Whither Small Change? The Diminishing Demand for Small-Denomination Currency

Gene Amromin
Sujit Chakravorti
Federal Reserve Bank of Chicago

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Motivation

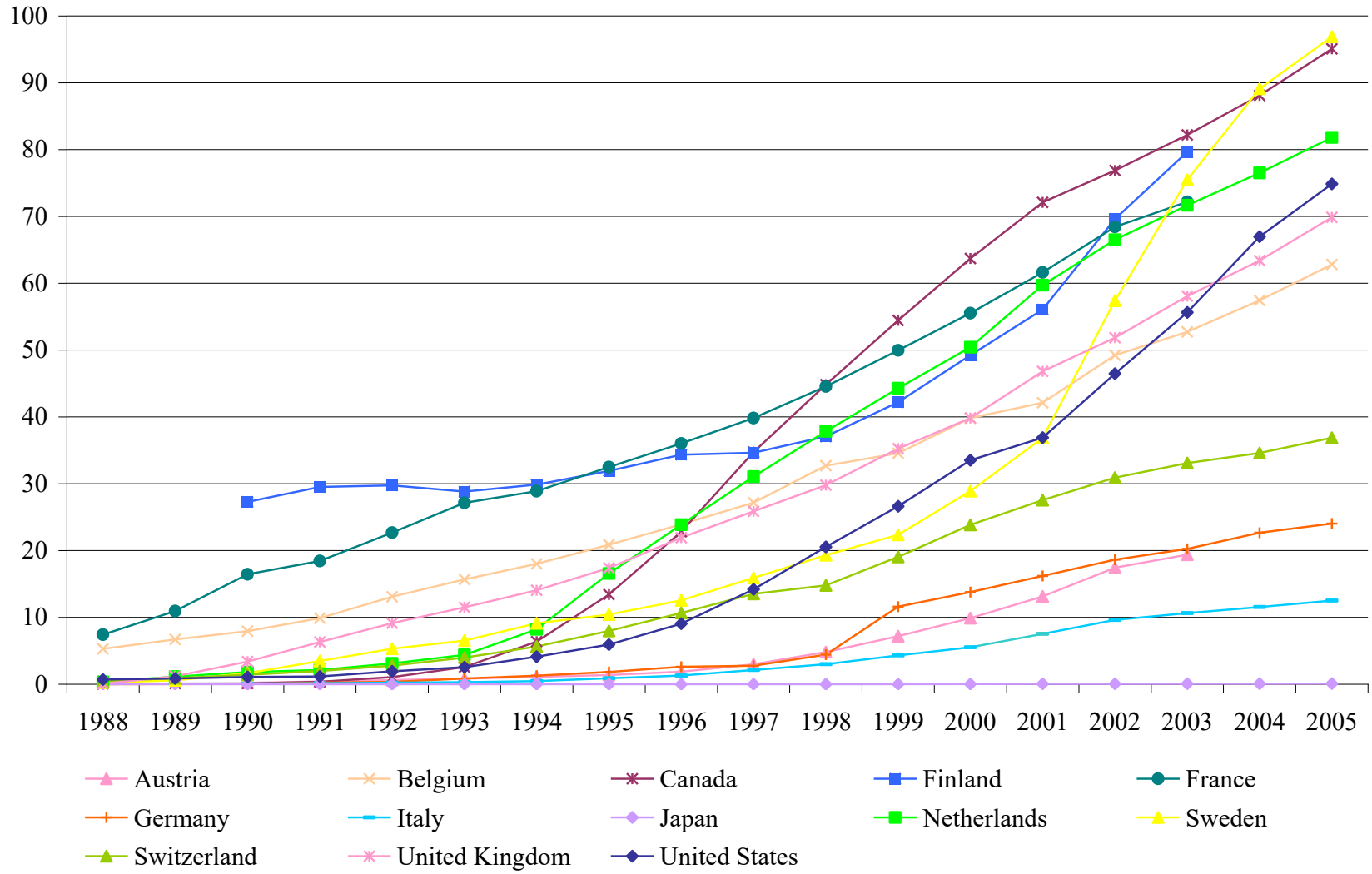
- Evidence of increasing use of electronic payments at the point of sale
- Even though a cashless society has been proclaimed dead numerous times
  - Cash aggregates are fairly stable in many developed economies
  - There is (some) cash in (nearly) every wallet
- So is transactional demand for cash decreasing?
- Policy concerns: how to forecast cash demand, interest rate elasticity, encourage non-cash instruments to promote greater efficiency

Our approach

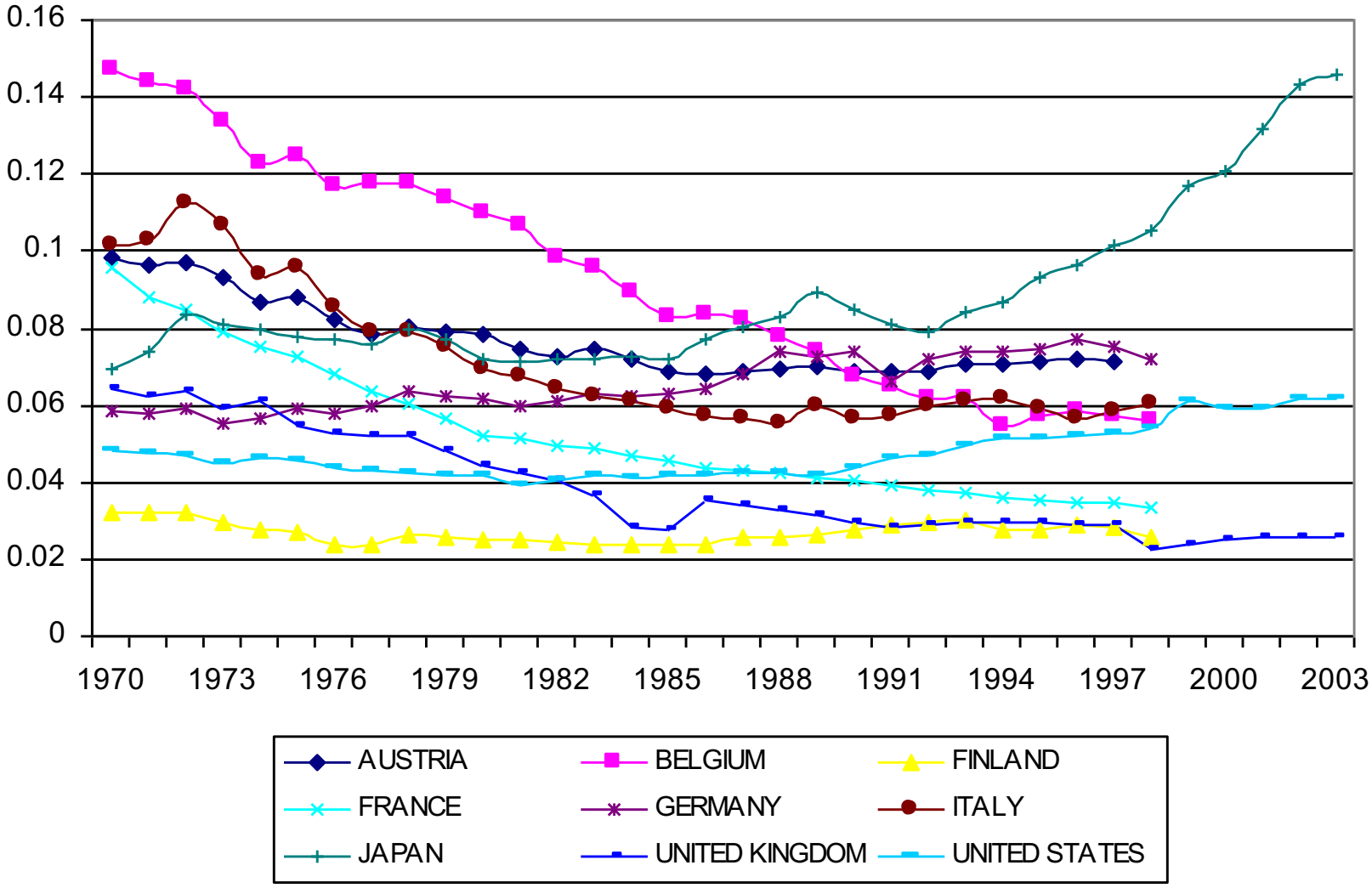
- Identifying the displacement effect of electronic payments is complicated because of the many uses of cash
- Our approach is to isolate the effect on transaction demand for cash by focusing on certain denominations
- Specifically, we look at small notes and coins
  - Small notes and coins are used to make change in transactions
  - Electronic payments → no change → no demand for small denominations
- Relate changes in payment infrastructure to changes in denomination-specific currency stocks

Debit card transactions grew rapidly

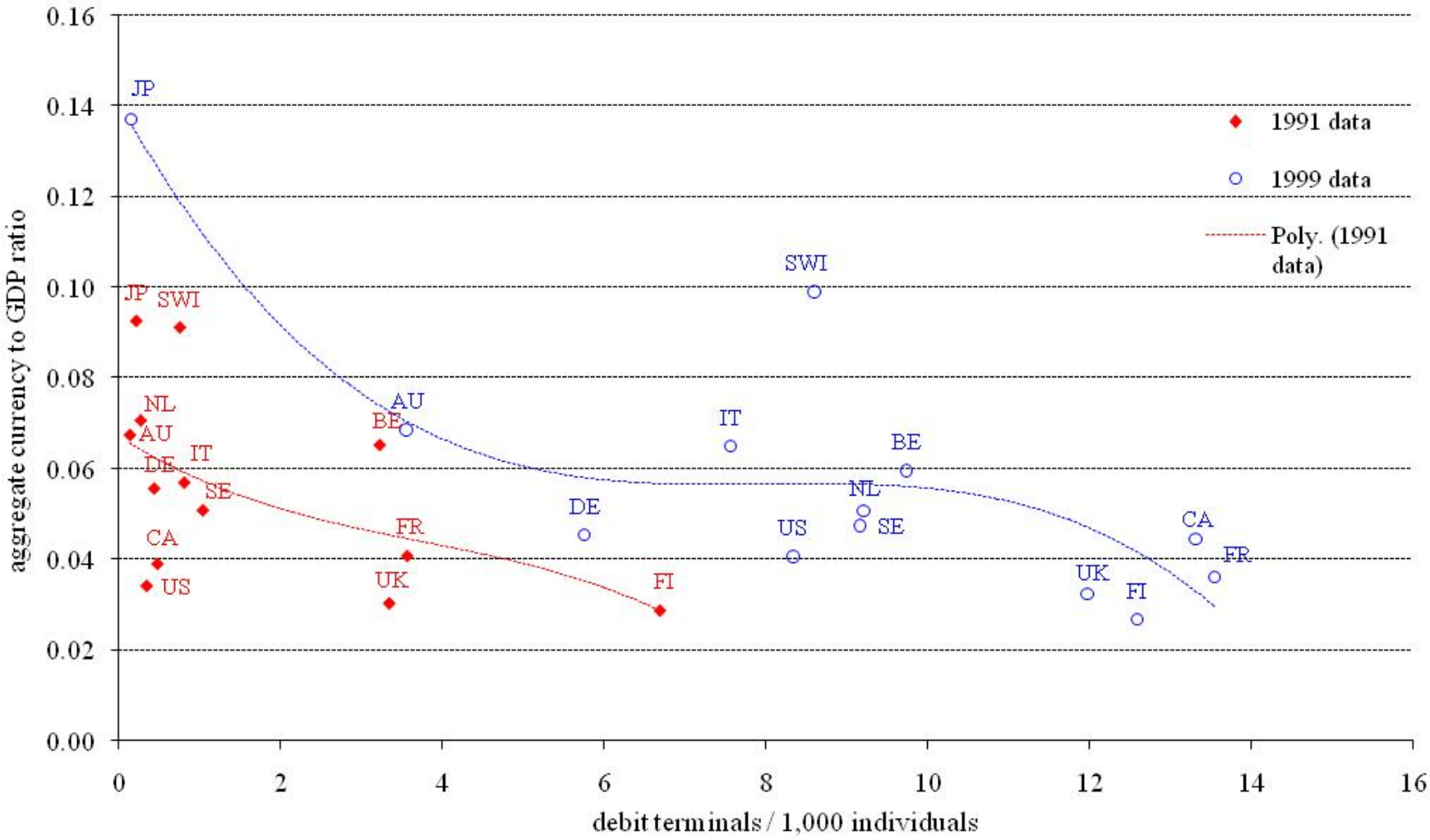
Figure 1: Per Capita Debit Card Volume



Currency (as a fraction of GDP) not always decreasing



Debit infrastructure v. currency holdings/GDP



Data sample and payments infrastructure

- Look at currency stocks in 13 OECD countries from 1988 through 2003 (data on Euro countries are used through 1999)
- Demand for cash is modeled as a function of
  - Payment infrastructure: debit card terminals, ATM terminals, bank branches
  - Small merchant prevalence (fixed costs and/or tax evasion)
  - Opportunity cost: short-term nominal interest rate
- Payments, currency, and population data from BIS CPSS Red Books and ECB Blue books
- Parsimonious model given small sample and fixed effects econometric design

Self-Employed Ratio and Shadow Economy as a Percent of Official GDP

Country	Self-employed ratio (1999)	Shadow Economy as % of official GDP (1999)
France	7.65	15.20
United States	7.65	8.70
Sweden	8.17	19.20
Germany	10.04	16.00
Finland	12.09	18.10
United Kingdom	12.56	12.70
Switzerland	13.80	8.60
Netherlands	14.00	13.10
Canada	17.04	16.00
Belgium	17.06	22.20
Japan	17.51	11.20
Austria	20.73	9.80
Italy	33.88	27.10

Source: IMF and shadow economy estimates are from Schneider (2006).

Aggregate currency stock/GDP model

Dependent variable: currency stock / GDP ratio	(1) Pooled OLS	(2) Fixed Effects (FE)	(3) FE with cluster-adjusted SE
log(Debit terminals/pop)	-0.116***	-0.024***	-0.024*
	(0.014)	(0.009)	(0.012)
log(ATMs/pop)	-0.128***	-0.034*	-0.034
	(0.041)	(0.019)	(0.031)
log(Bank branches/pop)	0.261***	0.352***	0.352***
	(0.073)	(0.048)	(0.078)
log(Ratio of self-employed)	0.229***	0.221**	0.221
	(0.047)	(0.104)	(0.220)
log(Short-term interest rate)	-0.307***	-0.092***	-0.092***
	(0.032)	(0.019)	(0.021)
Y2K dummy	-0.001	0.038	0.038
	(0.067)	(0.031)	(0.022)
constant	-2.991	-3.278	-3.278
N	128	128	128
Goodness-of-fit measure	adj. R^2	within R^2	within R^2
	0.71	0.43	0.43

Excludes countries with large currency holdings outside own borders; results are similar when those countries (Germany, Switzerland, and the US) are included

Denomination categories

ATM-dispensed → medium; above that → large; below → small

National Currency	Highest Denomination NCU	Highest Denomination US $	Most common ATM note NCU	Most common ATM note US $	*December 31, 2000* Exchange rate (NCU/$)
Austria Schillings	5,000	$342	100 - 1,000	$7 - $68	14.61
Belgium Francs	10,000	$234	1000	$23	42.82
Canada Dollars	1,000	$667	20	$13	1.50
Finland Markka	1,000	$158	100	$16	6.31
France Francs	500	$72	100	$14	6.96
Germany Deutsche Marks	1,000	$482	10 - 100	$5 - $48	2.08
Italy Lire	500,000	$243	10K - 50K	$5 - $24	2055.49
Japan Yen	10,000	$87	10000	$87	114.35
Netherlands Guilders	1,000	$427	100	$43	2.34
Sweden Kronor	1,000	$106	100 - 500	$11 - $53	9.40
Switzerland Francs	1,000	$621	20 - 200	$12 - $124	1.61
United Kingdom Pounds	50	$75	10 - 20	$15 - $30	0.67
United States Dollars	100	$100	20	$20	1.00

Denomination-specific currency/GDP stocks (full sample)

	logarithm of		
Dependent variable:	Large/GDP	Medium/GDP	Small/GDP
log(Debit terminals/pop)	-0.005	0.025	-0.043***
	(0.030)	(0.029)	(0.012)
log(ATMs/pop)	-0.030	-0.242**	0.000
	(0.103)	(0.108)	(0.036)
log(Bank branches/pop)	0.424**	0.212	0.275**
	(0.168)	(0.204)	(0.094)
log(Ratio of self-employed)	-0.344	0.286	0.318***
	(0.308)	(0.221)	(0.101)
log(Short-term interest rate)	-0.061	-0.044	-0.022
	(0.037)	(0.028)	(0.015)
Y2K dummy	0.018	0.022	-0.002
	(0.053)	(0.029)	(-0.015)
constant	-2.566	-4.950	-5.812
N	169	169	169
Goodness-of-fit measure	within R^2	within R^2	within R^2
	0.07	0.21	0.66

- Debit infrastructure only affects small denominations
- Self-employed effects are limited to small currency – fixed costs, not tax evasion
- No effect of interest rates on large notes???

Denomination-specific currency/GDP stocks ('small' sample)

	logarithm of		
Dependent variable:	Large/GDP	Medium/GDP	Small/GDP
log(Debit terminals/pop)	-0.028	0.029	-0.044***
	(0.025)	(0.026)	(0.014)
log(ATMs/pop)	0.052	-0.267**	0.004
	(0.066)	(0.097)	(0.039)
log(Bank branches/pop)	0.475**	0.260	0.301**
	(0.186)	(0.201)	(0.101)
log(Ratio of self-employed)	0.218	0.239	0.396**
	(0.249)	(0.440)	(0.147)
log(Short-term interest rate)	-0.131***	-0.035	-0.030
	(0.025)	(0.046)	(0.019)
Y2K dummy	0.054	0.000	-0.009
	(0.033)	(0.031)	(-0.018)
constant	-3.806	-4.999	-6.068
N	128	128	128
Goodness-of-fit measure	within R^2	within R^2	within R^2
	0.26	0.46	0.64

- Debit infrastructure and self-employed affects only small denominations
- Eliminating countries with substantial outside demand only affects large denomination estimates and it "cures" the interest rate effect

Conclusion

- Dividing currency stocks into denomination classes allows better separation of transaction and store-of-wealth functions of cash
- Displacement effects of electronic payments should be concentrated in smallest notes – confirmed empirically
- A greater share of self-employed (smaller merchants) results in greater demand for change-making small notes – fixed cost story
- Only large denomination notes display interest rate sensitivity, and only when measured in countries where currency mainly circulates domestically