are: AU, BE, BR, CA, CN, EA, FR, DE, HK, IN, IT, JP, KR, MX, NL, RU, SA, SG, ZA, SE, CH, TR, GB and US.
Objective

Address the issue of the compilation of the stock of cash in circulation

• Raise awareness to the complexity introduced by the participation in a monetary union and by the international relevance of the currency

• Discuss possible methods to consider such complexity in the techniques used to estimate currency in circulation

• Promote the debate within the central banking community on this issue
Methodology

Case-study: Cash in circulation in euro area countries (fixed 2002 composition)

- All information used is publicly accessible
- Cash in circulation is considered net of coins, due to their low quantitative relevance
- Estimation period: 2002 to 2017
- 3 different methods tested:
  - Extrapolation of legacy currencies
  - Allocating a proportion of the circulation estimated for the euro area
  - Exploring a structural money demand model
Method 1 - Extrapolation of legacy currencies

Application of auto.ARIMA to legacy cash in circulation and forecast for euro era

- Imposed relatively long time-series (> 5 years, monthly) and overfit restrictions
- Data available only for 5 countries: France, Italy, Spain, Greece and Portugal
Method 2 - Allocating a proportion of the circulation estimated for the euro area

Based on ECB (2017a)'s estimate for cash in circulation outside the euro area

- Estimate of cash in circulation in euro area is obtained by difference
- 2 allocation keys considered: GDP share & contribution to M3 share
Method 2 - Allocating a proportion of the circulation estimated for the euro area
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Method 3 - Exploring a structural money demand model

Estimate structural money demand for EU countries outside the euro area and apply structural parameters for euro area countries

- Technique similar to proposal in Bartzsch et al. (2011b, section 2.2.4)
- Assume negligible foreign demand for non-euro EU currencies
- Include proxies for price level, transactions level and opportunity cost of holding cash

Reference countries $X$

$$\hat{c}_t^X = \hat{\beta}_0 + \hat{\beta}_1 P_t^X + \hat{\beta}_2 Y_t^X + \hat{\beta}_3 i_t^X$$

(1)

Euro area country $Z$

$$\hat{c}_t^Z = \hat{\beta}_0 + \hat{\beta}_1 P_t^Z + \hat{\beta}_2 Y_t^Z + \hat{\beta}_3 i_t^Z$$

(2)
Method 3 - Exploring a structural money demand model

Pairs of non-euro & euro countries were determined according to Ward’s (1963) and MacQueen’s (1967) clustering methods

- Clustering based on dataset with proxies for transaction level, wealth, dimension, importance of tourism, hoarding motive, importance of cashless payments
- Non-euro countries in each cluster with best econometric performance were selected as reference
Method 3 - Exploring a structural money demand model
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![Combined countries](chart.png)

- **Legend**
  - Combined estimates
  - Combined reported circulation

- **Y-axis** (10^9 EUR)
- **X-axis** (Date: 2003 to 2017)
## Conclusions

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<thead>
<tr>
<th>Method</th>
<th>Merits</th>
<th>Limitations</th>
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<tbody>
<tr>
<td>Extrapolation of legacy currencies</td>
<td>Technically easy to implement</td>
<td>Assumes legacy time series structure holds in monetary union era</td>
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<td>Allocating a proportion of the circulation estimated for the euro area</td>
<td>Enables the harmonization of the compilation of cash in circulation in the monetary union’s countries</td>
<td>Assumes no differences between countries in the preference for cash</td>
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<td>Exploring a structural money demand model</td>
<td>Proxies nearly all motives to hold cash and tracks their short &amp; long run effects</td>
<td>Depends on structural resemblance between paired countries</td>
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- Cash still holds an instrumental role in the way we pay and ‘save’
- Strong international role of currency & participation in a monetary union complexify the compilation of cash in circulation
There are no optimal answers to this issue... further research & discussion are very much welcome!

Thank you!

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