OESTERREICHISCHE NATIONALBANK
EUROSYSTEM

Doomed to disappear? The surprising return of cash across time and across countries

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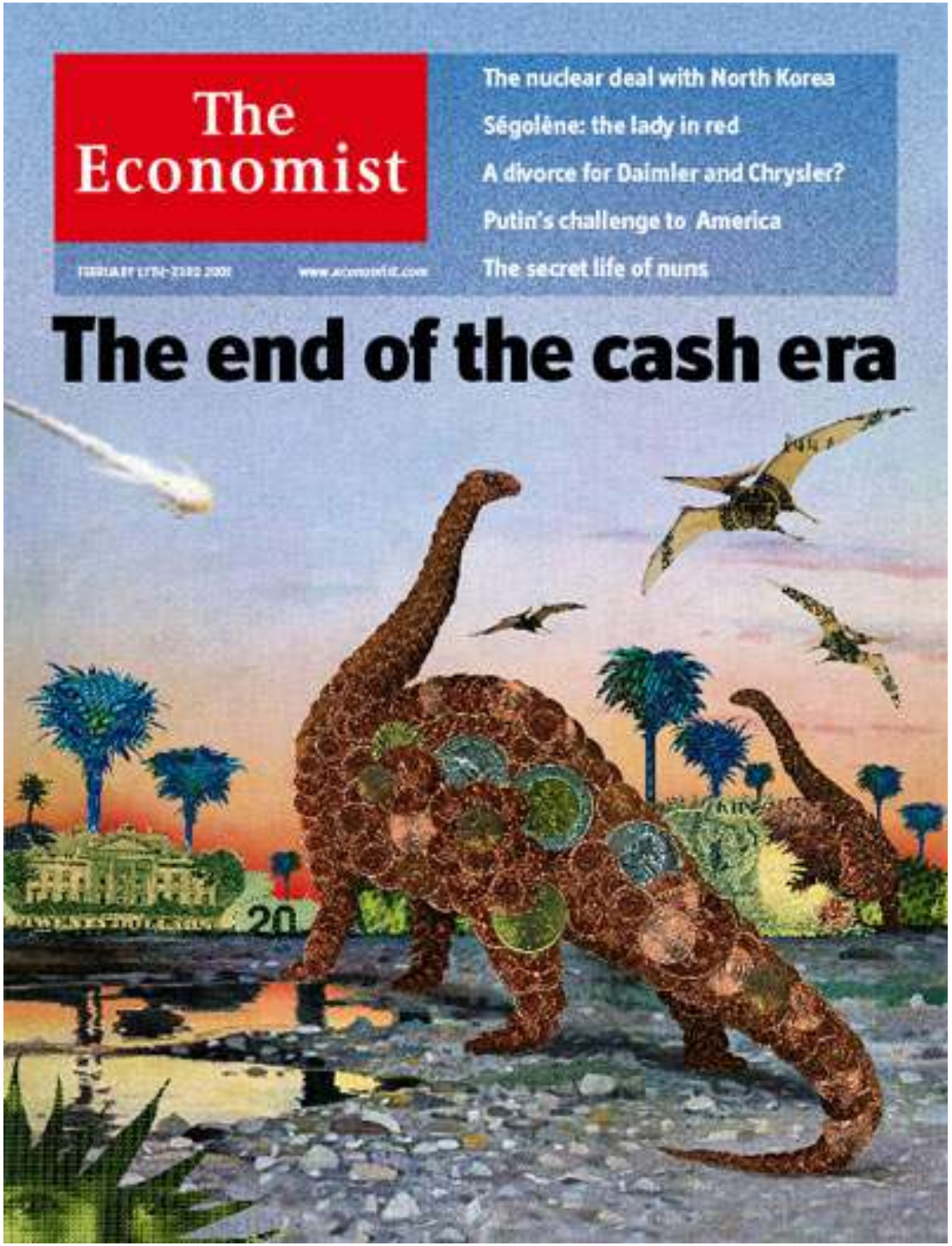
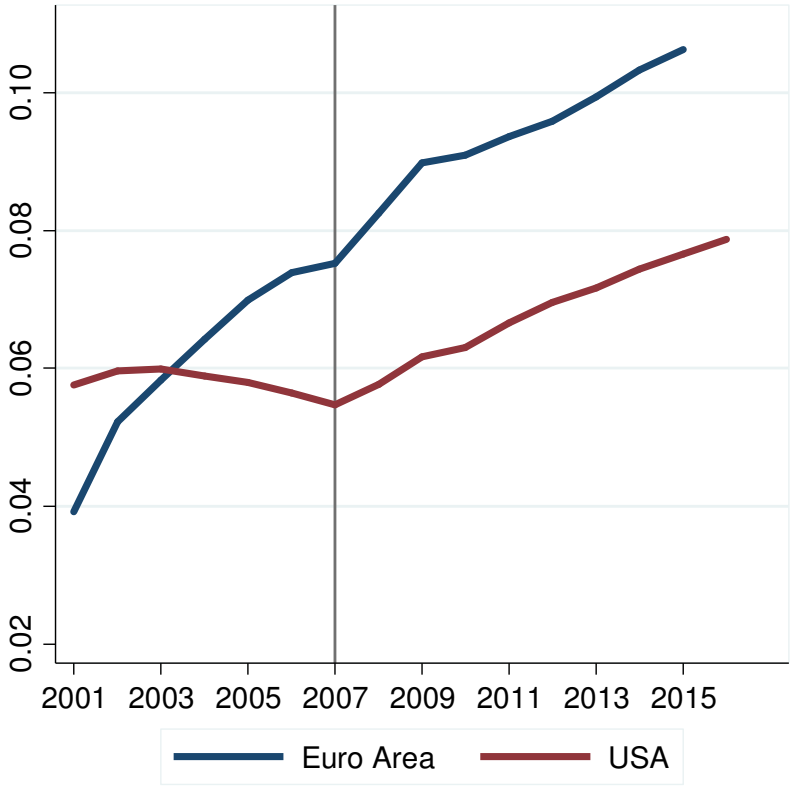
The views expressed here are exclusively those of the authors and do not necessarily reflect those of the OeNB or the Eurosystem.



The Economist, 15.2.2007

Motivation

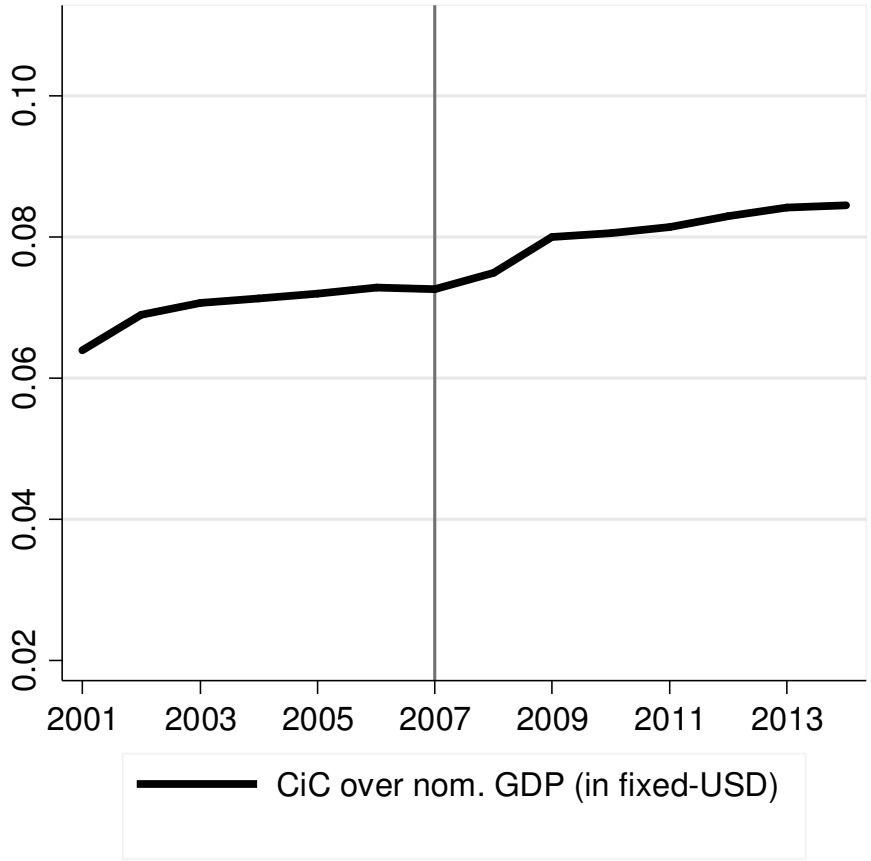
Currency in Circulation over Nominal GDP (in %)



- no decrease, increase after 2007
- EUR, USA per capita holding 2014 ~3000 EUR → foreign demand, hoarding

Motivation

“World” Currency in Circulation over Nominal GDP (in %)

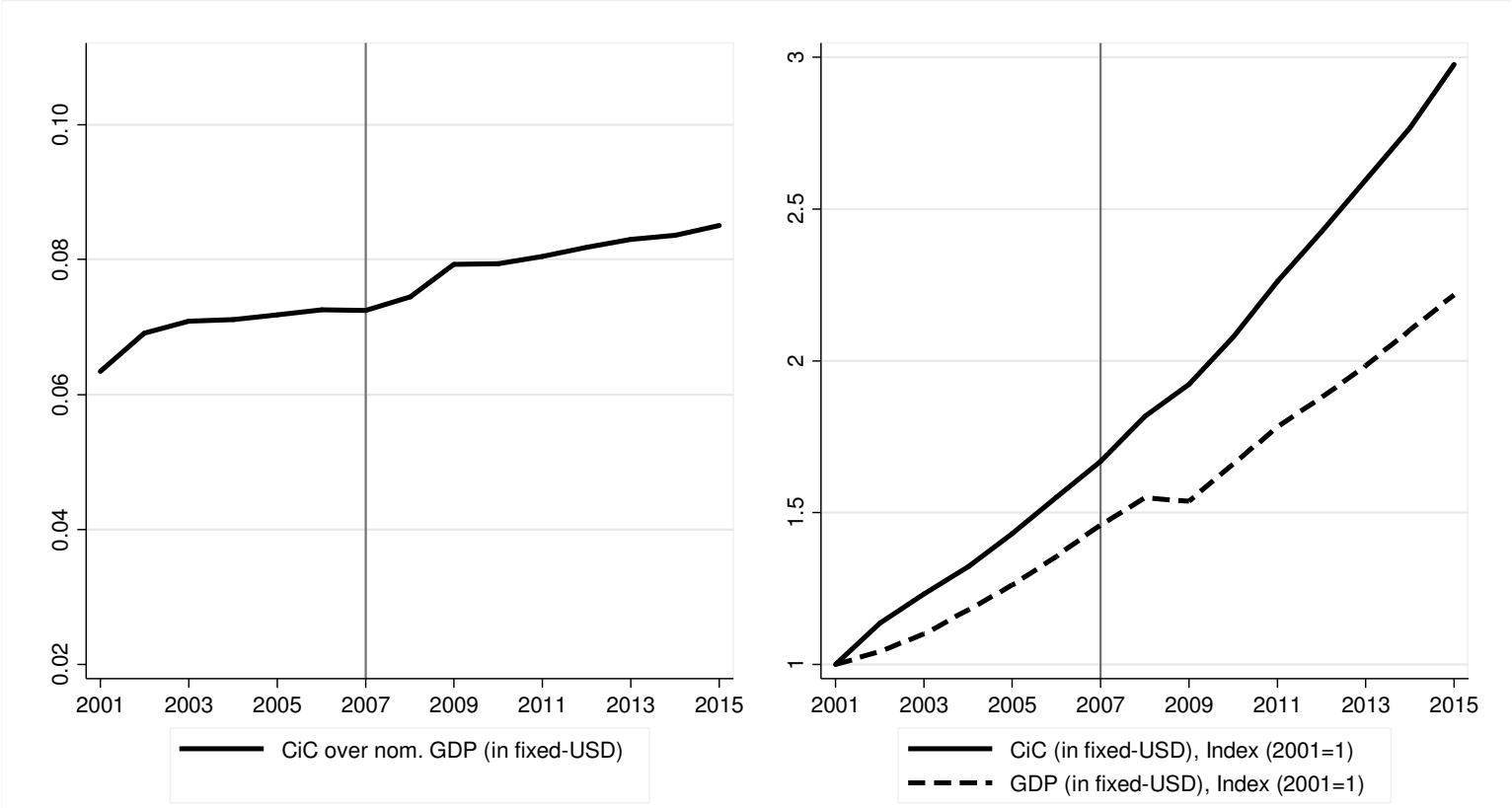


Note: The figure shows the currency in circulation to nominal GDP ratio for a sample of economies which comprise about 95% of World GDP (see Jobst and Stix 2017). All aggregations are based on market USD exchange rates that are fixed at 2006.

Source: Jobst and Stix (2017).

Increase not just a mechanical effect

Currency in Circulation over Nominal GDP (in %) – "World"



Note: The figures show the currency in circulation to nominal GDP ratios (left panel) as well as the evolution of currency in circulation and nominal GDP (right panel). All figures refer to the "World" as specified in the text. Own calculations. All aggregations are based on market USD exchange rates that are fixed at 2006. Variables are described in the Appendix. Data: IMF, OECD, national central banks.

Demand for currency has increased in many economies

Change in CiC / NGDP Ratios from 2003/04 to 2013/14 in 72 economies

- Mean increase 17%
- 63% of economies had an increase
- 50% of economies had an increase of >13%

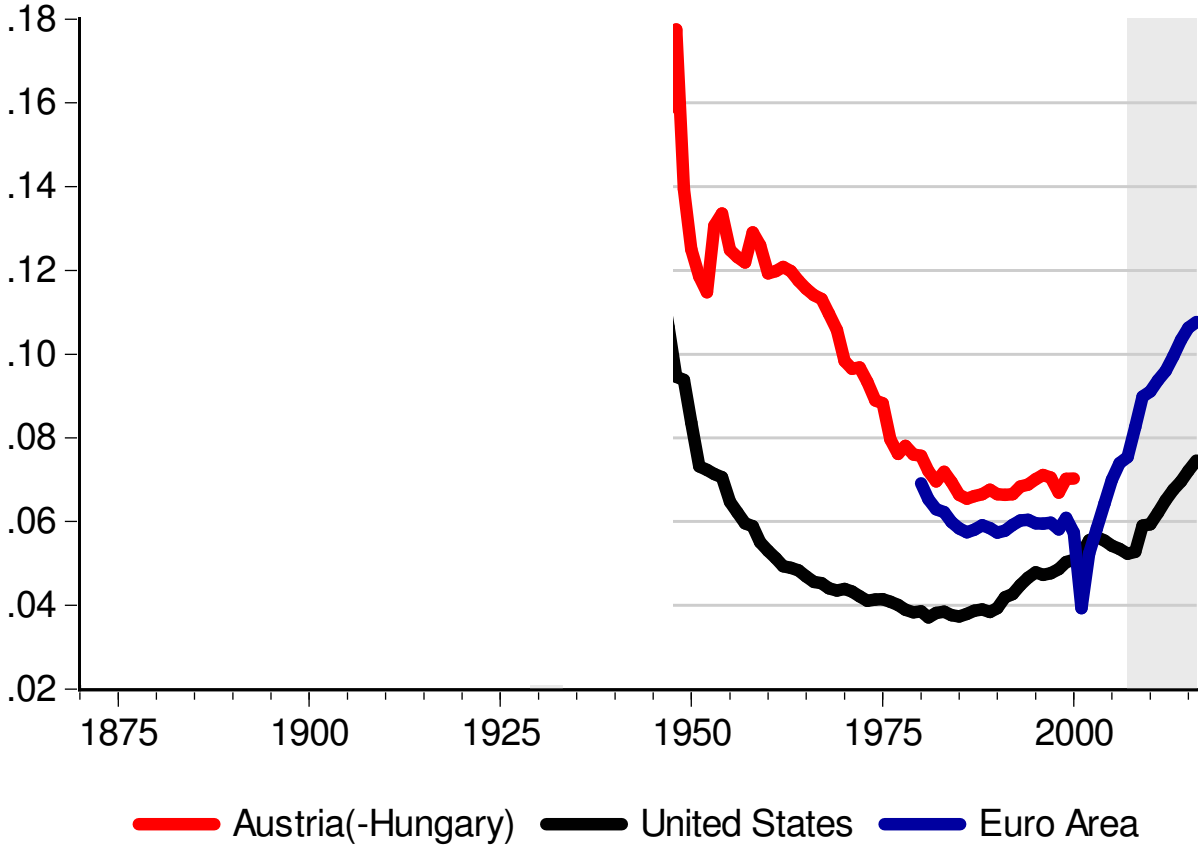
Motivation

How can these increases be explained?

- Aim of this paper:
  - Inform this debate by providing some facts
  - Put this development into two perspectives:

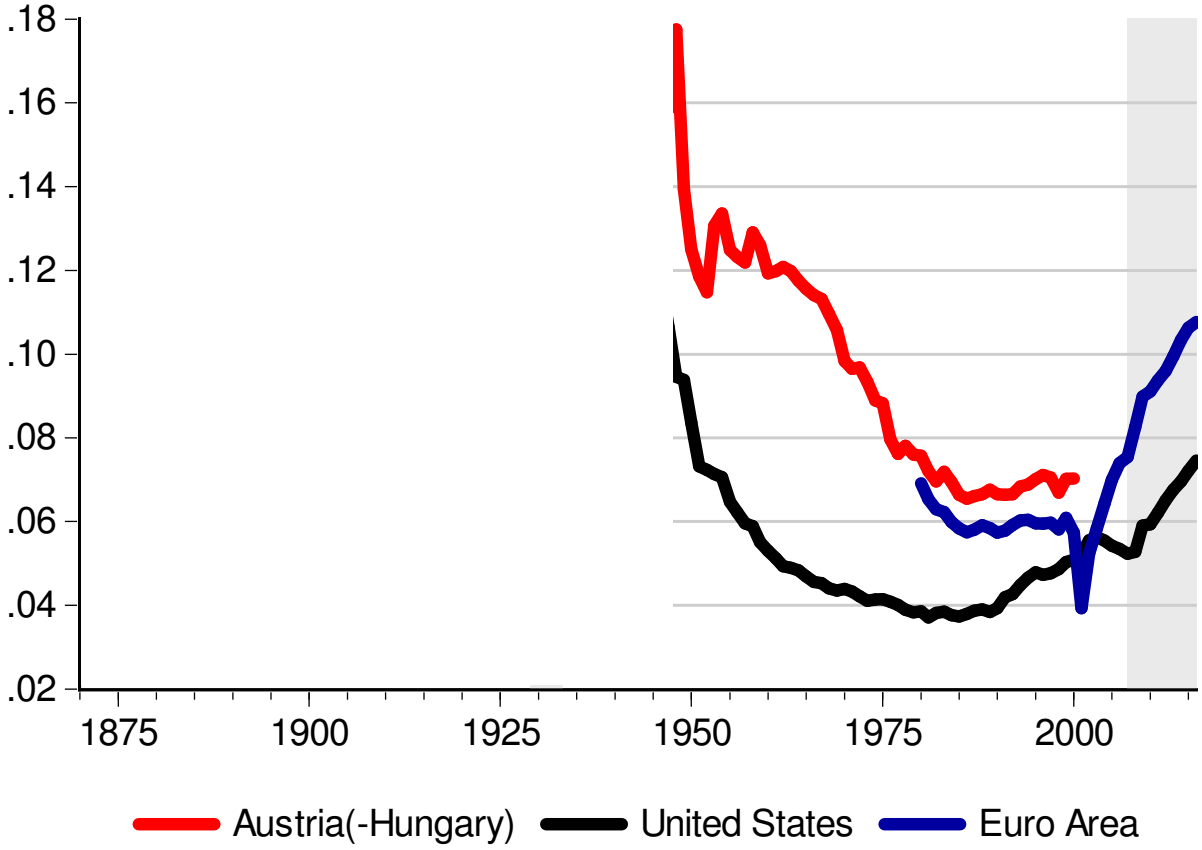
    1. Analyze longer time series
    2. Comparison of recent development across many economies

A long-run view on currency in circulation (over nom. GDP in %)



Note: The shaded area marks the period from 1929 to 1933 and from 2007 to 2015. Sources: See Jobst and Stix 2016.

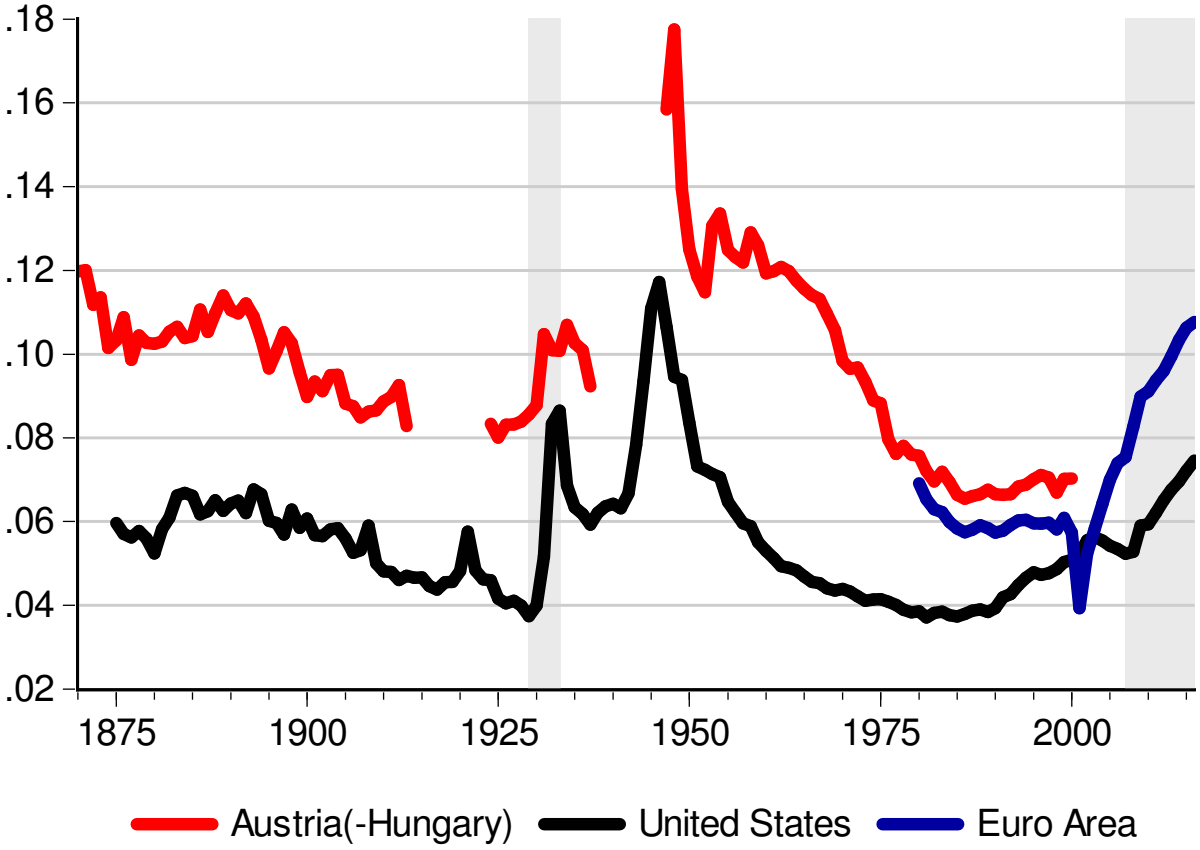
A long-run view on currency in circulation (over nom. GDP in %)



- Financial innovations ↓ cash
- Increase after ~1990
- Recent increase strong

Note: The shaded area marks the period from 1929 to 1933 and from 2007 to 2015. Sources: See Jobst and Stix 2016.

A long-run view on currency in circulation (over nom. GDP in %)



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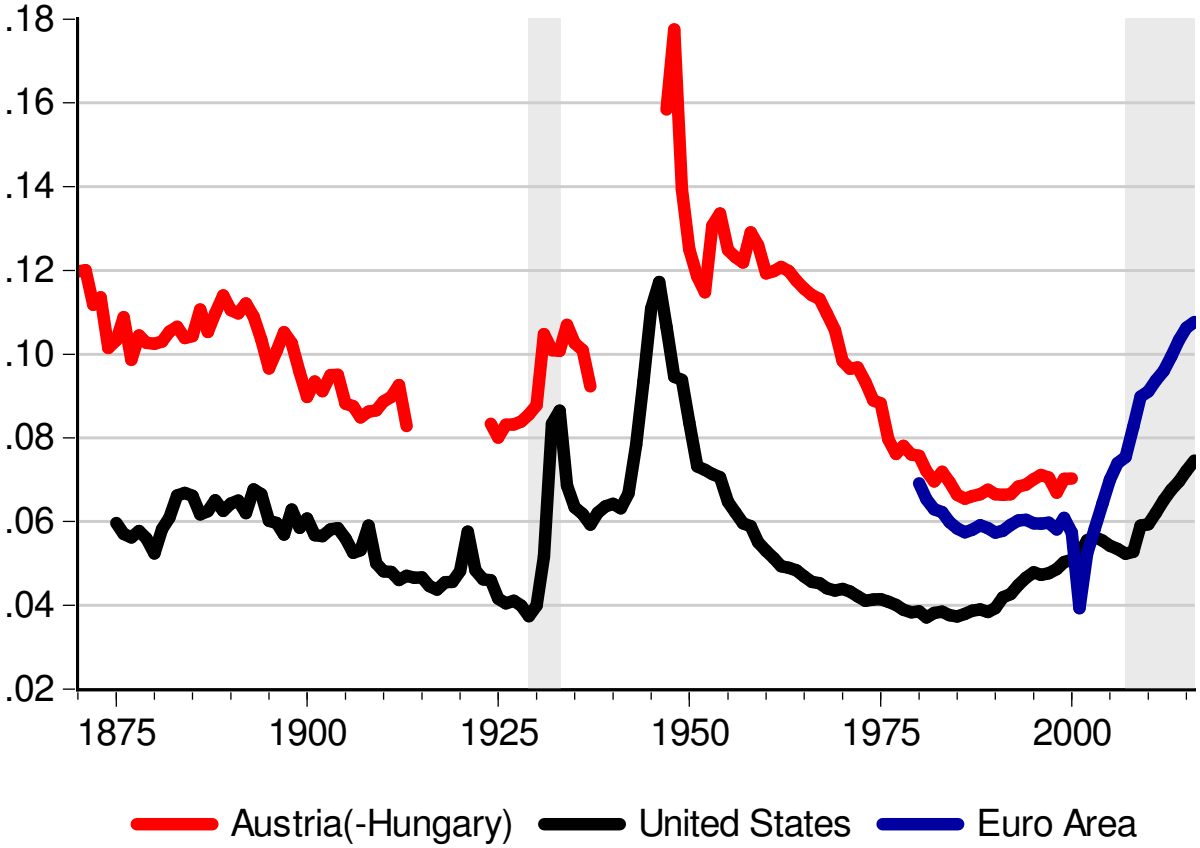
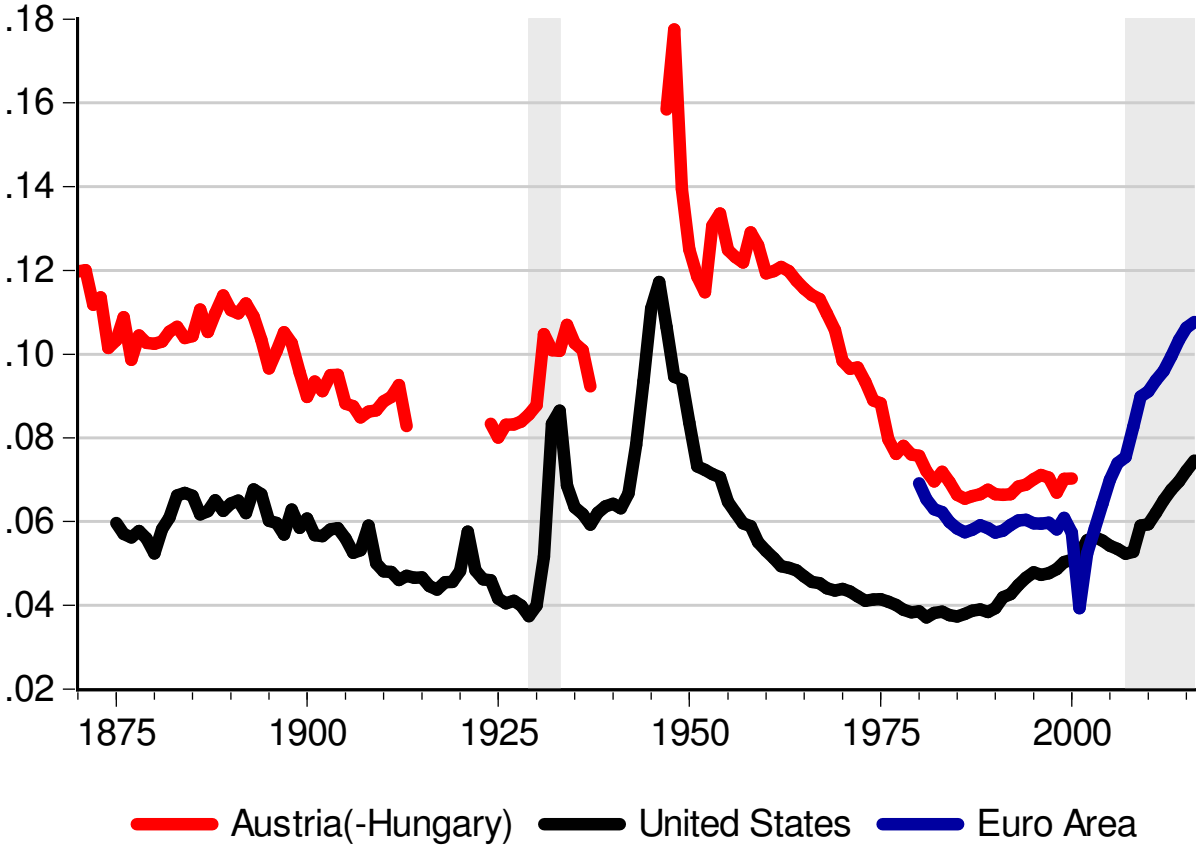
A long-run view on currency in circulation (over nom. GDP in %)



- Financial innovations ↓ cash
- Increase after ~1990
- Recent increase strong
- Cash resilient

Note: The shaded area marks the period from 1929 to 1933 and from 2007 to 2015. Sources: See Jobst and Stix 2016.

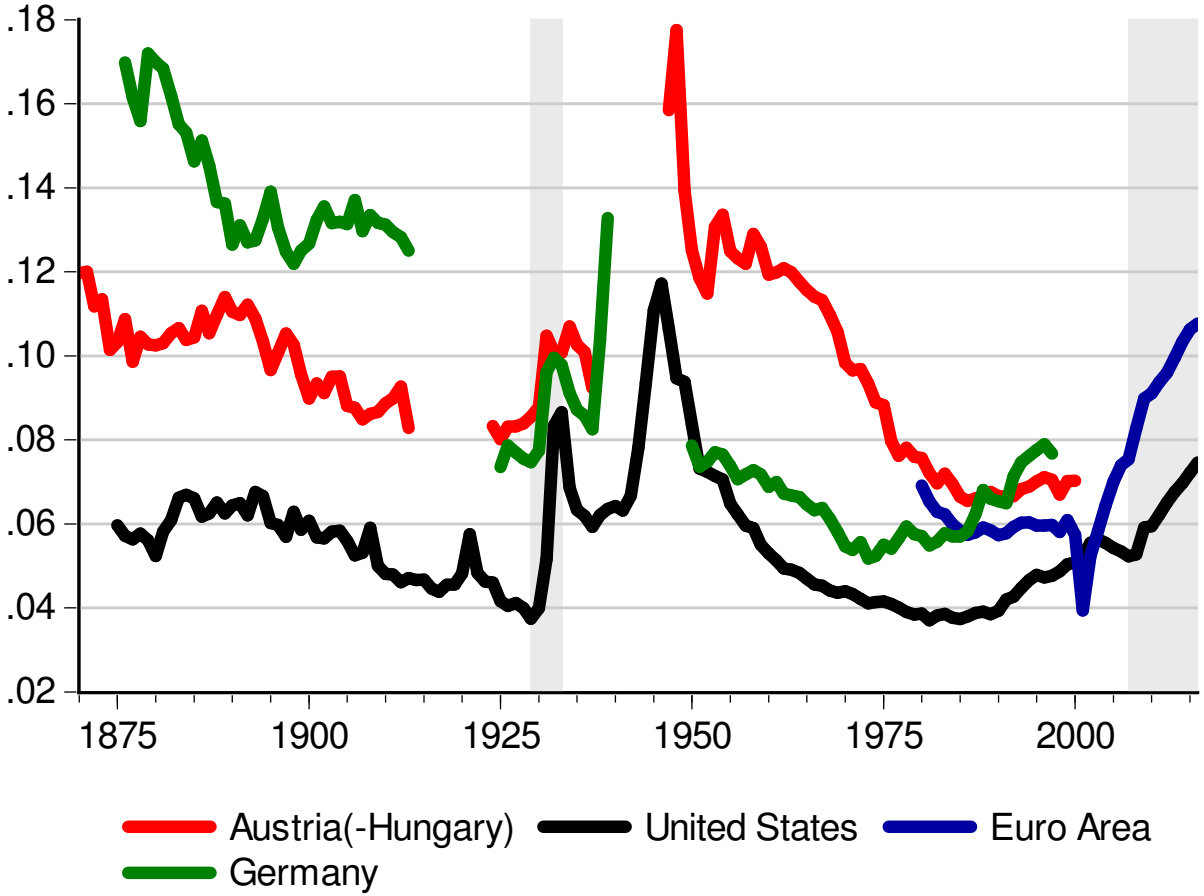
A long-run view on currency in circulation (over nom. GDP in %)



- Financial innovations ↓ cash
- Increase after ~1990
- Recent increase strong
- Cash resilient
- Increase also in Great Depression

Note: The shaded area marks the period from 1929 to 1933 and from 2007 to 2015. Sources: See Jobst and Stix 2016.

A long-run view on currency in circulation (over nom. GDP in %)



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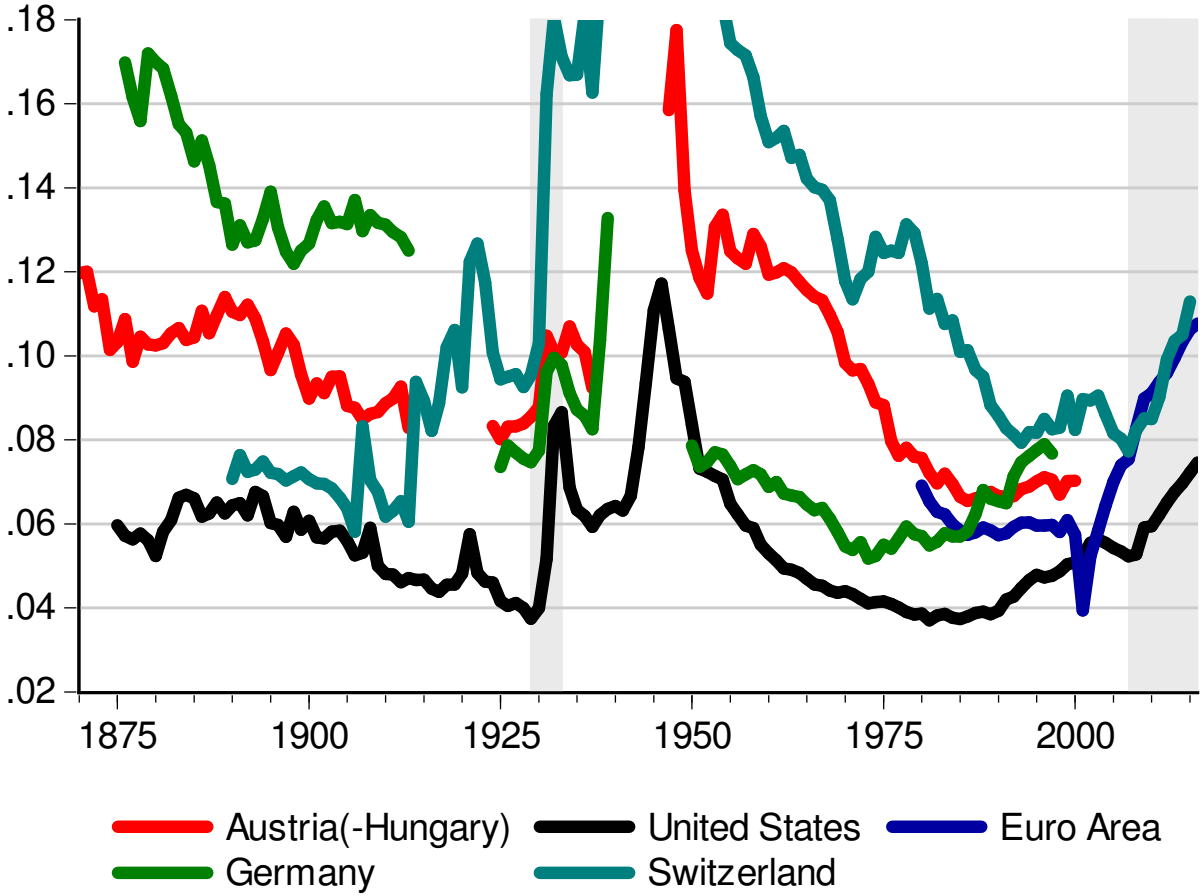
A long-run view on currency in circulation (over nom. GDP in %)



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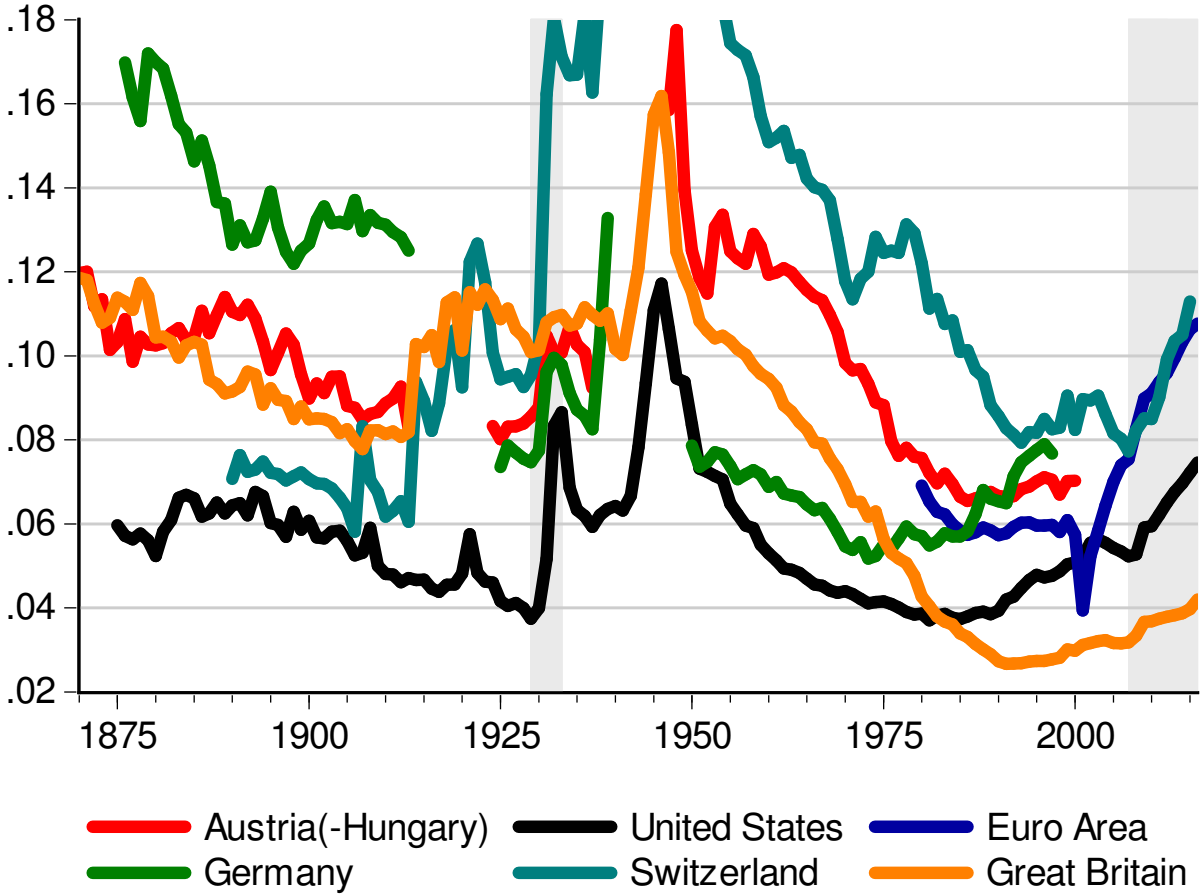
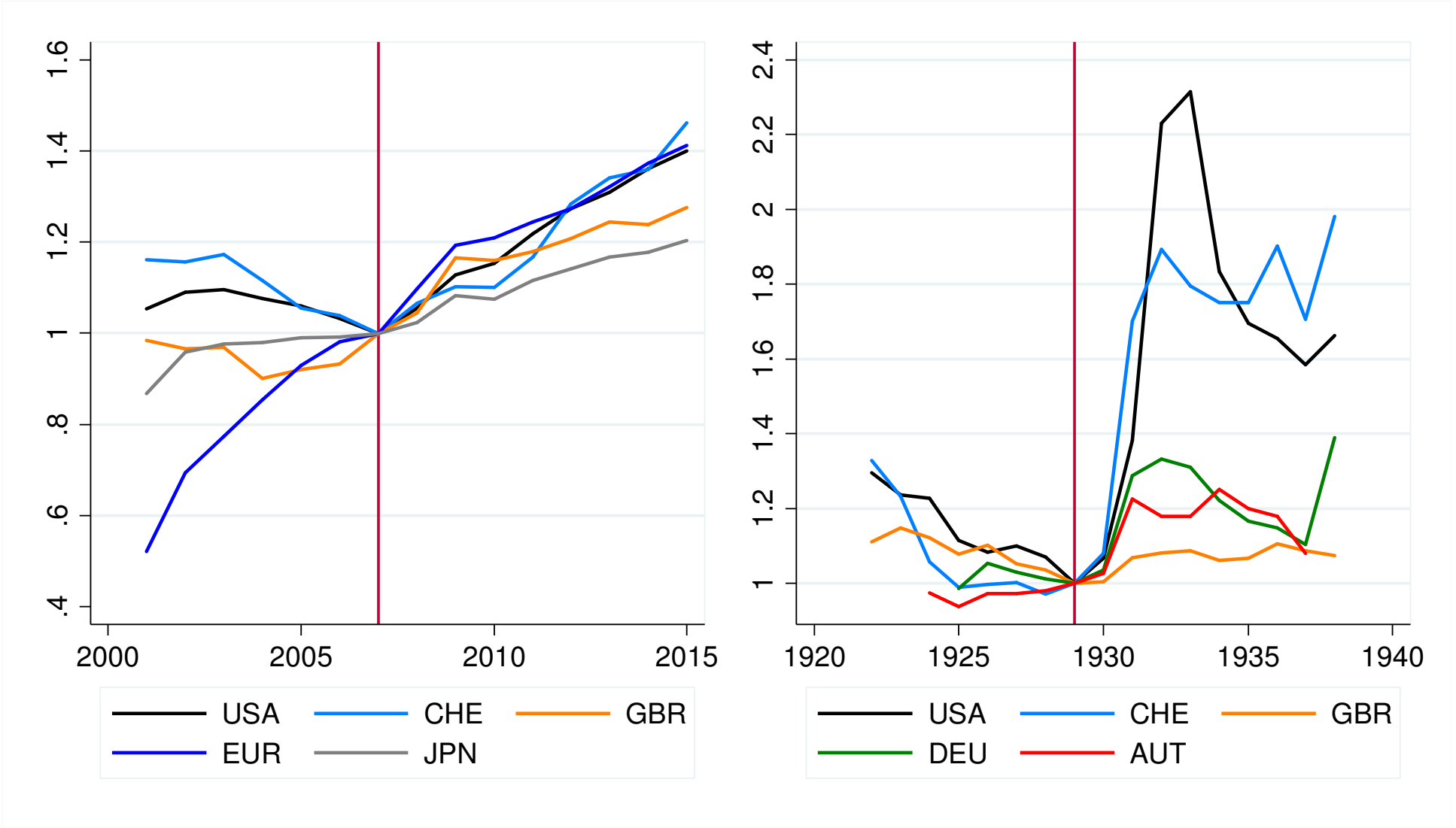
A long-run view on currency in circulation (over nom. GDP in %)



- Financial innovations ↓ cash
- Increase after ~1990
- Recent increase strong
- Cash resilient
- Increase also in Great Depression
- Increase also in GBR

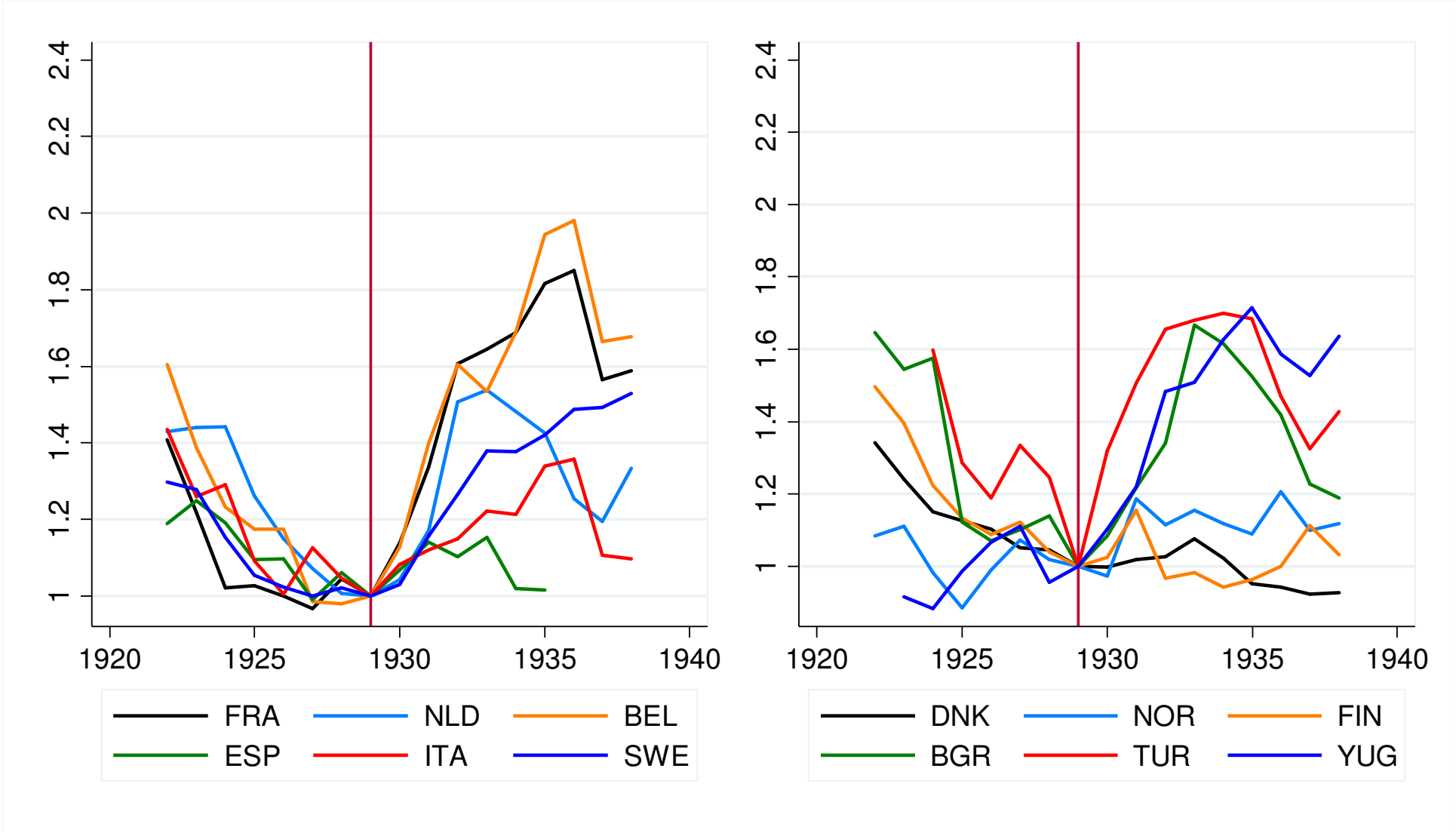
Note: The shaded area marks the period from 1929 to 1933 and from 2007 to 2015. Sources: See Jobst and Stix 2016.

Comparison with the 1930s banking crises



Sources: See Jobst and Stix 2016.

…other economies



Sources: See Jobst and Stix 2016.

Key questions

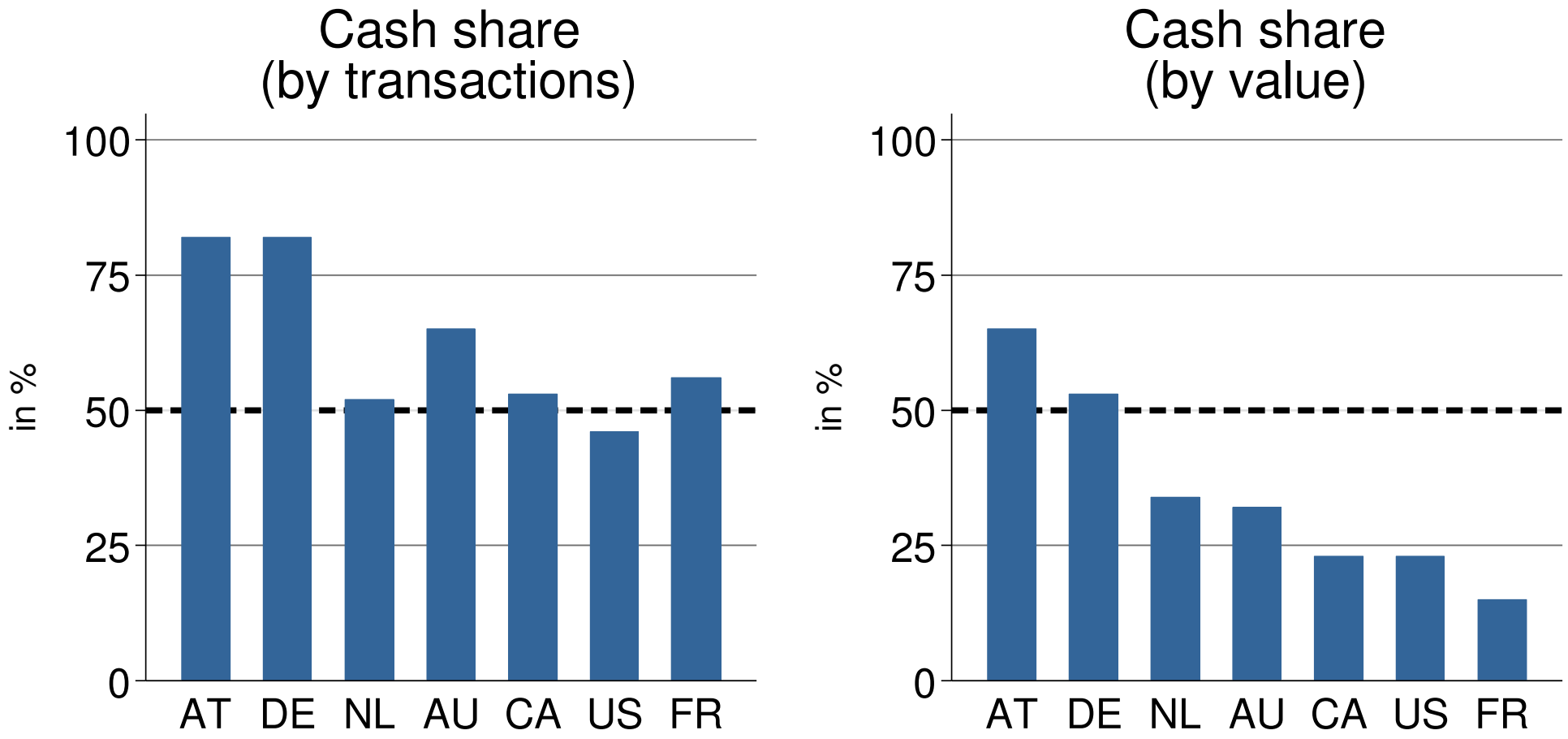
- What are the drivers of recent increases of currency demand?
- To what extent and why is cash still used for transactions?

To what extent and why is cash used for transactions?

- Technological innovations → direct effect on cash
- Cash balances used for transactions comprise only small share of total currency in circulation

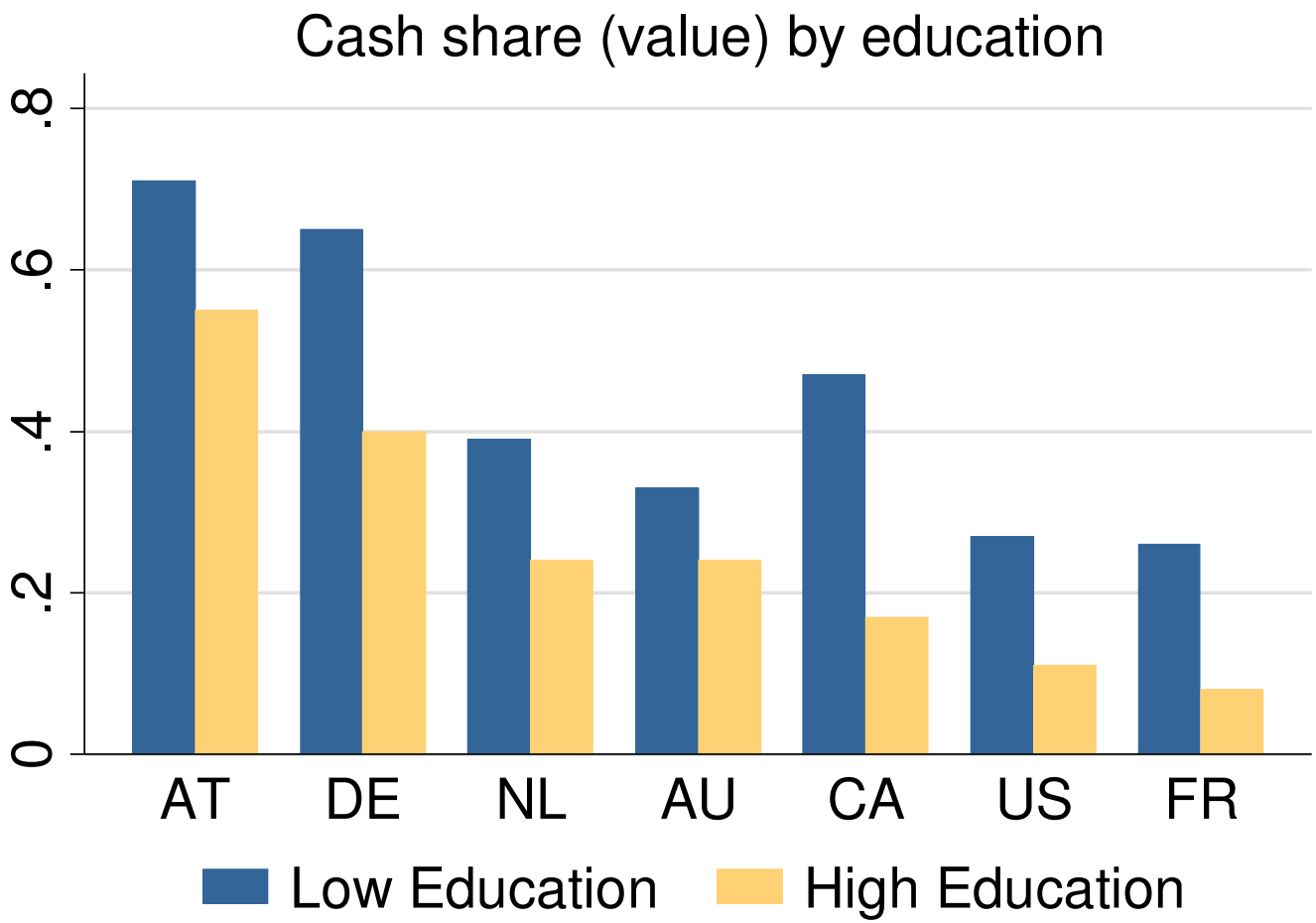
- Payment diary survey studies provide information on use of cash at the point-of-sale
- Bagnall et. al. (2016, IJCB): Compare results from 7 advanced economies
  - Payment card ownership almost universal

Share of cash at point-of-sale transactions



Source: Bagnall et al. 2016.

Socio-demography & preferences matter



- Cash for expenditure control, to economizing on fees
- Use of payment instruments largely in line with what consumers prefer, how they assess attributes of payment instruments

Trend

- Cash use will decline due to payment innovations (NFC, mobile payments, etc.)
- Cash has attributes that are valued by (some) consumers
- Cash will continue to play a role for payments

Declining use for payments → recent increases even more puzzling

What are the drivers of recent increases?

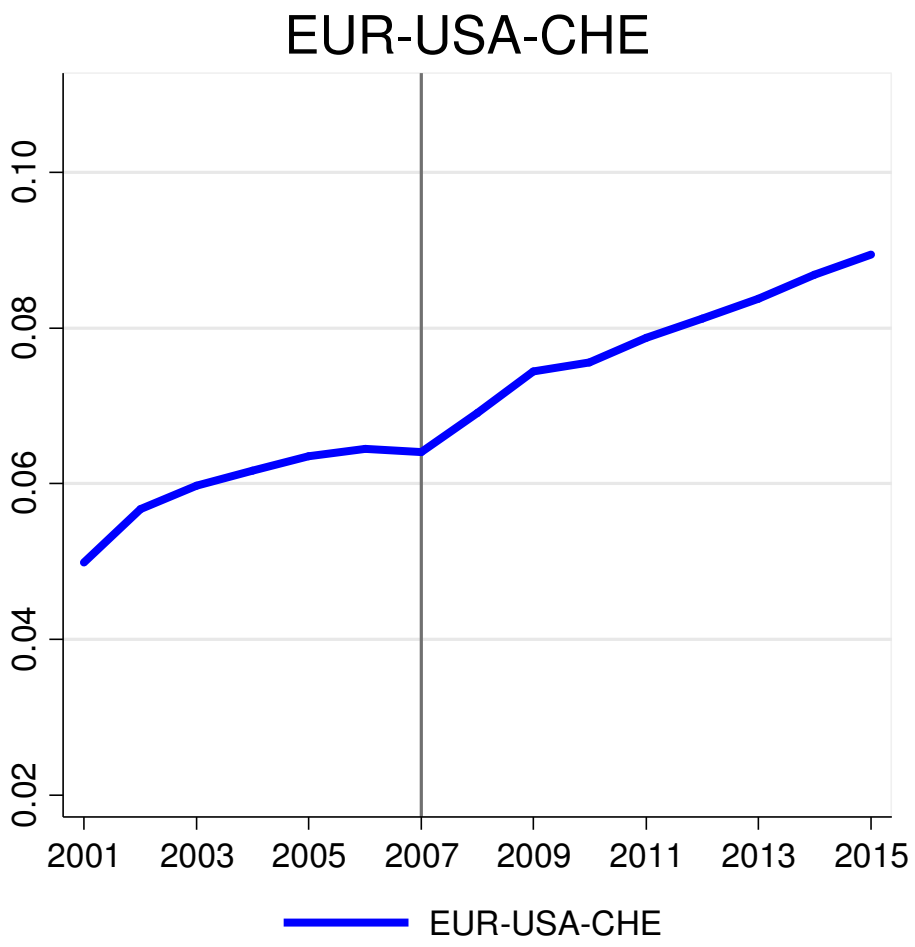
- Foreign Demand
- Lower interest rates
- Alternative explanations:
  - shadow economy
- Crisis effect after 2007/08:
  - Portfolio rebalancing: shift from deposits to cash (confidence, uncertainty)
  - Temporary fall in income: Agents hold currency according to their permanent income and have not adjusted their expectations of permanent income (Friedman and Schwartz, 1963)

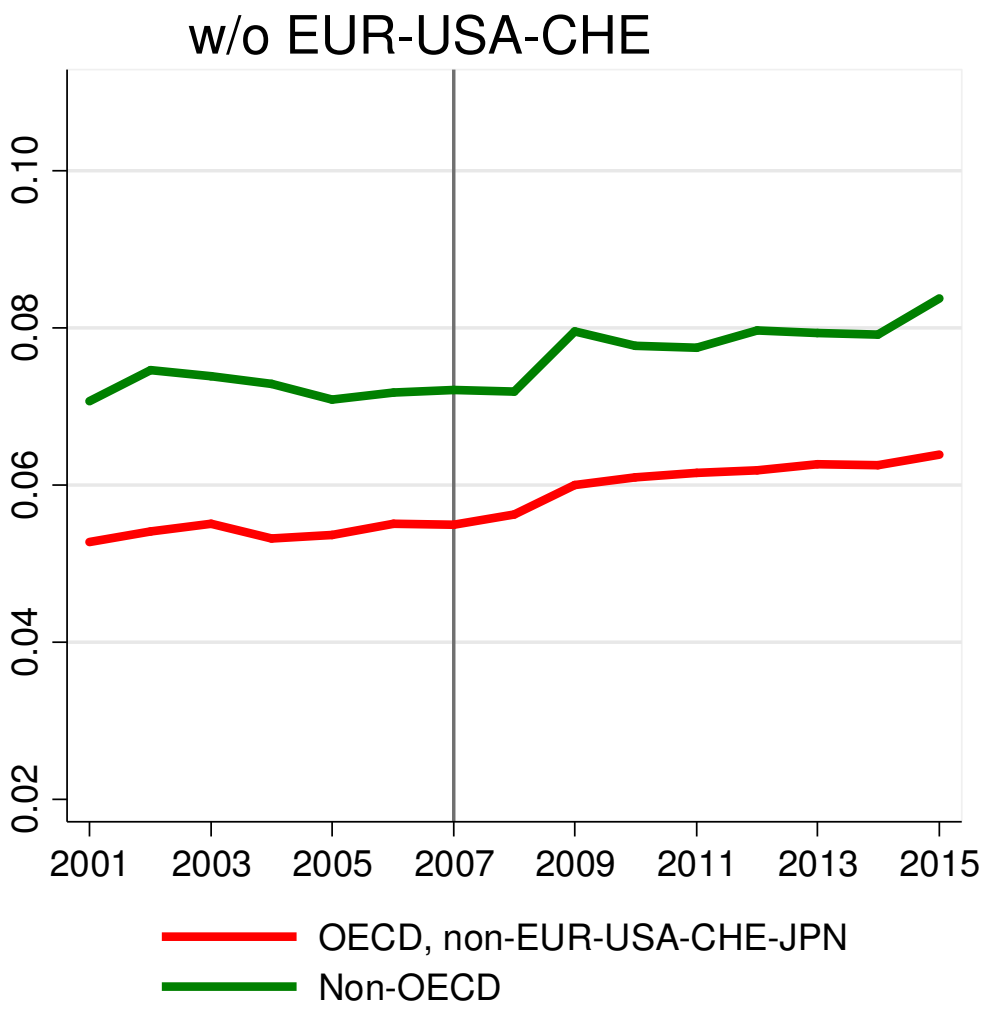
2. Demand for Currency for a Large Set of Economies

- Data from 2001 to 2014
- 80 largest economies in terms of 2010 GNI, EUR counts as single economy ~ 95% of World GDP
- ~60 used in estimation

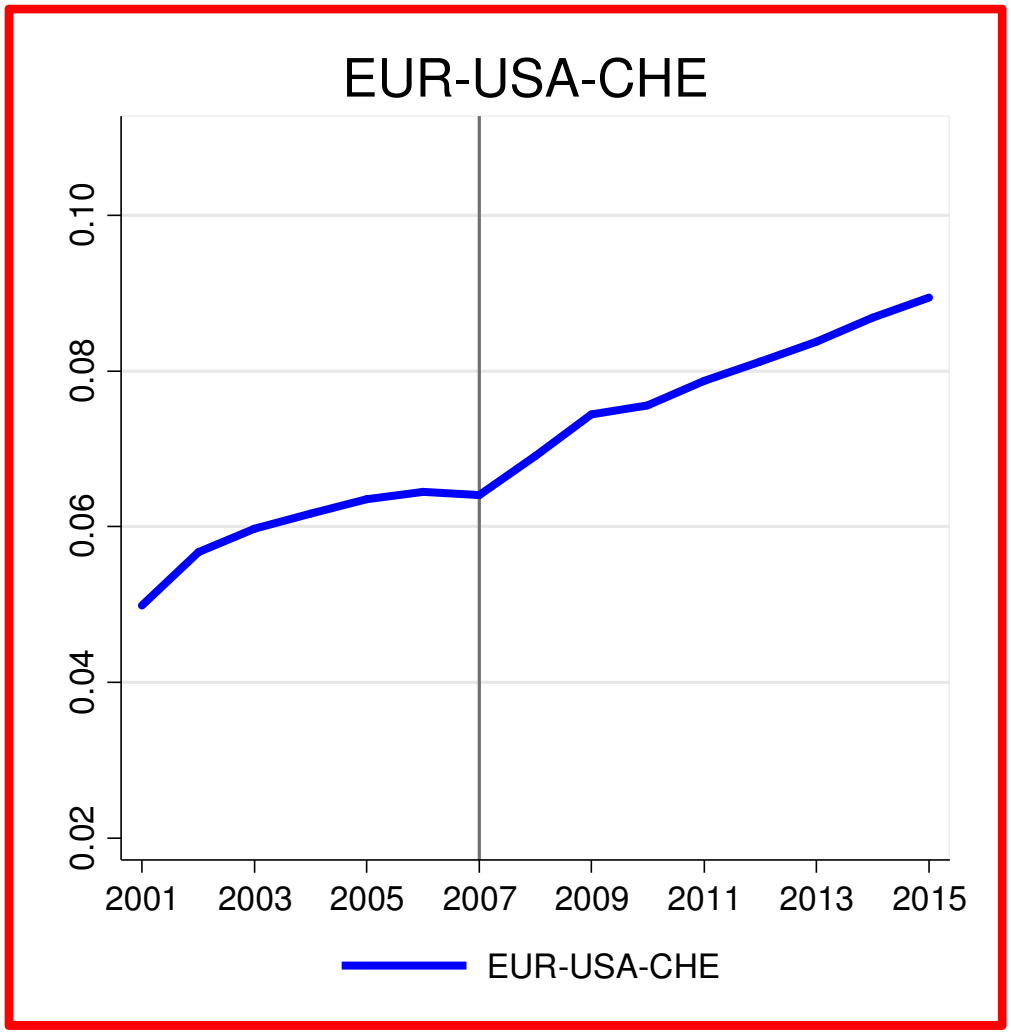
- Drop countries with missing data, war or officially dollarized
- Add largest economies from all continents to ensure broad coverage
- Classify into dollarized and non-dollarized (Nicoló, Honohan and Ize 2006)
- Harmonization & aggregation issues

Separate economies by foreign demand

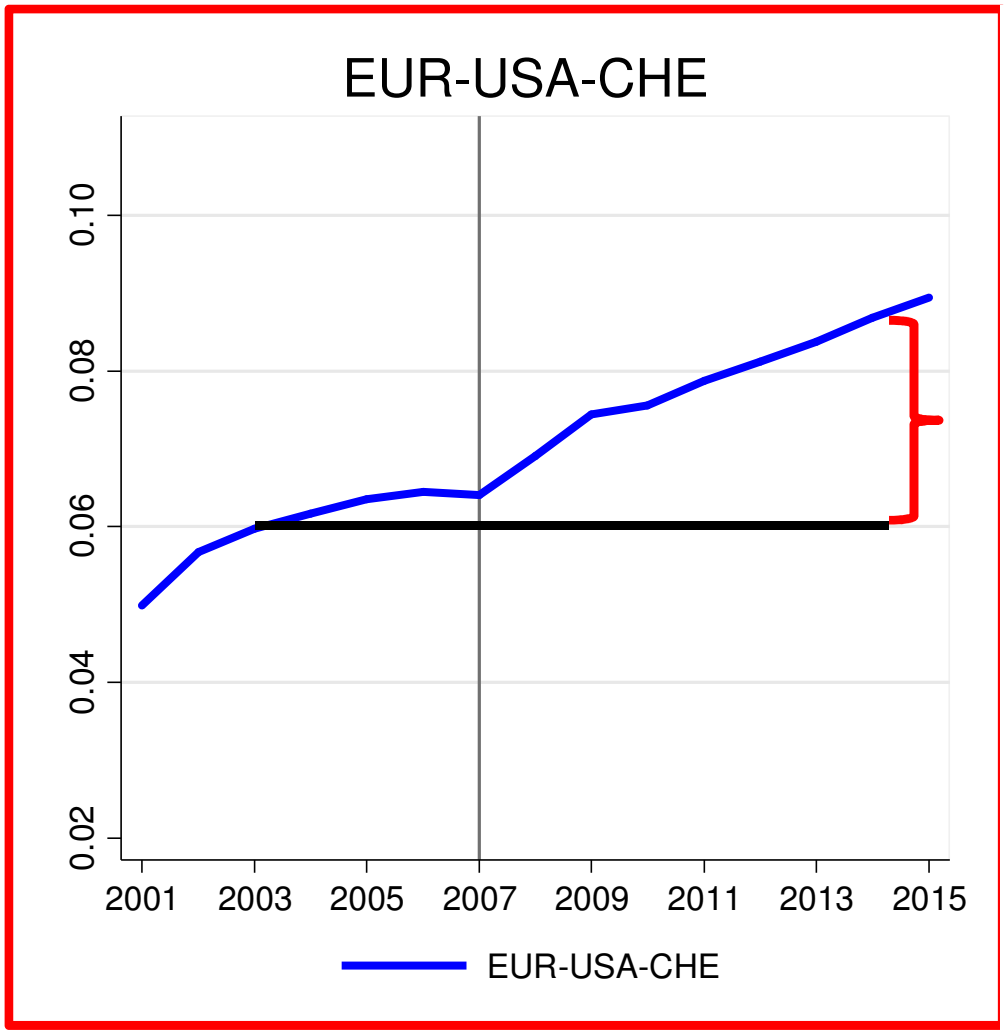




Separate economies by foreign demand



Separate economies by foreign demand



Back-of-the envelope calculation:

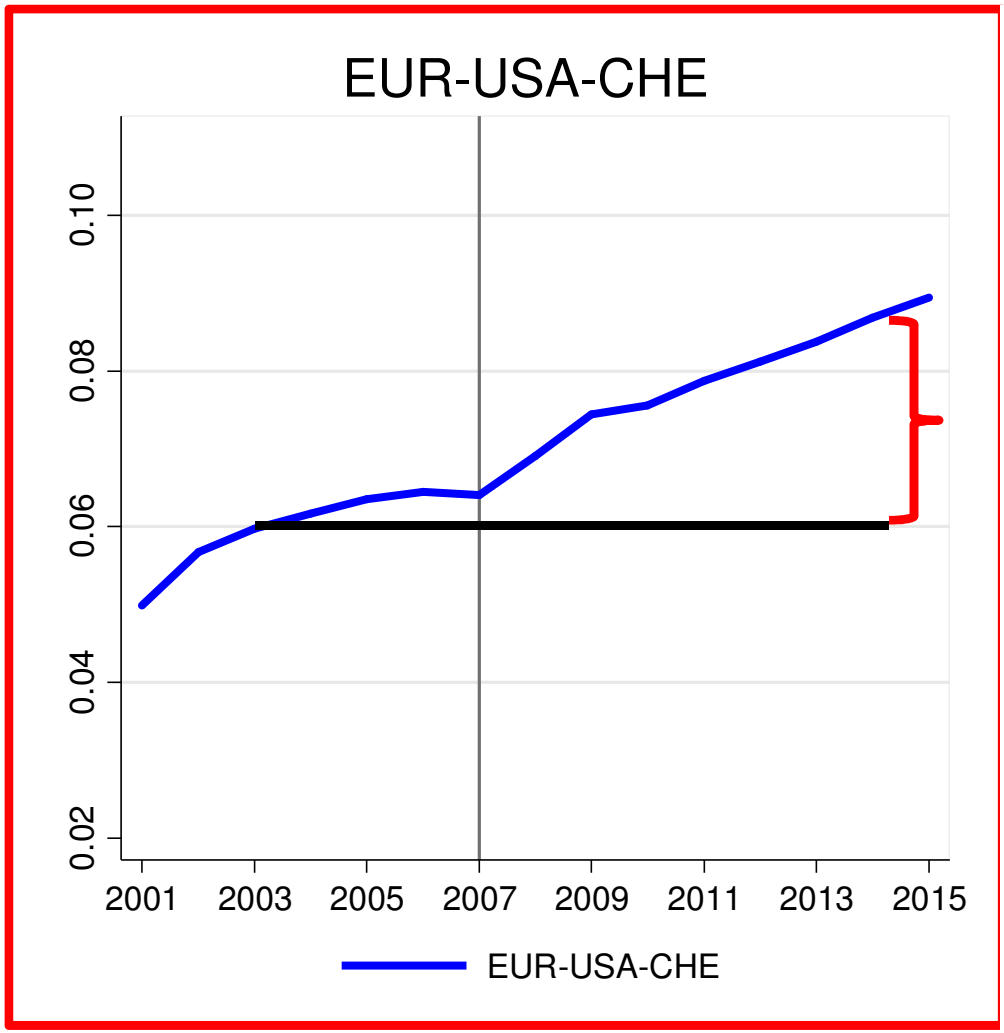
~1/3 foreign demand

~1/3 explained domestic (interest rates, GDP)

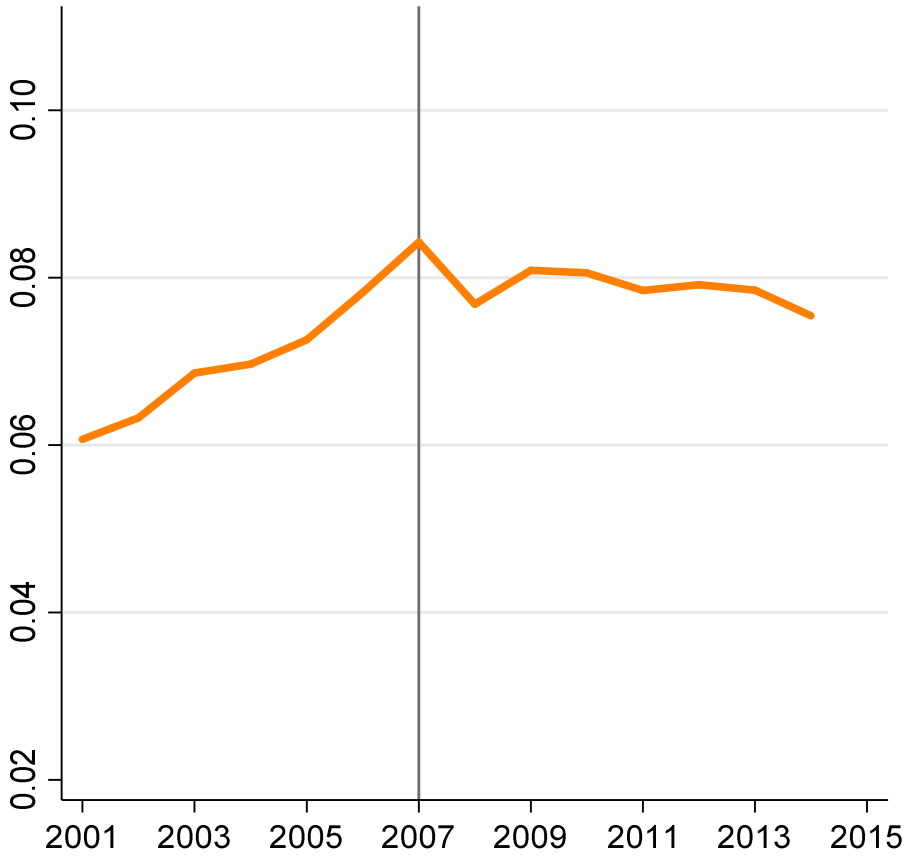
~1/3 unexplained domestic

*Real CiC = a+ 1*real GDP – 0.02* IR*

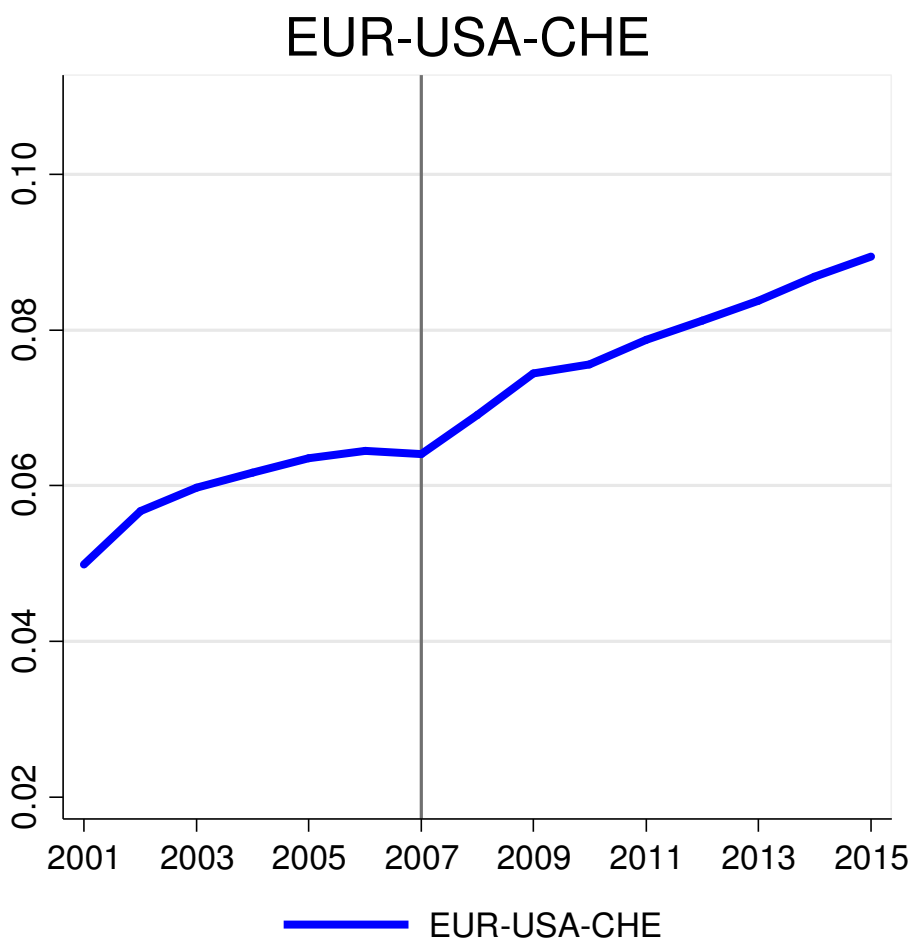
Separate economies by foreign demand

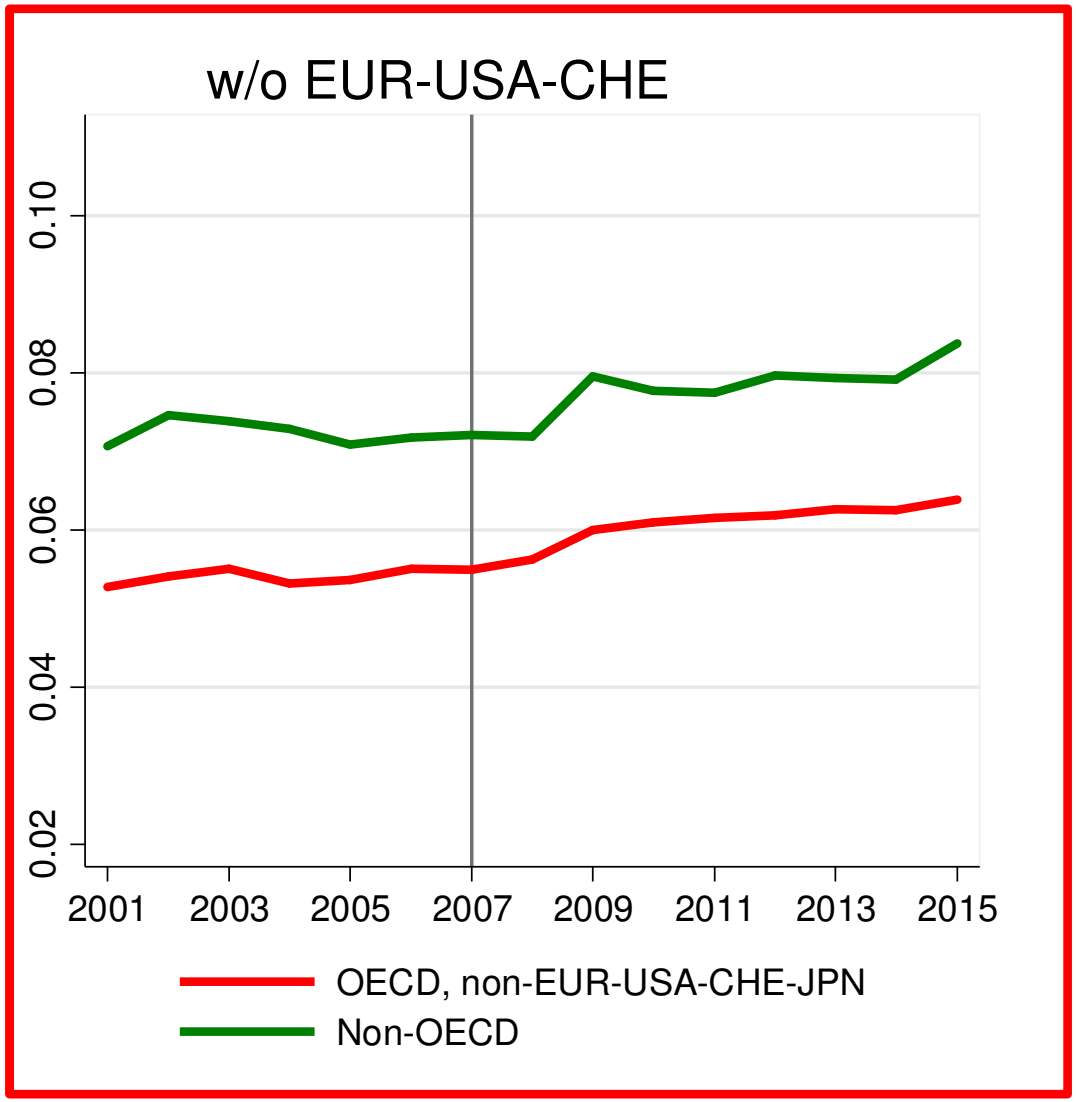


Dollarized economies



Separate economies by foreign demand





What are the drivers?

- ~~Foreign Demand~~
- Lower interest rates
- Alternative explanations:
  - shadow economy
- Crisis effect:
  - Portfolio rebalancing: shift from deposits to cash (confidence, uncertainty)
  - Temporary fall in income: Agents hold currency according to their permanent income and have not adjusted their expectations of permanent income (Friedman and Schwartz, 1963)

Can evolution of demand for currency be explained by a standard money demand model?

- Focus on changes over time, fixed effects panel model

- Average scale elasticity meaningful (<1 in non-dollarized economies)
- Currency demand reacts to interest rates

→ Part of increase due to conventional economic factors (lower interest rates)

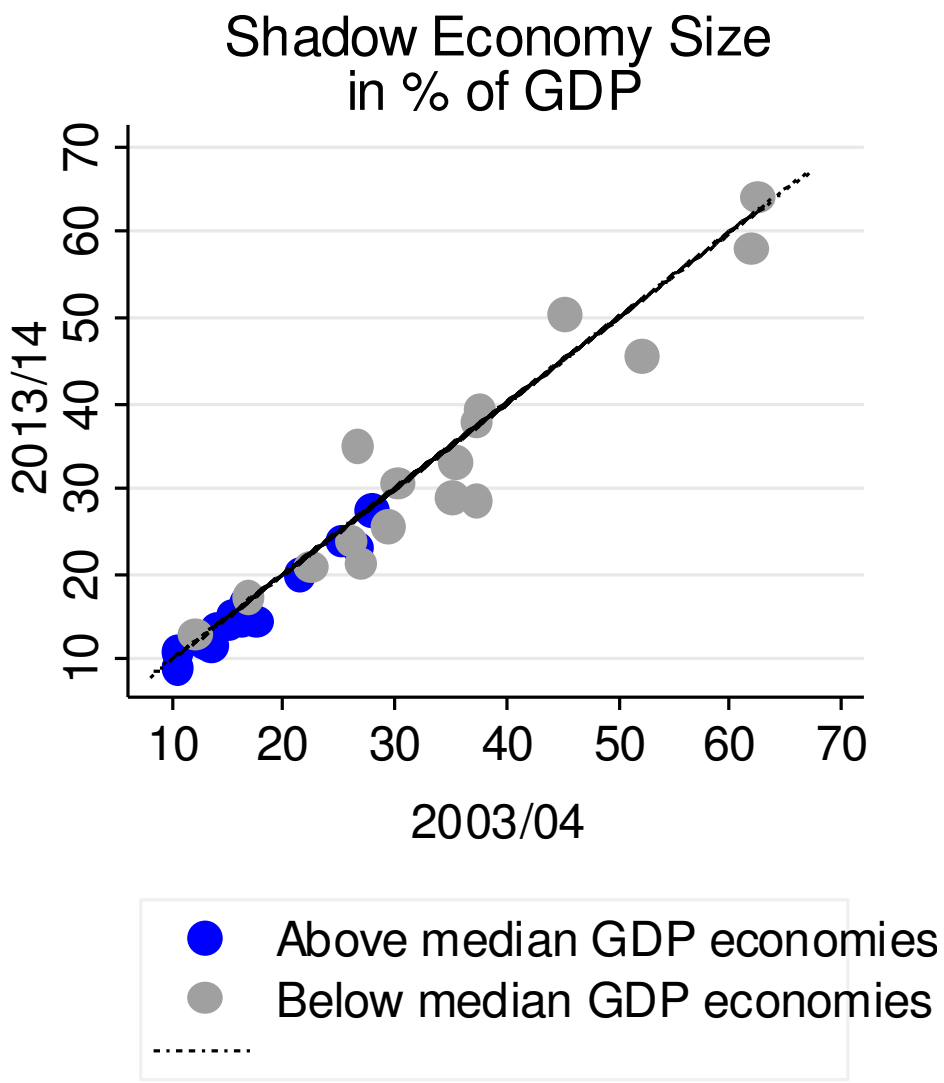
- No effect of shadow economy

Overall:

→ Before 2007: everything explained

→ 2007 and afterwards: unexplained autonomous shift in currency demand (significant year dummies)

Shadow Economy Declined in Most Economies



Change from 2003/04 to 2013/14:

- High Income OECD: decrease in 30 out of 32 economies
- Euro Area: Increase only in Spain, Portugal and Cyprus
- USA, GBR, JPN slight decrease

Source of Shadow Economy Data: F. Schneider

Separate groups of economies

- Above / below median GDP (15/14)
- Interest rate decline / increase (18/11)
- Above / below median withdrawal frequency (14/14)
- Above / below median migrants

→ Unexplained increases after 2007 for

- Above / below median GDP
- Interest rate decline / increase
- Above / below median withdrawal frequency

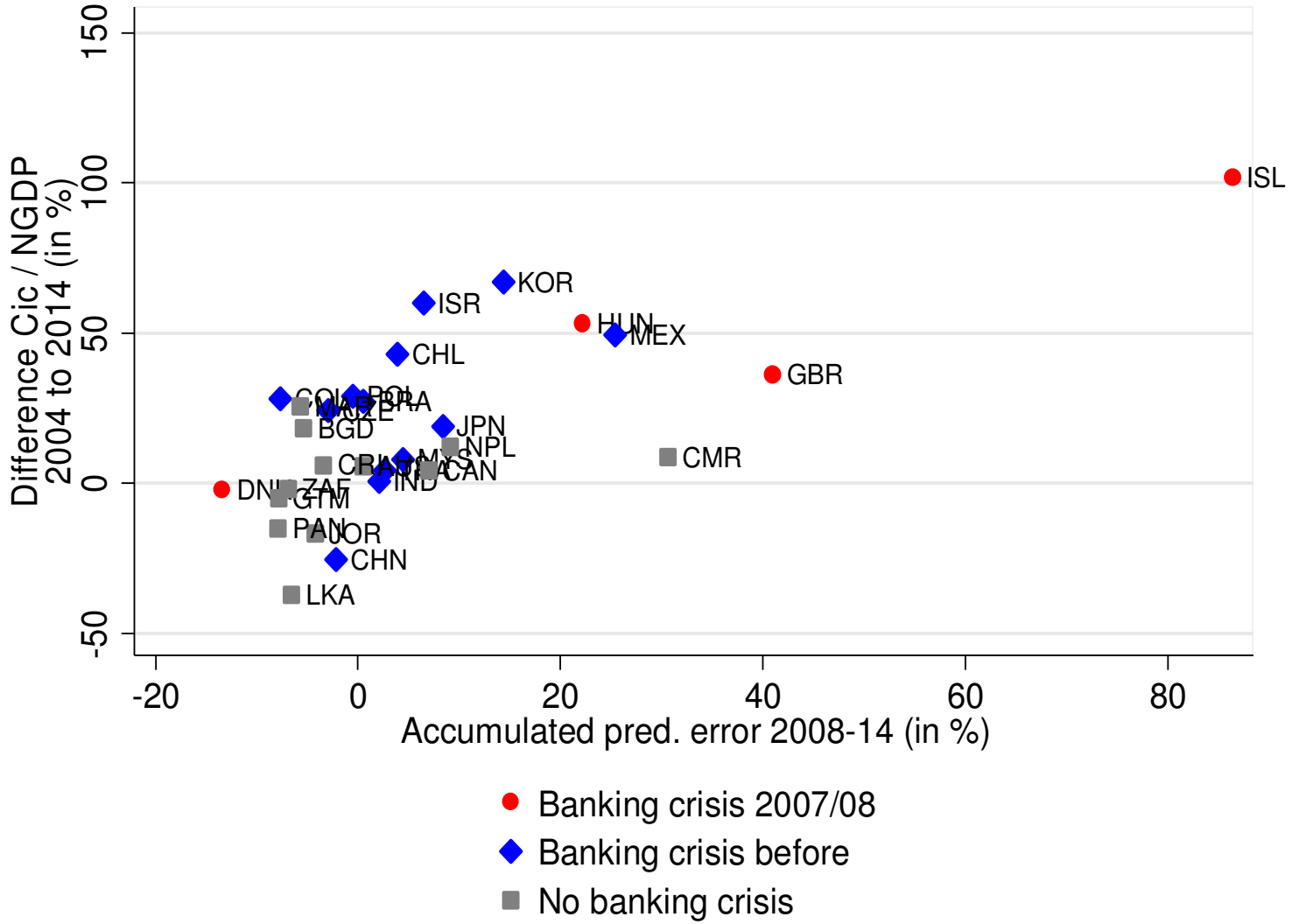
- In other economies, GDP and interest rates explain currency demand

Which other factors behind level shift?

1. Use permanent income instead of period income → does not explain entire unexplained shift

2. Alternatively: Study whether cash demand differs by financial crisis exposure and financial crisis experience
   - No data on confidence / trust
   - Compare groups of economies according to experience of a systemic financial crisis
     - Crisis in 2007/08, crisis before 2007/08 but not in 2007/08, no crisis
   - Results:
     - Higher cash demand in economies with a financial crisis in 2007/08, a financial crisis before 2007/08
     - No higher cash demand in economies without a financial crisis

Prediction Errors and change in CiC over nom. GDP ratios



Note: The figures show prediction errors from model (3) of Table 4 with year dummies omitted from the regression. The prediction errors are accummulated for the years 2008 to 2014. A value of 20% means that actual real per capita currency is 20% higher than predicted real per capita currency. Observations are grouped into (i) economies with a systemic banking

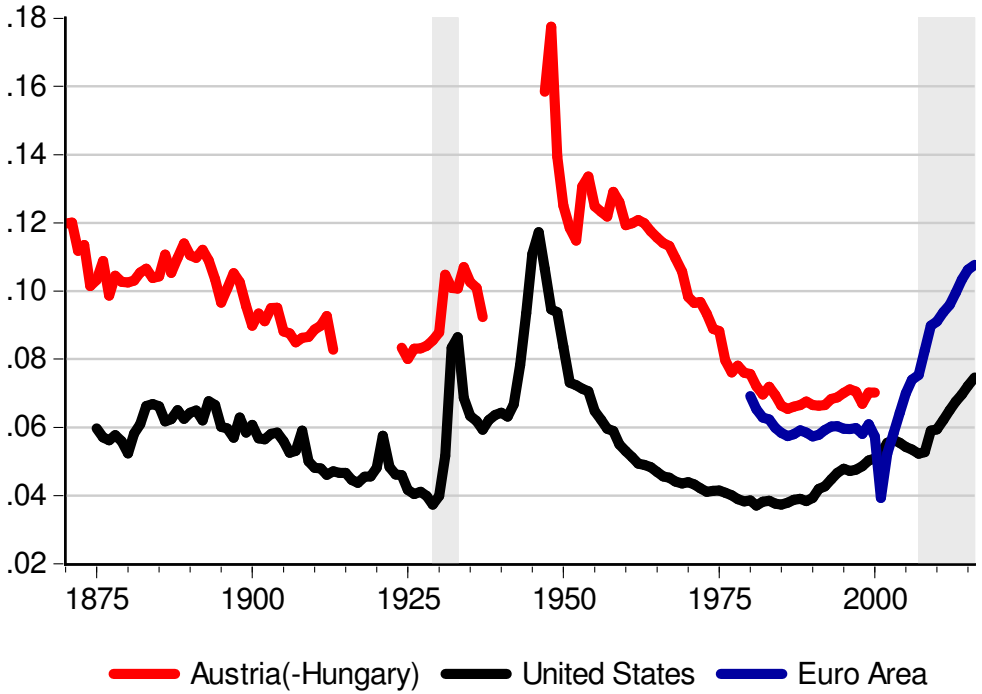
Unexplained increases in two groups:

1. Economies which experienced financial crisis (in 2007/08 or before)

2. Higher GDP economies

Difficult/impossible to identify: 80% of richer economies experienced systemic financial crises

Conclusions



- Cash is surprisingly resilient in the longer run
- In recent years, demand for currency has increased not only in the Euro Area and the US but also in many other economies
- Popular contention that cash is about to disappear is wrong – at least for the time being

Conclusions

Drivers of recent increases

- Foreign demand for EUR, USD, CHF
- Substantial part of increase is of domestic origin
- Lower interest rates

These factors cannot fully explain increases

Increases in …

- richer economies
- economies that experienced a financial crisis

Conclusions

- Cash as a safe haven asset in periods with elevated uncertainties

> *"The more uncertain the future, the greater the value of [the] flexibility [of cash] and hence the greater the demand for [it] is likely to be."*
>
> (Friedman and Schwartz, 1964, p. 673).

- Conjecture: important reason for increase in cash demand

- General: Without deep understanding of drivers of cash demand, we think that it is not a good idea to call for a replacement of cash

Thanks for your attention

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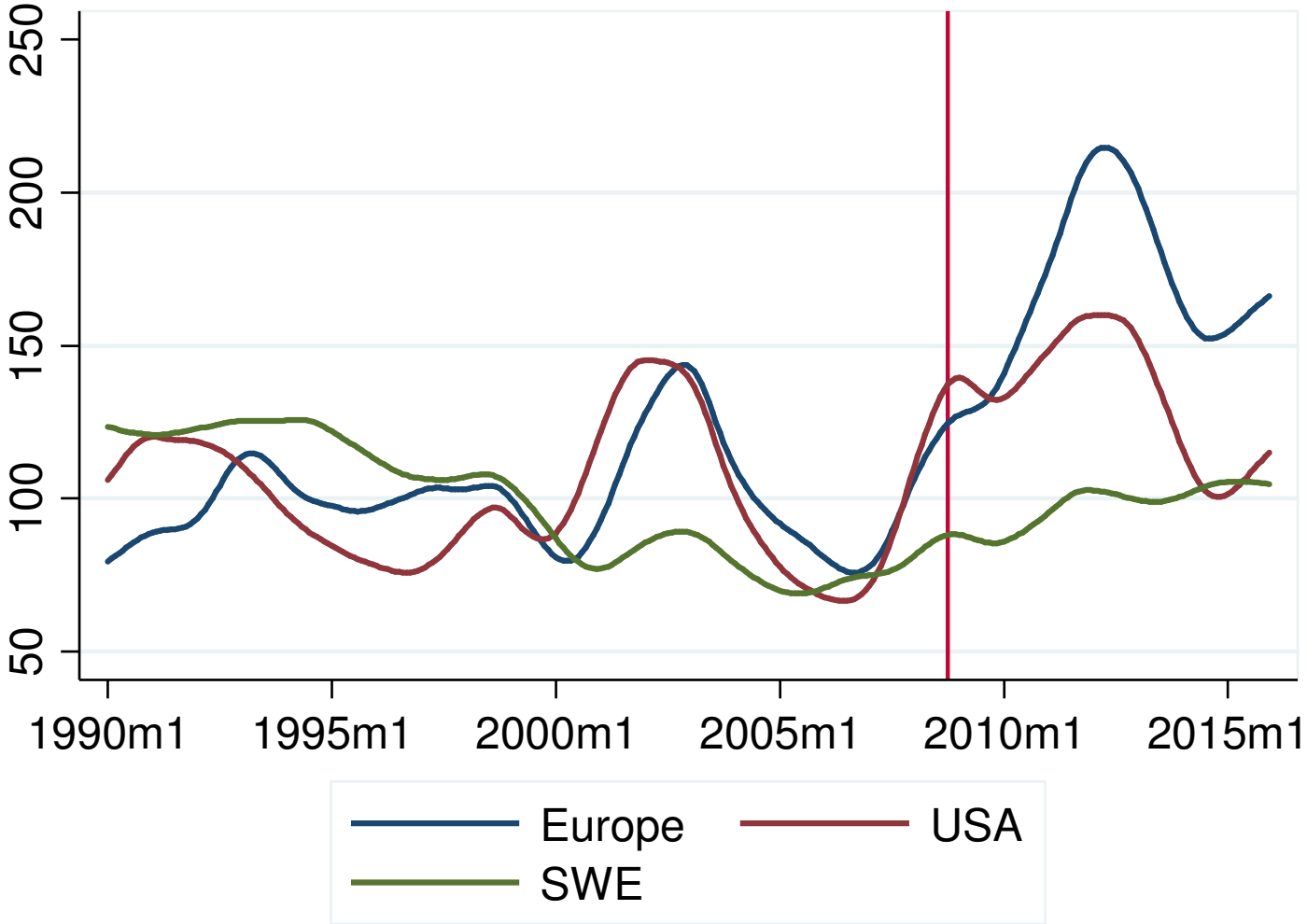
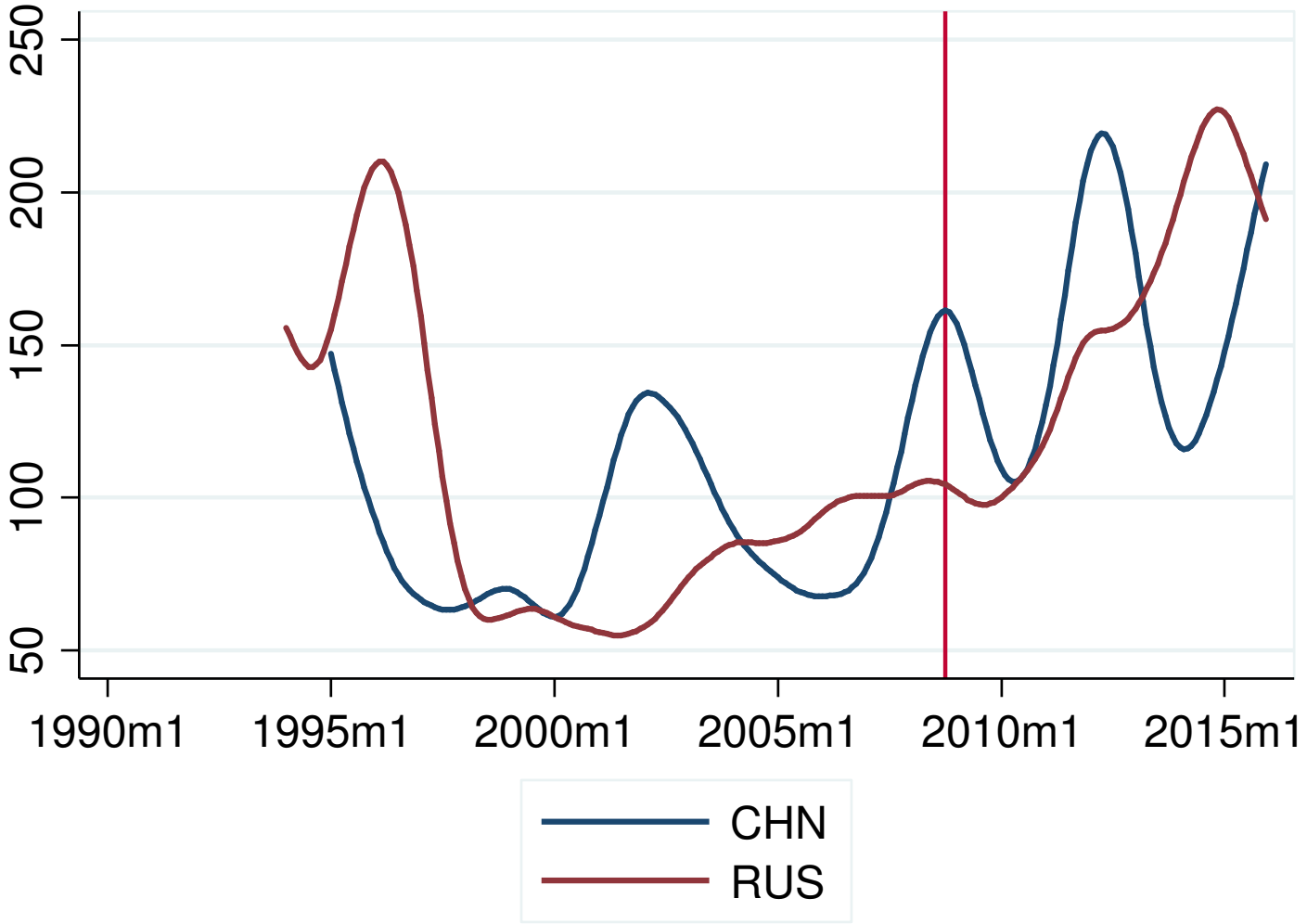
News-Based Economic Policy Uncertainty



Note: The figure shows news-based economic policy uncertainty indices. The original monthly series was HP filtered. Source: USA and Europe: Baker Scott R., Bloom Nicholas and Davis, Steven J. “Measuring Economic Policy Uncertainty”. Sweden: Armelious Hanna, Hull Isaiah and Stenbacka Köhler Hanna, "The Timing of Uncertainty Shocks in a Small Open Economy," Sveriges Riksbank Working Paper 334, December 2016. All series from www.PolicyUncertainty.com (accessed April 2017).



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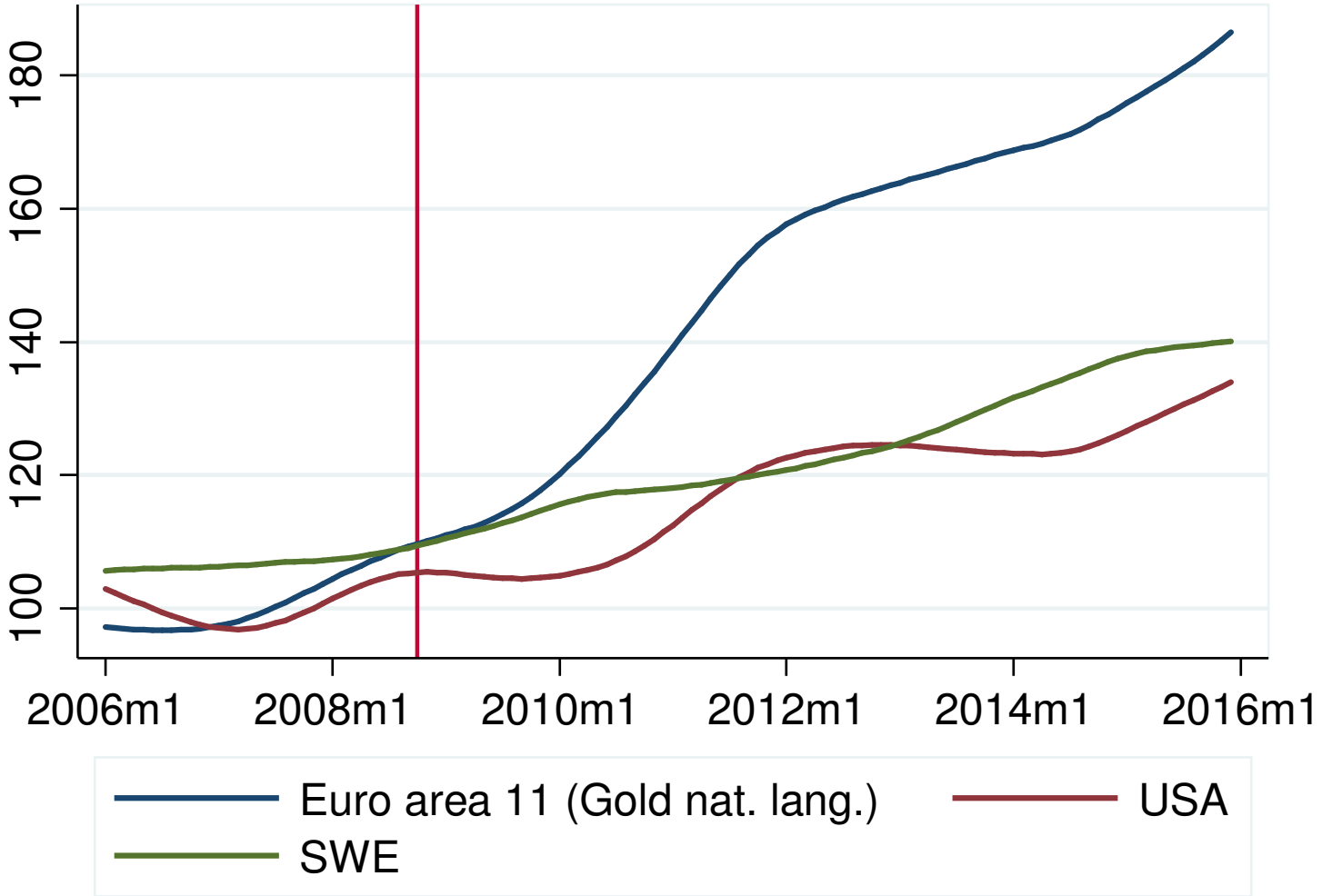
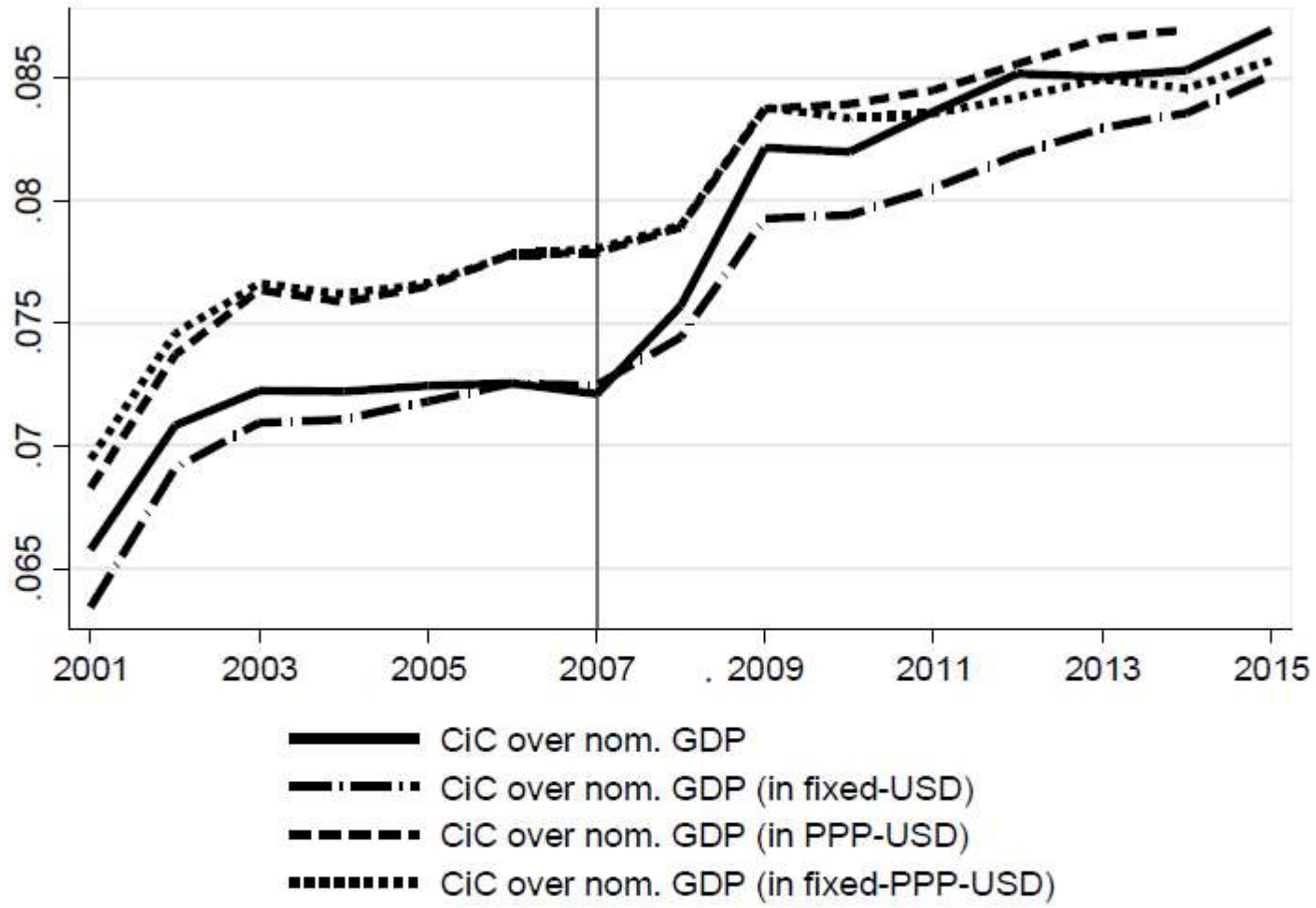
Index of Google Searches for „Gold“

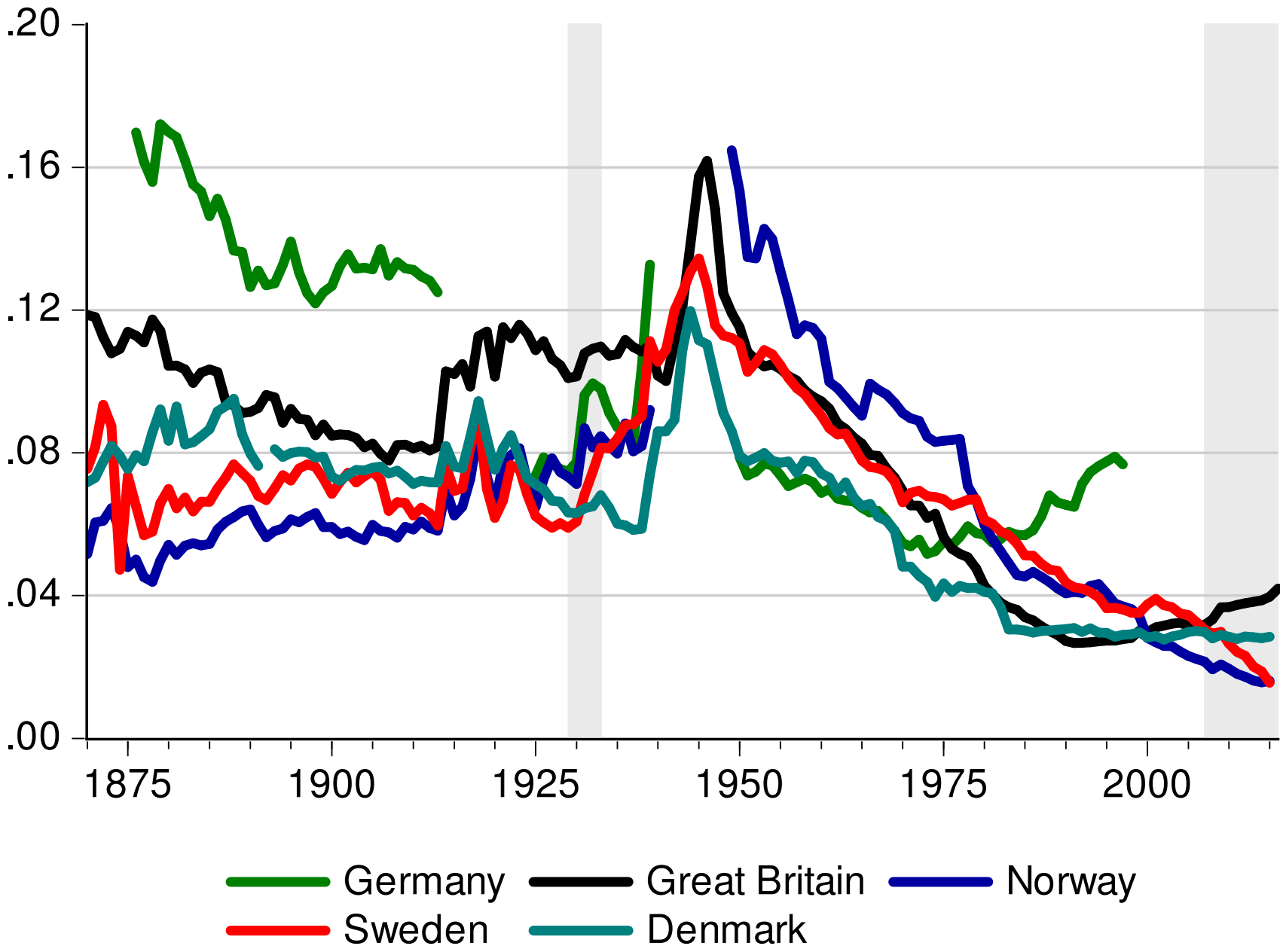


Note: The figure shows HP filtered indices of Google search trends for the word “Gold”. The series for the Euro area 11 aggregate was constructed using search terms in national language and weights according to the Eurosystem capital keys of individual economies..
Source: Google Trends (trends.google.at/trends), accessed April 2017.

Figure 8. "World" currency in circulation over nominal GDP (in %) – Different exchange rates

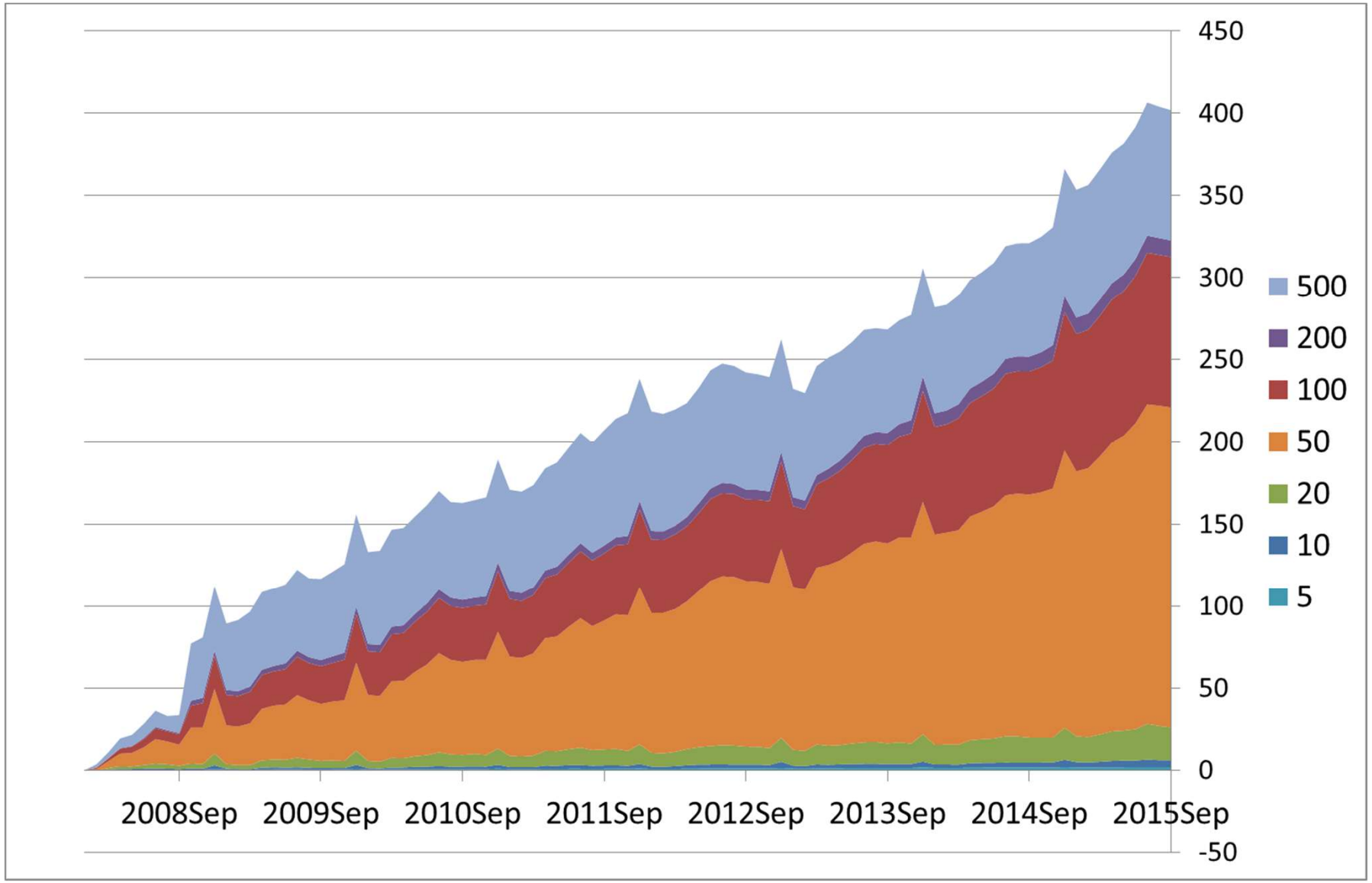


Note: The figure shows the ratio of currency over nominal GDP for all economies ("World") for several exchange rates. Only those ecoomies are included in the aggregation for which all required variables are oberved over the entire period. For this reason the figure may deviate from Figure 1. Variables are described in the Appendix.



Note: The shaded area marks the period from 1929 to 1933 and from 2007 to 2015. Sources: See Jobst and Stix 2016.

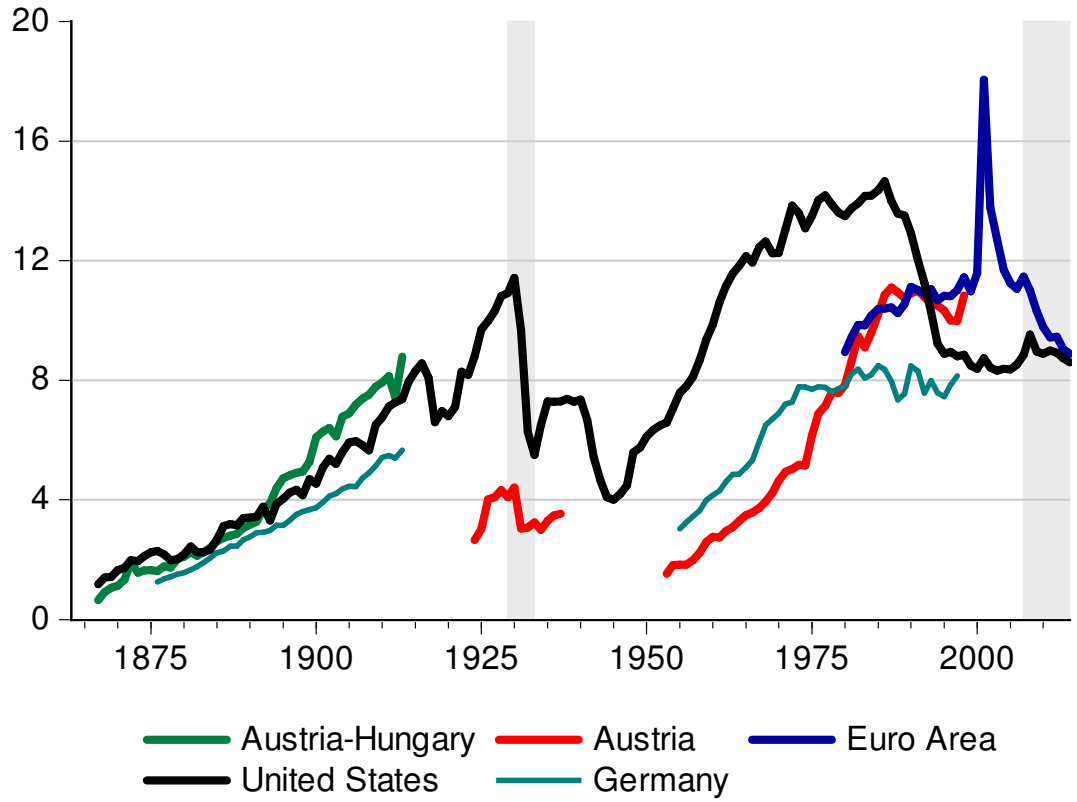
Decomposition of the Increase in EUR-CiC by Denomination Since Jan 2008



Source: ECB.

Confidence in banks

- Friedman and Schwartz (1963) highlight the importance of the deposit to currency ratio



- In the current situation less informative due to international demand

Back-of-the-Envelope Money Demand

		All (="World")	Non-Dollarized				Dollarized
			Total	EUR, USA, CHE	other OECD	other non-OECD	
Real GDP - in bn fixed USD	2004/05	44,712	41,637	24,021	15,215	2,401	3,075
	2013/14	54,888	50,322	26,385	20,447	3,489	4,566
	Change in %	23%	21%	10%	34%	45%	48%
Deposit rate	2004/05	5.75	4.76	1.78	4.45	5.54	6.95
	2013/14	4.97	3.29	0.12	2.56	4.52	7.01
	Change (in perc. points)	-0.78	-1.47	-1.65	-1.89	-1.02	0.05
Real CiC - in bn fixed USD	2004/05	3,155	2,927	1,526	1,258	142	228
	2013/14	4,743	4,357	2,270	1,833	253	387
	Change (bn USD)	1,589	1,430	744	575	111	158
	Change in %	50%	49%	49%	46%	78%	69%
(a) Income elasticity = 1, interest rate semi-elasticity -0.02							
unexplained increase / actual increase in CiC (%)		51%	50%	72%	13%	38%	30%
(b) Income elasticity = 1, interest rate semi-elasticity -0.005							
unexplained increase / actual increase in CiC (%)		54%	55%	78%	22%	41%	30%
(c) Income elasticity = 0.8, interest rate semi-elasticity -0.02							
unexplained increase / actual increase in CiC (%)		61%	59%	77%	31%	52%	47%
(d) Income elasticity = 1.2, interest rate semi-elasticity -0.02							
unexplained increase / actual increase in CiC (%)		35%	35%	66%	-15%	15%	4%

Can change in currency demand be explained by a decline in interest rates or by movements in income?

Back-of-the-envelope money demand:

*Real currency = a+ b*real GDP + c* IR*

Change from 2004/05 to 2013/14

Assume b=0.8, c=-0.02: Unexplained increase/actual increase 61%

Assume b=1, c=-0.02: Unexplained increase/actual increase 51%

Assume b=1.1, c=-0.02: Unexplained increase/actual increase 35%

→ Explained share increases with income elasticity

→ Income elasticity >1 → Currency as a store of wealth

→ Unexplained portion substantial

Country coverage and Aggregation

- Roughly 80 countries, covering 95% of world GDP

- Non-dollarized OECD economies (22 economies): Norway (NOR), Switzerland (CHE), United States (USA), Denmark (DNK), Sweden (SWE), Australia (AUS), Canada (CAN), Iceland (ISL), United Kingdom (GBR), Euro Area (EUR), Japan (JPN), New Zealand (NZL), South Korea (KOR), Israel (ISR), Czech Republic (CZE), Hungary (HUN), Poland (POL), Chile (CHL), Mexico (MEX), South Africa (ZAF), Colombia (COL), China (CHN).
- Non-dollarized non-OECD economies (23 economies): Qatar (QAT), Kuweit (KWT), Singapore (SGP), Oman (OMN), Hong Kong (HKG), Saudi Arabia (SAU), Malaysia (MYS), Venezuela (VEN), Brazil (BRA), Thailand (THA), Algeria (DZA), Costa Rica (CRI), Jordan (JOR), Dominican Republic (DOM), Sri Lanka (LKA), Guatemala (GTM), Morocco (MAR), India (IND), Cote d'Ivoire (CIV), Cameroon (CMR), Bangladesh (BGD), Nepal (NPL), Ethiopia (ETH).
- Dollarized economies (40 economies): Russia (RUS), Croatia (HRV), Kazakhstan (KAZ), Romania (ROU), Turkey (TUR), Uruguay (URY), Lebanon (LBN), Azerbaijan (AZE), Belarus (BLR), Bulgaria (BGR), Serbia (SRB), Macedonia (MKD), Egypt (EGY), Peru (PER), Albania (ALB), Bosnia and Herzegovina (BIH), Indonesia (IDN), Ukraine (UKR), Angola (AGO), Paraguay (PRY), Armenia (ARM), Georgia (GEO), Philippines (PHL), Bolivia (BOL), Nigeria (NGA), Vietnam (VNM), Pakistan (PAK), Moldova (MDA), Ghana (GHA), Kyrgyzstan (KGZ), Tajikistan (TJK), Kenya (KEN), Tanzania (TZA), Uganda (UGA). The following six economies are included in the sample, however no PPP rates are available: Argentina (ARG), Lithuania (LTU), Estonia (EST), Slovak Republic (SVK), Latvia (LVA), Slovenia (SVN).

- Harmonization issues: Data are not perfect and comparability is an issue – CiC series, nom. GDP - GNI would be better, which exchange rate to use.
- Exchange rate: Fixed USD rates 2006, robustness checks with different x-rates does not change results

Can evolution of demand for currency be explained by a standard money demand model?

$$Real\ p.c.\ currency_{it} = a + b_i * real\ p.c.\ GDP_{it} + c * IR_{it} + $$
$$+ d*Dummy\ 2007 + e*Dummy\ 2008 + \ldots Dummy\ 2014 + u_{it}$$

where *i* denotes countries 1,…,N

t denotes years 1,…,T.

- Fixed effects model to account for unobserved structural country characteristics
- Scale elasticity b_i allowed to vary over countries → try to avoid misspecification
- All specifications omit EUR, USD, SFR, HKD and SGD

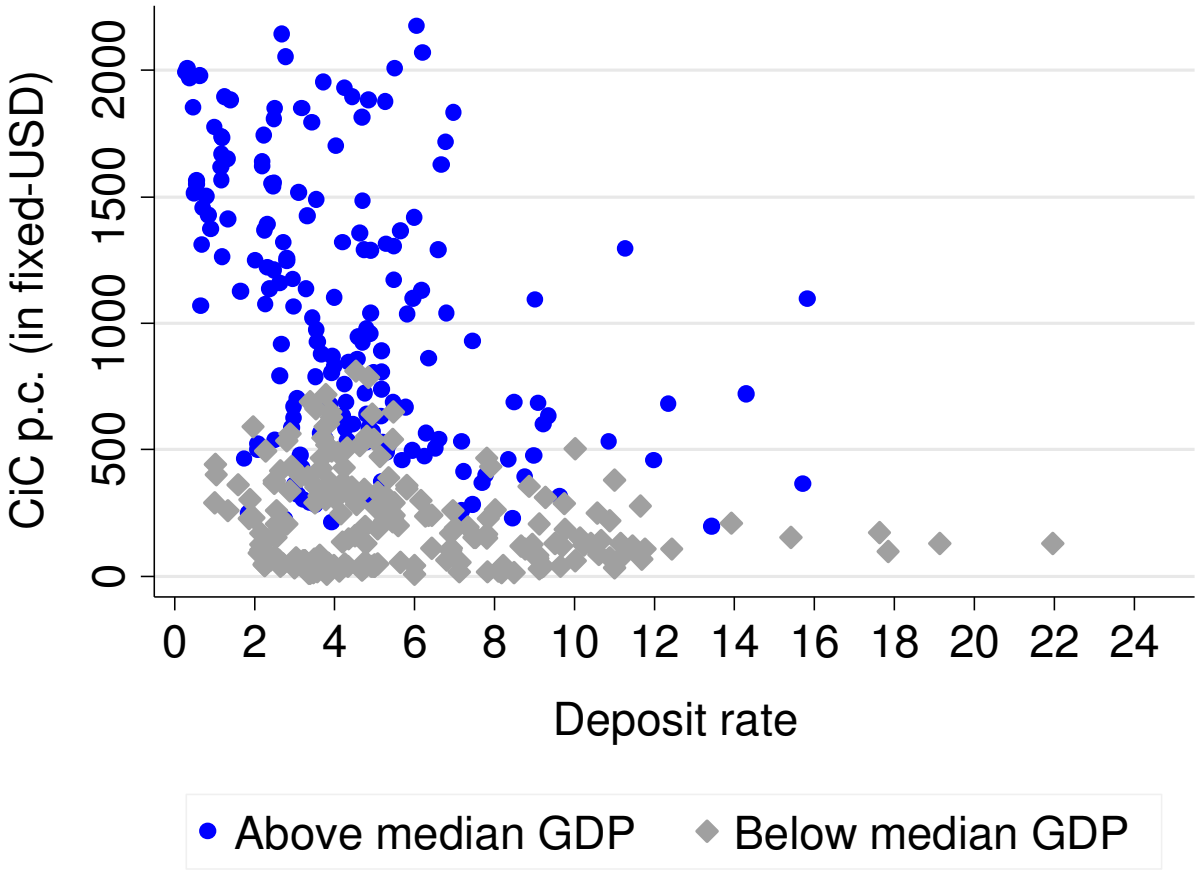
Panel A. Semi-log specification

	All	All	Non-Dollarized	Dollarized
	(1)	(2)	(3)	(4)
Deposit rate	-0.020***	-0.020***	-0.025***	-0.016***
	(0.005)	(0.005)	(0.006)	(0.005)
Ln Share shadow ecnmy	-0.025	-0.048	-0.055	0.004
	(0.100)	(0.113)	(0.159)	(0.161)
2007		0.081***	0.056**	0.103***
		(0.018)	(0.022)	(0.027)
2008		0.075***	0.089**	0.051
		(0.026)	(0.036)	(0.036)
2009		0.099***	0.088***	0.087**
		(0.027)	(0.030)	(0.041)
2010		0.093***	0.087**	0.076*
		(0.032)	(0.041)	(0.042)
2011		0.091**	0.116**	0.041
		(0.035)	(0.045)	(0.045)
2012		0.117***	0.134**	0.072
		(0.039)	(0.050)	(0.052)
2013		0.111**	0.138**	0.051
		(0.043)	(0.055)	(0.056)
2014		0.121**	0.165***	0.036
		(0.049)	(0.058)	(0.069)
Mean income elasticity	1.40	1.01	0.77	1.29
R2-within	0.89	0.90	0.90	0.91
R2-between	0.14	0.07	0.25	0.00
R2-overall	0.14	0.07	0.25	0.00
log-L	832.6	869.8	527.2	383.7
N	787	787	401	386
N-economies	58	58	29	29

	Above median GDP	Below median GDP	Interest rate decline	Interest rate increase	Above median withdrawal frequency	Below median withdrawal frequency	Above median share migrants	Below median share migrants
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Deposit rate	-0.024**	-0.017***	-0.028***	-0.013*	-0.015***	-0.019***	-0.025**	-0.020***
	(0.010)	(0.004)	(0.007)	(0.006)	(0.004)	(0.005)	(0.011)	(0.005)
Deposit rate <1%	-0.078		-0.081	-0.021	0.005		-0.107	-0.071**
	(0.062)		(0.068)	(0.033)	(0.023)		(0.092)	(0.025)
Ln Share shadow ecnmy	0.234	-0.081	0.042	-0.105	0.183	-0.045	0.119	0.044
	(0.320)	(0.113)	(0.211)	(0.212)	(0.190)	(0.146)	(0.256)	(0.142)
2007	0.046	0.036	0.072**	0.017	0.017	0.070**	0.045	0.092**
	(0.029)	(0.032)	(0.027)	(0.018)	(0.028)	(0.032)	(0.031)	(0.028)
2008	0.123**	0.016	0.126**	0.012	0.051	0.071	0.085	0.102**
	(0.055)	(0.040)	(0.047)	(0.026)	(0.035)	(0.045)	(0.057)	(0.042)
2009	0.108***	0.027	0.102**	0.056	0.063**	0.081	0.079*	0.105**
	(0.036)	(0.040)	(0.041)	(0.032)	(0.022)	(0.048)	(0.043)	(0.039)
2010	0.118*	0.009	0.109*	0.034	0.049	0.070	0.101	0.119**
	(0.056)	(0.046)	(0.057)	(0.030)	(0.031)	(0.052)	(0.068)	(0.039)
2011	0.158**	0.020	0.143**	0.050	0.087**	0.085	0.147*	0.130**
	(0.057)	(0.052)	(0.058)	(0.043)	(0.038)	(0.060)	(0.070)	(0.047)
2012	0.191***	0.017	0.173**	0.046	0.101**	0.106	0.191**	0.138**
	(0.064)	(0.059)	(0.064)	(0.054)	(0.040)	(0.072)	(0.082)	(0.054)
2013	0.197***	-0.005	0.164**	0.050	0.118**	0.096	0.182**	0.135*
	(0.065)	(0.061)	(0.068)	(0.056)	(0.049)	(0.082)	(0.084)	(0.065)
2014	0.241***	0.012	0.216***	0.051	0.152**	0.125	0.227**	0.145
	(0.064)	(0.064)	(0.074)	(0.063)	(0.057)	(0.088)	(0.085)	(0.079)
Mean income elasticity	1.04	0.99	0.65	1.08	1.22	0.72	0.74	0.83

	Scale variable Ln GDP			Scale variable Ln GDP (moving avg)		
	All	All	All	All	Above median GDP	Below median GDP
	(1)	(2)	(3)	(4)	(5)	(6)
GDP growth <0%		0.017				
		(0.025)				
GDP growth <0.5%			0.014			
			(0.016)			
2007	0.061**	0.060**	0.060**	0.063***	0.041	0.049
	(0.023)	(0.023)	(0.023)	(0.019)	(0.024)	(0.039)
2008	0.093**	0.092**	0.088**	0.079**	0.090*	0.015
	(0.038)	(0.037)	(0.035)	(0.032)	(0.046)	(0.057)
2009	0.093***	0.085***	0.087***	0.055	0.034	0.007
	(0.032)	(0.031)	(0.031)	(0.034)	(0.043)	(0.067)
2010	0.094**	0.091**	0.088**	0.058	0.052	-0.009
	(0.045)	(0.042)	(0.042)	(0.039)	(0.049)	(0.076)
2011	0.122**	0.120**	0.115**	0.089**	0.100*	-0.003
	(0.048)	(0.047)	(0.044)	(0.043)	(0.051)	(0.083)
2012	0.144**	0.142**	0.136**	0.113**	0.134**	-0.001
	(0.055)	(0.053)	(0.050)	(0.048)	(0.056)	(0.094)
2013	0.145**	0.143**	0.135**	0.112*	0.141*	-0.029
	(0.058)	(0.057)	(0.054)	(0.056)	(0.066)	(0.104)
2014	0.174***	0.172***	0.162***	0.132**	0.171**	-0.020
	(0.062)	(0.061)	(0.057)	(0.060)	(0.068)	(0.109)
Mean income elasticity	0.74	0.75	0.77	0.79	1.06	1.09

Interest Rates



- Decline in interest rates affects currency demand
- Variation at very low interest rates

	Economies **without** systemic banking crises			Economies **with** systemic banking crises before 2007 but not in 2007/08		
	Scale variable Ln GDP fix	Scale variable Ln GDP variable	Scale variable: Ln GDP (moving avg) variabel	Scale variable Ln GDP fix	Scale variable Ln GDP variable	Scale variable: Ln GDP (moving avg) variabel
	(1)	(2)	(3)	(4)	(5)	(6)
2007	0.034	0.047	0.066*	0.089***	0.030	0.038*
	(0.029)	(0.034)	(0.037)	(0.021)	(0.021)	(0.020)
2008	0.013	0.024	0.040	0.151***	0.088***	0.076**
	(0.034)	(0.042)	(0.051)	(0.030)	(0.029)	(0.030)
2009	0.047	0.024	0.029	0.172***	0.114***	0.061
	(0.039)	(0.039)	(0.060)	(0.025)	(0.026)	(0.036)
2010	0.032	0.006	0.014	0.165***	0.100***	0.055
	(0.035)	(0.048)	(0.070)	(0.034)	(0.029)	(0.040)
2011	0.020	0.014	0.021	0.211***	0.143***	0.103**
	(0.031)	(0.047)	(0.068)	(0.041)	(0.033)	(0.045)
2012	0.020	0.025	0.034	0.244***	0.160***	0.126**
	(0.037)	(0.055)	(0.076)	(0.053)	(0.045)	(0.054)
2013	0.013	0.005	0.017	0.275***	0.180***	0.129*
	(0.036)	(0.056)	(0.084)	(0.061)	(0.053)	(0.069)
2014	0.033	0.031	0.035	0.305***	0.212***	0.151*
	(0.045)	(0.056)	(0.085)	(0.068)	(0.062)	(0.082)
Mean income elasticity		0.77	0.69		1.18	1.22

Some descriptive statistics

- Which economies important for currency in circulation?

	% Share 2012
Euro Area	21%
United States	19%
Japan	18%
China	14%
Russia	4%
India	3%

- … in terms of per capita circulation?

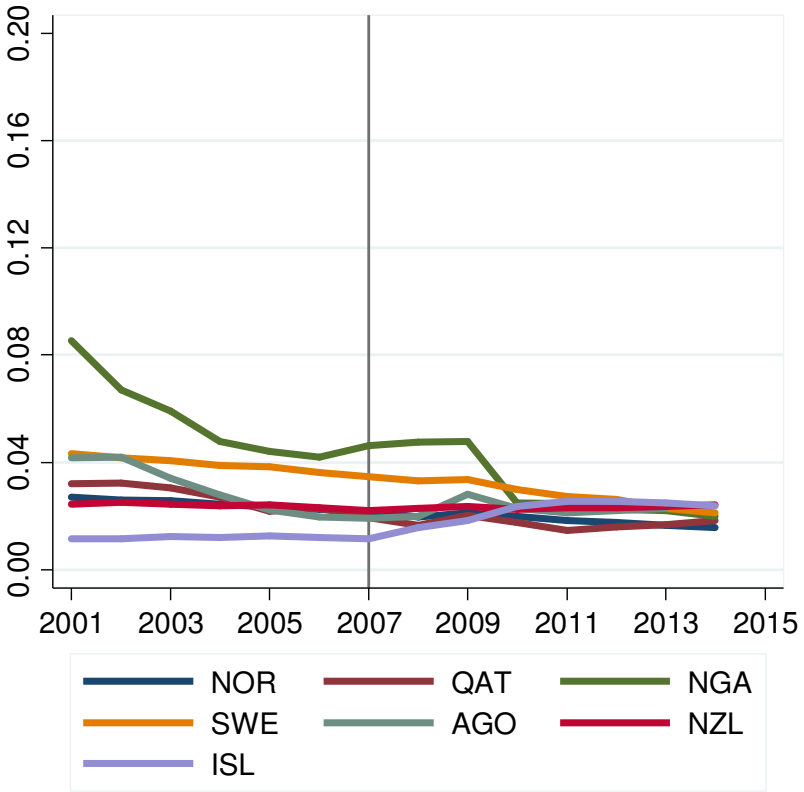
	pc CiC (in USD) 2014
Switzerland	9010
Japan	7001
Hong Kong	5874
Singapore	4546
Euro Area	4083
United States	4059

Note: Own calculations. Source: IMF, OECD, national central banks.

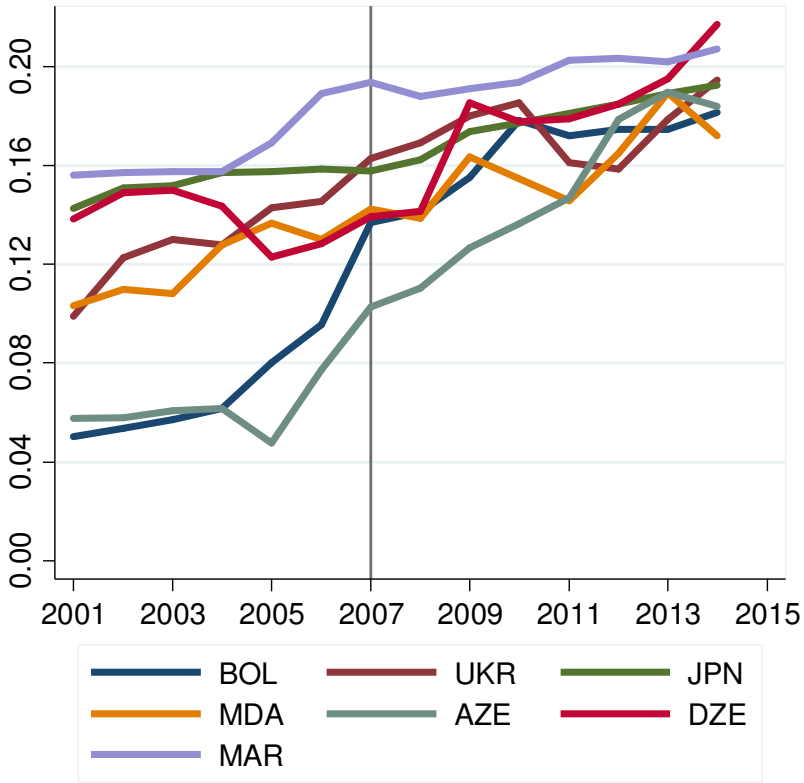
Large dispersion across economies

Currency in Circulation over Nominal GDP (in %)

Lowest ratio

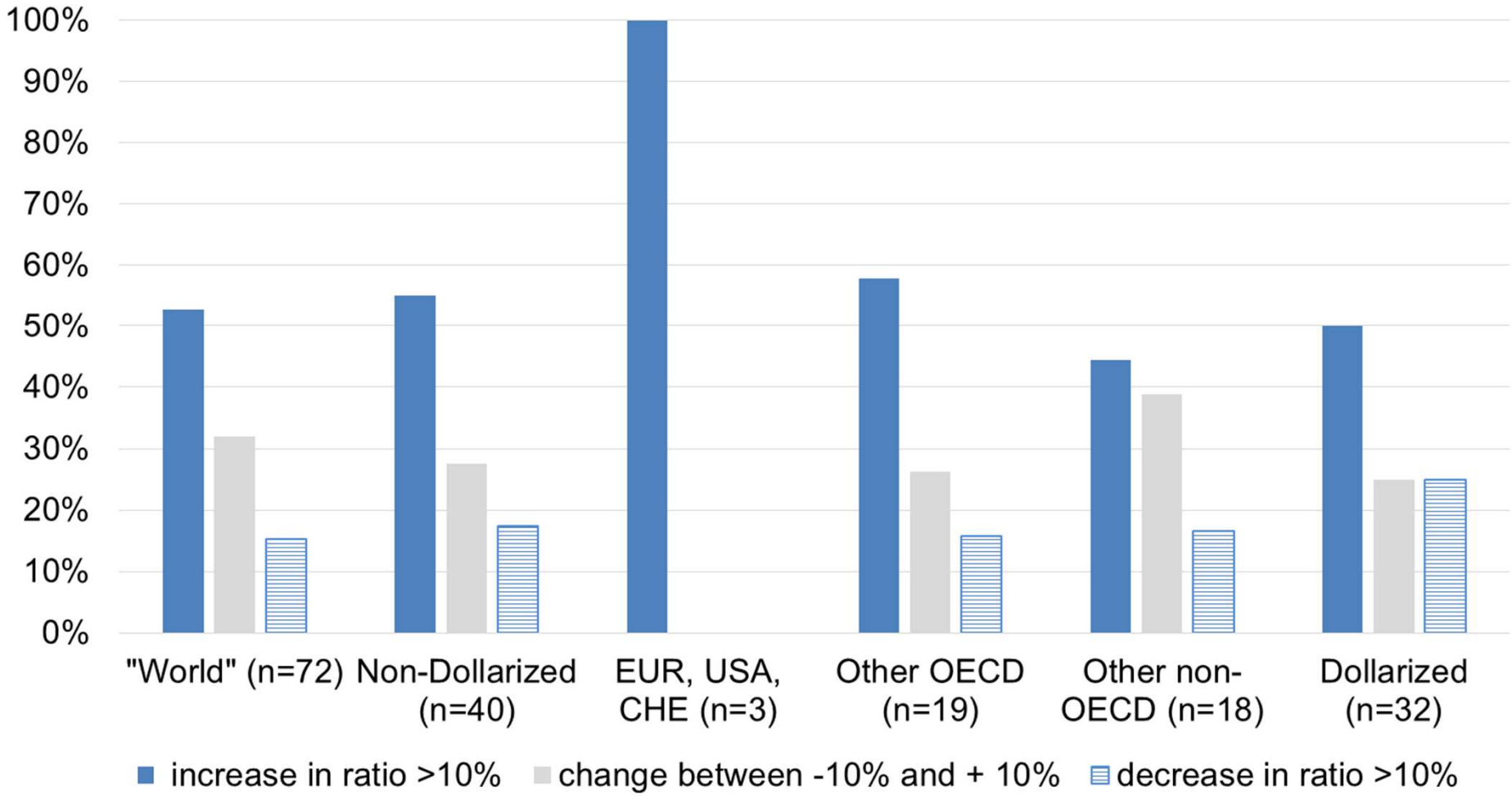


Highest ratio



Note: The left panel shows the 7 economies with the lowest ratio as of 2013. The right panel shows the 7 economies with the highest ratio as of 2013. Own calculations. Data: IMF, OECD, national central banks.

Changes in currency in circulation over nominal GDP ratios from 2004 to 2014



Source: Jobst and Stix (2017).
Note: The chart shows descriptive statistics about changes in the currency in circulation over nominal GDP ratios over the period from 2004/05 to 2013/14 for the "World" and several sub-aggregates. The group size is indicated in parenthesis. Averages are taken for 2004/05 and 2013/14 to reduce the effect of outliers.