

Technological Innovation and the Cashless Economy

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Why do policymakers want cash to disappear?

- Anonymity of cash transactions is a (net) social cost for society.
(privacy concerns vs illegal activities)
- As a way to increase tax revenues.
(efficiency vs revenue maximizing)
- Inability to substantially decrease nominal interest rates below zero.
(current concern on Euro area, Japan, etc)

- Functions of cash:
 - Transactions
 - Think of money demand in both dimensions
 - "cash" vs "credit" (Lucas-Stokey) & cash management (Baumol-Tobin)
 - Store of value
 - Think why nominal rates can't be too negative (ZLB)
 - Unit of Account
 - Think sticky prices, inefficiency, and power of monetary policy.
- Interactions between functions

- Logic for cost of inflation (money demand based)
(sate with money, avoid "cost of accessing cash")
- Recent analysis of ZLB w/money demand (Ronglie)
(balance both effects)
- Eliminating cash completely:
 - must argue that social net cost outweigh "consumer welfare".
 - limits and commitment to inflation tax

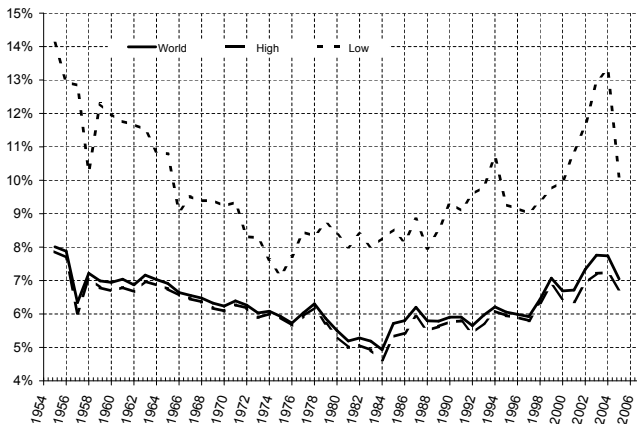
Normative vs Positive



- Cash = bills and coins in circulation.
- We have argued that cash is NOT disappearing globally.
- If anything the world economy is becoming more cash intensive.
(complement to argument of share of large denomination bills -Rogoff)
- Technology has worked (slowly) to decrease use of cash on transactions.
- Conjecture that cash is resilient mostly as store of value.
- Conclude that this is mostly a problem relative to ZLB issues.

Cash GDP, U shape (long view), JME, Lippi 2009

Figure 1: Currency over GDP: world averages 1954 - 2006



Notes: Averages are weighted by the share of a Country GDP in the group; whole sample = 98% of world GDP 1995. Source: IFS. Shares of world GDP: High Income 80.6%, Low Income 2.9%.

Cash/GDP

- Cash = bills and coins in circulation.
- Source: IFS, OECD, and countries CB's and statistical agencies.
- After 1999 (or when applicable) collapse Euro zone countries into one.
- Early on GDP is missing for many low income countries.
 - Simple averages of ratios Cash/GDP.
 - Aggregate Cash/GDP in common currency.
 - Balanced vs Unbalanced panel.

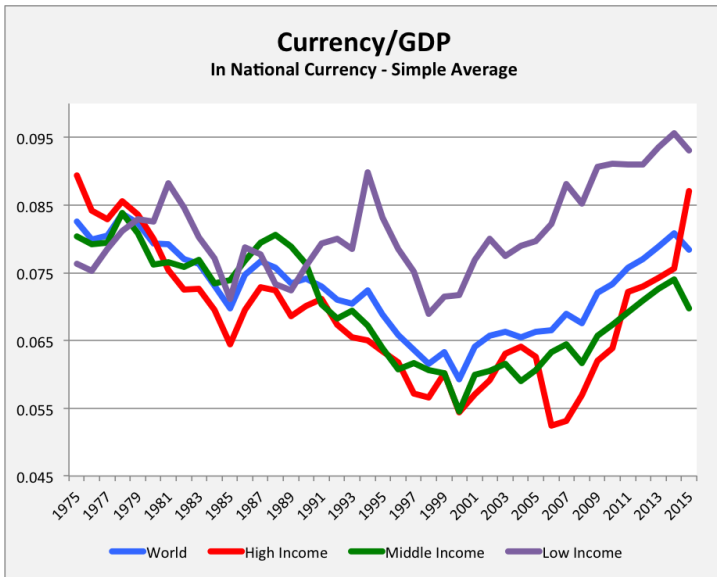
Cash abroad

- Cash/GDP high (or growing) in US because dollars are abroad.
(same for Deutsche Mark, Euro, or Swiss Franc)
- "Solution": World Cash/ World GDP.
- Cash and GDP converted to a common currency.
- Equivalently:

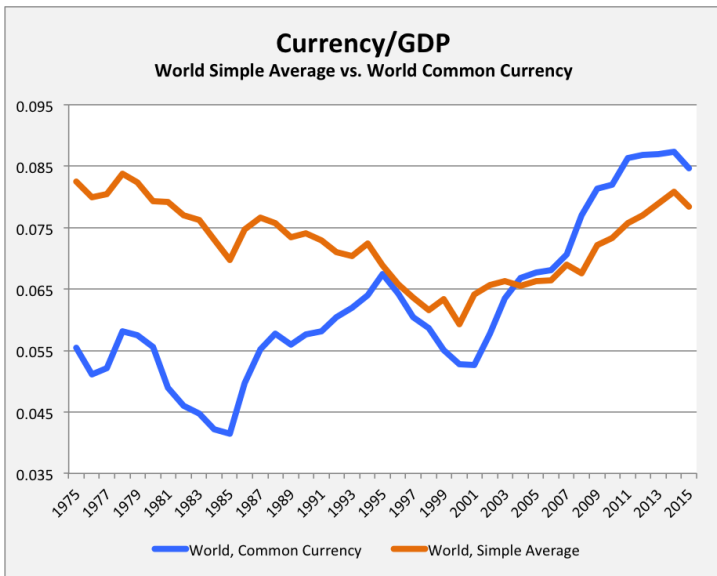
$$\frac{\text{World Cash}}{\text{World GDP}} = \text{average of } \frac{\text{Cash}}{\text{GDP}} \text{ across countries,}$$

weighted by country share of world GDP (in common currency.)

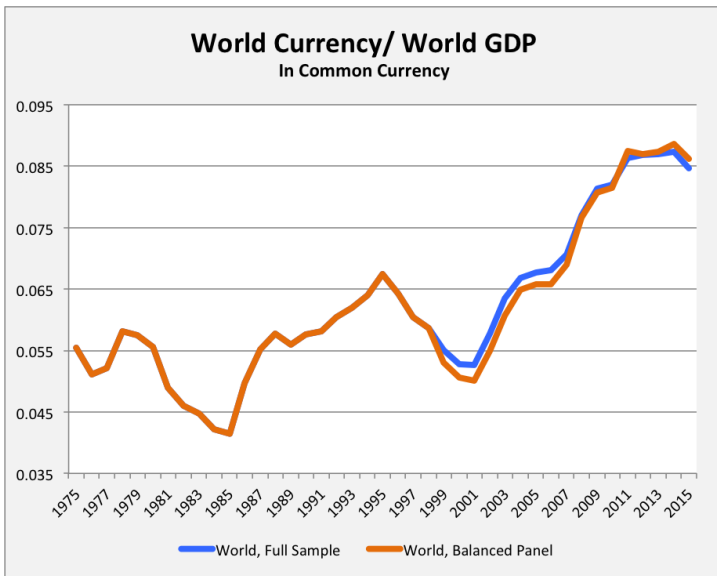
Common currency by group, all countries since 1975



World currency common currency, 1975

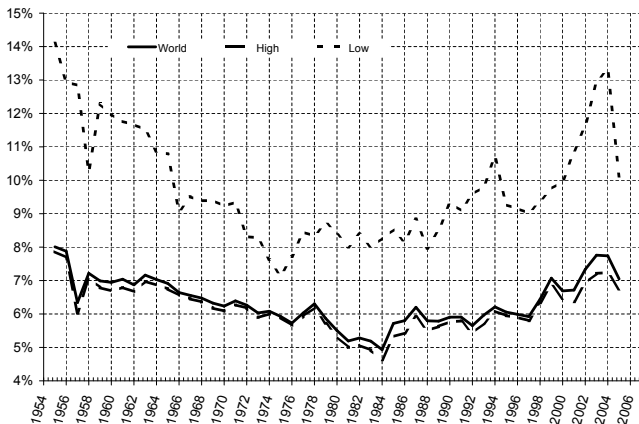


World currency common currency, 1975



Cash GDP, U shape (long view), JME, Lippi 2009

Figure 1: Currency over GDP: world averages 1954 - 2006



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Two 40-year-old technologies

- Credit (and charge) Cards (CC), birthdate ≈ 1960
 - Affects choice of means of payment.
 - Higher credit card ownership or acceptance, decreases need to carry cash.
 - Similarity with newer electronic means of payments.
- Automated Teller Machine (ATM), birthdate ≈ 1970
 - If cash is replenished often, decreases need to carry cash.
 - Higher density or lower cost of ATM access, decreases average cash balances.

Data on Household's use of cash for transactions

- Comprehensive data bases on Survey and Diary of transactions
- Survey ask about cash management (+ other info)
 - average cash balances
 - average withdrawal: size and frequency.
 - average cash at time of ATM withdrawal
 - average expenditure paid on cash
- Diary records number and value of purchases (+ other info)
 - record of each transaction: type of good/service, how was it paid
 - \$ value of each transaction
 - acceptance of means of payments at each transaction

TABLE I
HOUSEHOLDS' CURRENCY MANAGEMENT^a

| Variable | 1993 | 1995 | 1998 | 2000 | 2002 | 2004 |
|--|------|------|------|------|------|------|
| Expenditure share paid w/ currency ^b | | | | | | |
| w/o ATM | 0.68 | 0.67 | 0.63 | 0.66 | 0.65 | 0.63 |
| w. ATM | 0.62 | 0.59 | 0.56 | 0.55 | 0.52 | 0.47 |
| Currency ^c | | | | | | |
| <i>M/c</i> (c per day) | | | | | | |
| w/o ATM | 15 | 17 | 19 | 18 | 17 | 18 |
| w. ATM | 10 | 11 | 13 | 12 | 13 | 14 |
| <i>M</i> per household, in 2004 euros ^d | | | | | | |
| w/o ATM | 430 | 490 | 440 | 440 | 410 | 410 |
| w. ATM | 370 | 410 | 370 | 340 | 330 | 350 |
| Currency at withdrawals ^e $\frac{M}{M}$ | | | | | | |
| w/o ATM | 0.41 | 0.31 | 0.47 | 0.46 | 0.46 | na |
| w. ATM | 0.42 | 0.30 | 0.39 | 0.45 | 0.41 | na |
| Withdrawal ^f $\frac{W}{M}$ | | | | | | |
| w/o ATM | 2.3 | 1.7 | 1.9 | 2.0 | 2.0 | 1.9 |
| w. ATM | 1.5 | 1.2 | 1.3 | 1.4 | 1.3 | 1.4 |
| No. of withdrawals | | | | | | |
| <i>n</i> (per year) ^g | | | | | | |
| w/o ATM | 16 | 17 | 25 | 24 | 23 | 23 |
| w. ATM | 50 | 51 | 59 | 64 | 58 | 63 |
| Normalized: $\frac{n}{c/(2M)}$ (c per year) ^g | | | | | | |
| w/o ATM | 1.2 | 1.4 | 2.6 | 2.0 | 1.7 | 2.0 |
| w. ATM | 2.4 | 2.7 | 3.8 | 3.8 | 3.9 | 4.1 |
| No. of observations w ATM card ^h | 2322 | 2781 | 2998 | 3562 | 3729 | 3866 |
| No. of observations w/o ATM card ^h | 3421 | 3020 | 2103 | 2276 | 2275 | 2190 |

Table 1: Salient Results

| | AU | AT | CA | FR | DE | NL | US |
|--|-------------------|------|------|-------------------|-------|------|-------------------|
| Payment share by volume | | | | | | | |
| Cash | 0.65 | 0.82 | 0.53 | 0.56 | 0.82 | 0.52 | 0.46 |
| Debit | 0.22 | 0.14 | 0.25 | 0.31 | 0.13 | 0.41 | 0.26 |
| Credit | 0.09 | 0.02 | 0.19 | 0.01 | 0.02 | 0.01 | 0.19 |
| <i>Total</i> | 0.96 | 0.98 | 0.97 | 0.88 | 0.97 | 0.95 | 0.91 |
| <i>other most important payment instrument (share > 5%)</i> | . | . | . | 0.09 ^a | . | . | . |
| Payment share by value | | | | | | | |
| Cash | 0.32 | 0.65 | 0.23 | 0.15 | 0.53 | 0.34 | 0.23 |
| Debit | 0.32 | 0.25 | 0.30 | 0.43 | 0.28 | 0.60 | 0.27 |
| Credit | 0.18 | 0.05 | 0.41 | 0.03 | 0.07 | 0.04 | 0.28 |
| <i>Total</i> | 0.82 | 0.95 | 0.94 | 0.60 | 0.89 | 0.97 | 0.78 |
| <i>other most important payment instrument (share > 5%)</i> | 0.12 ^b | . | . | 0.30 ^a | . | . | 0.14 ^a |
| Ownership of payment cards | | | | | | | |
| Debit share | 0.93 | 0.85 | 0.97 | 0.83 | 0.94 | 0.99 | 0.76 |
| Credit share | 0.47 | 0.24 | 0.81 | 0.36 | 0.33 | 0.62 | 0.67 |
| Average transaction values | | | | | | | |
| Cash | 15.2 | 24.7 | 12.9 | 10.9 | 25.0 | 17.4 | 17.8 |
| Debit | 43.3 | 55.6 | 37.6 | 56.6 | 75.7 | 39.1 | 37.3 |
| Credit | 60.0 | 85.9 | 64.7 | 92.5 | 160.5 | 95.6 | 56.4 |
| Acceptance of alternatives to cash^c | | | | | | | |
| Share | . | 0.63 | 0.73 | . | 0.57 | . | . |
| Average cash balances in wallet | | | | | | | |
| mean | 59 | 148 | 64 | 70 | 123 | 51 | 74 |
| median | 32 | 114 | 38 | 30 | 94 | 28 | 37 |

Own research (with Francesco Lippi)

- Structural models, estimated out of micro-data
- Estimate cost of accessing to replenish cash and relative cost of different means of payments.
- Few structural parameters, non-parametric on heterogeneity.
- Identification: relies on observing multiple "aspects" of cash-management (cash balances, frequency .holdings at withdrawal, avg. withdrawal, etc).
- Etca 09' large panel of households from Italy.
spatial and time series closely tracks ATM/branch difussion.
- JME 13': (Austrian data) taking into account purchases size.
- JME forth.: interaction b/choice of means of payments & cash inventory.

- Bauomol-Tobin type model with random cost accessing cash.
- cost b , but p times a year, free.

SUMMARY OF ($p, b/c$) ESTIMATES ACROSS PROVINCE-YEAR-TYPE CELLS

| | Cash Expenditure ^a | | | |
|--|-------------------------------|------|------------------|------|
| | Household w/o ATM | | Household w. ATM | |
| | Low | High | Low | High |
| Parameter p (avg. no. of opportunities per year) | | | | |
| Mean ^b | 6.8 | 8.7 | 20 | 25 |
| Median ^b | 5.6 | 6.2 | 17 | 20 |
| 95th percentile ^b | 17 | 25 | 49 | 61 |
| 5th percentile ^b | 1.1 | 0.8 | 3 | 4 |
| Mean t -statistics ^b | 2.5 | 2.2 | 2.7 | 3.5 |
| Parameter b/c (in % of daily cash expenditure) | | | | |
| Mean ^b | 10.5 | 5.5 | 6.5 | 2.1 |
| Median ^b | 7.3 | 3.6 | 3.5 | 1.1 |
| 95th percentile ^b | 30 | 17 | 24 | 7 |
| 5th percentile ^b | 1.5 | 0.4 | 0.6 | 0.3 |
| Mean t -statistics ^b | 2.8 | 2.5 | 2.4 | 3.3 |

Own research (with R. Townsend)

- Use detailed Thai village data on cash use
- Detailed long monthly panel data on consumption expenditures, income receipts, bank transactions.
- Payments in cash and in kind (no use credit or debit card).
- Cash holdings much larger than can be accounted for transaction patterns.
- Use cash as a store of value.

Conclusions

- World (or even typical) country is not becoming cashless.
- Hard (to impossible) to account for cash holding as role on transaction.
- Evidence of technological innovation in cash management & means of payments.
- Low frequency (slow) changes in use of cash in transactions.