

Money Demand and Income Inequality: International Evidence using a Century of Data

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Money and Inequality: from theory to data

Theory:

- ▶ Laidler [1985] points out that the “key prediction of transactions and precautionary theories (of money demand) is that there should exist economies of scale in money holding, particularly where narrow money is concerned”.

Evidence:

- ▶ Microdata: Erosa and Ventura [2002], Ragot [2014], Lippi and Secchi [2009]: USA and Italy.
- ▶ Macrodata: [Cover and Hooks \[1993\] \(CH henceforth\)](#) and [this paper](#).
 - ▶ CH test the link between aggregate money demand and income inequality, using Gini coefficient data for USA for the 1947-1988 period.
 - ▶ I extend the empirical exercise of CH: longer time period (1916-2016) and many countries, using top income shares.

Non-homothetic money demand: aggregation

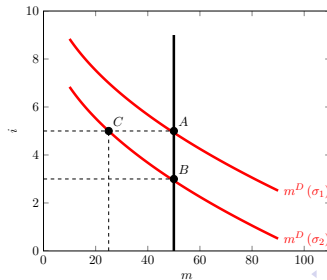
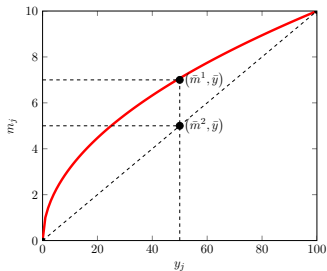
- ▶ Transactions theories imply that richer households hold less money relative to income than do poorer households.
- ▶ We thus expect aggregate money demand to decline as income inequality increases.
 - ▶ Anytime individual demand functions are nonlinear, the aggregate demand is a function of the distribution of income (Bertola, Foellmi and Zweimüller [2014]).
 - ▶ A formal proof for the money demand case can be found in Pfähler and Wiese [1990].

Baumol-Tobin case:

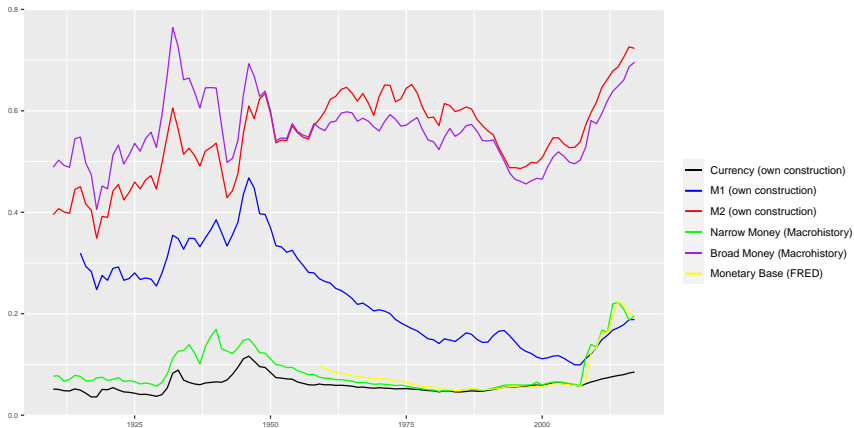
- ▶ Individual money demand: $m_t^j = \sqrt{\frac{by_t^j}{2i_t}}$ where y_t^j is real income of household j , i_t is the nominal interest rate and b is a transaction cost.
- ▶ Aggregate money demand:

$$M_t = \sum_{j=1}^N \left(\frac{by_t^j}{2i_t} \right)^{.5} = \left(\frac{b}{2i_t} \right)^{.5} \sum_{j=1}^N \left(y_t^j \right)^{.5}$$

Money and inequality in equilibrium: $m_t = f \left(\begin{matrix} y_t, i_t, \sigma_t \\ + \quad - \quad - \end{matrix} \right)$



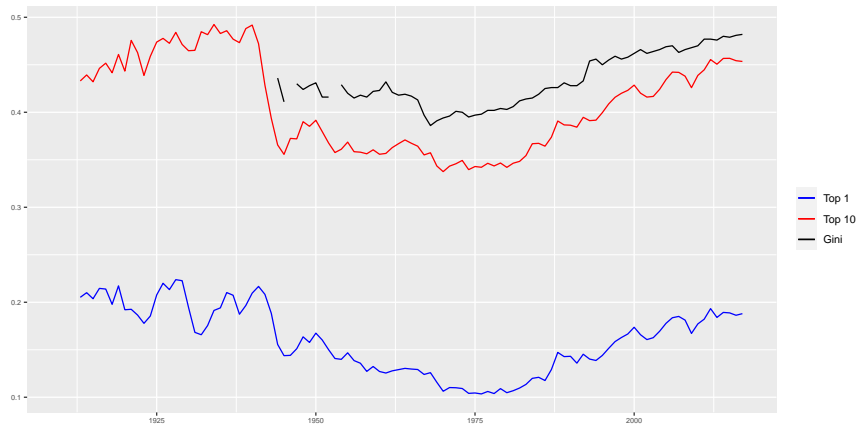
USA Data: Monetary Aggregates (as a fraction of GDP)



Source: Own calculation based on several sources (see appendix) and Macrohistory database (Jordà-Schularick-Taylor).

Note: $k = \frac{M}{PY} = \frac{1}{V}$ ("Cambridge equation").

USA Data: Inequality



Source: WID and WIID.

Regression

First differences (following specification in CH):

$$\Delta \log(m_t) = \gamma_0 + \gamma_1 \Delta \log(x_t) + \gamma_2 \Delta \log(i_t) + \gamma_3 \Delta \log(m_{t-1}) + \gamma_4 \Delta \log(\sigma_t) + \varepsilon_t \quad (1)$$

where x_t can be either real income (GDP) or consumption, Δ is the yearly difference, m_{t-1} is the lagged real money balance and where ε_t is the error term.

Table: USA (Subsample 1946-1973): M1 Money Demand and Inequality, First Difference Regression

	<i>Dependent variable:</i>					
	FD Log M1					
	(1)	(2)	(3)	(4)	(5)	(6)
FD Log GDP	0.50*** (0.14)	0.48*** (0.14)			0.55*** (0.13)	
FD Log Cons.			0.48 (0.35)	1.03*** (0.37)		0.88** (0.37)
FD Int. Rate	-0.01** (0.004)	-0.01** (0.004)	-0.01 (0.005)	-0.01** (0.004)	-0.01** (0.004)	-0.01 (0.004)
Lagged FD Log M	0.34** (0.13)	0.36*** (0.13)	0.12 (0.19)	-0.01 (0.18)	0.33** (0.12)	-0.03 (0.19)
FD Top 10		-0.76 (0.64)		-2.23** (0.81)		
FD Top 1					-1.65** (0.78)	-2.27** (1.05)
Constant	-0.01* (0.01)	-0.01* (0.01)	-0.02 (0.01)	-0.04** (0.01)	-0.02** (0.01)	-0.03** (0.02)
Observations	28	28	28	28	28	28
R ²	0.45	0.48	0.21	0.41	0.54	0.34
Adjusted R ²	0.38	0.39	0.11	0.30	0.46	0.23

Note:

* p<0.1; ** p<0.05; *** p<0.01

What I find

USA evidence:

- ▶ Support of the theory only for a subsample (Bretton Woods period, 1946-1973). Not for entire period nor War/Interwar period 1916-1945 nor Great Moderation period 1985-2007.
- ▶ Robustness: similar results with Lucas-Nicolini [2015] “New” M1 measure in USA.
- ▶ Other side of the coin: “remunerated accounts” (M2-M1): positive and significant for entire period.
- ▶ Comparison with CH (1944-1988 period): Top income shares not statistically significant but Gini coefficient is positive, as CH report. Why?

International evidence:

- ▶ Macrohistory database issues.
- ▶ To do: get Benati et al. [2020] international M1 data.

Concluding remarks

Policy implications:

- ▶ Distributional impact of monetary policy: the inflation tax is regressive.

Macro theory implications:

- ▶ Non-homothetic money demand in models with inequality (in the lines of Allais et al. [2020]).

Thank you!

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Appendix

Table: USA (Subsample 1946-1973): M2 Money Demand and Inequality, First Difference Regression

	<i>Dependent variable:</i>					
	FD Log M2					
	(1)	(2)	(3)	(4)	(5)	(6)
FD Log GDP	0.44** (0.18)	0.47*** (0.17)			0.42** (0.18)	
FD Log Cons.			0.50 (0.38)	0.27 (0.45)		0.45 (0.44)
FD Int. Rate	-0.01** (0.01)	-0.01** (0.005)	-0.01** (0.01)	-0.01* (0.01)	-0.01** (0.01)	-0.01* (0.01)
FD FD Lagged Log M	0.04 (0.15)	0.01 (0.15)	-0.15 (0.20)	-0.10 (0.20)	0.05 (0.16)	-0.13 (0.22)
FD Top 10		1.58* (0.77)		1.03 (1.04)		
FD Top 1					0.46 (1.08)	0.29 (1.32)
Constant	0.02** (0.01)	0.02** (0.01)	0.03* (0.01)	0.03* (0.02)	0.02** (0.01)	0.03 (0.02)
Observations	28	28	28	28	28	28
R ²	0.30	0.41	0.18	0.21	0.31	0.18
Adjusted R ²	0.21	0.31	0.08	0.08	0.19	0.04

Note:

* p<0.1; ** p<0.05; *** p<0.01

Table: USA (Subsample 1945-1973): Currency Demand and Inequality, First Difference Regression

	<i>Dependent variable:</i>					
	FD Log currency					
	(1)	(2)	(3)	(4)	(5)	(6)
FD Log GDP	0.72*** (0.19)	0.71*** (0.20)			0.77*** (0.19)	
FD Log Cons.			0.33 (0.48)	0.73 (0.56)		0.69 (0.56)
FD Int. Rate	-0.001 (0.01)	-0.001 (0.01)	0.003 (0.01)	0.001 (0.01)	-0.001 (0.01)	0.002 (0.01)
FD FD Lagged Log M	0.35** (0.13)	0.36** (0.14)	0.19 (0.20)	0.12 (0.20)	0.33** (0.13)	0.07 (0.22)
FD Top 10		-0.46 (0.92)		-1.71 (1.31)		
FD Top 1					-1.71 (1.15)	-2.01 (1.68)
Constant	-0.02** (0.01)	-0.02** (0.01)	-0.01 (0.02)	-0.03 (0.02)	-0.02** (0.01)	-0.03 (0.02)
Observations	28	28	28	28	28	28
R ²	0.44	0.44	0.13	0.19	0.49	0.18
Adjusted R ²	0.37	0.35	0.02	0.05	0.40	0.04

Note:

* p<0.1; ** p<0.05; *** p<0.01

Table: USA 1915-2016, Levels: M1 Money Demand and Inequality

	<i>Dependent variable:</i>					
	M1					
	(1)	(2)	(3)	(4)	(5)	(6)
GDP	0.65*** (0.02)	0.58*** (0.02)			0.58*** (0.02)	
Cons.			0.62*** (0.03)	0.55*** (0.02)		0.54*** (0.02)
Int. Rate	-0.09*** (0.02)	-0.17*** (0.01)	-0.08*** (0.02)	-0.18*** (0.02)	-0.16*** (0.02)	-0.17*** (0.02)
Top 10		-1.48*** (0.14)		-2.06*** (0.15)		
Top 1					-0.66*** (0.09)	-0.93*** (0.11)
Constant	-0.30*** (0.07)	-1.34*** (0.11)	-8.11*** (0.41)	-8.65*** (0.25)	-1.25*** (0.15)	-8.42*** (0.32)
Observations	103	103	103	103	103	103
R ²	0.92	0.96	0.86	0.95	0.95	0.92
Adjusted R ²	0.92	0.96	0.86	0.95	0.94	0.91

Note:

* p<0.1; ** p<0.05; *** p<0.01

Table: USA: M1 Money Demand and Inequality, First Difference Regression, 1915-2016

	<i>Dependent variable:</i>					
	FD Log M1					
	(1)	(2)	(3)	(4)	(5)	(6)
FD Log GDP	0.31*** (0.08)	0.32*** (0.08)			0.31*** (0.08)	
FD Log Cons.			0.25* (0.13)	0.27** (0.13)		0.24* (0.14)
FD Int. Rate	-0.01*** (0.002)	-0.01*** (0.002)	-0.01*** (0.003)	-0.01*** (0.003)	-0.01*** (0.002)	-0.01*** (0.003)
Lagged FD Log M	0.54*** (0.07)	0.54*** (0.07)	0.59*** (0.07)	0.56*** (0.08)	0.54*** (0.07)	0.59*** (0.08)
FD Top 10		0.12 (0.36)		-0.41 (0.36)		
FD Top 1					0.05 (0.39)	0.06 (0.44)
Constant	0.002 (0.004)	0.002 (0.005)	0.002 (0.01)	0.002 (0.01)	0.002 (0.004)	0.002 (0.01)
Observations	101	101	101	101	101	101
R ²	0.55	0.55	0.49	0.50	0.55	0.49
Adjusted R ²	0.53	0.53	0.48	0.48	0.53	0.47

Note:

* p<0.1; ** p<0.05; *** p<0.01

Table: USA: Currency Demand and Inequality, First Difference Regression

	<i>Dependent variable:</i>					
	FD Log currency					
	(1)	(2)	(3)	(4)	(5)	(6)
FD Log GDP	0.14 (0.12)	0.07 (0.12)			0.16 (0.12)	
FD Log Cons.			-0.31 (0.19)	-0.31 (0.19)		-0.26 (0.21)
FD Int. Rate	-0.004 (0.004)	-0.004 (0.004)	-0.002 (0.004)	-0.002 (0.004)	-0.003 (0.004)	-0.002 (0.004)
Lagged FD Log M	0.50*** (0.09)	0.47*** (0.09)	0.48*** (0.09)	0.45*** (0.09)	0.48*** (0.09)	0.47*** (0.09)
FD Top 10		-0.83 (0.59)		-0.94* (0.55)		
FD Top 1					-0.93 (0.64)	-0.49 (0.68)
Constant	0.01* (0.01)	0.02** (0.01)	0.03*** (0.01)	0.03*** (0.01)	0.01* (0.01)	0.03*** (0.01)
Observations	106	104	106	104	104	104
R ²	0.26	0.27	0.27	0.29	0.27	0.27
Adjusted R ²	0.24	0.24	0.25	0.26	0.24	0.24

Note:

* p<0.1; ** p<0.05; *** p<0.01

Table: USA: M2 Money Demand and Inequality, First Difference Regression

	<i>Dependent variable:</i>					
	FD Log M2					
	(1)	(2)	(3)	(4)	(5)	(6)
FD Log GDP	0.32*** (0.07)	0.36*** (0.08)			0.31*** (0.07)	
FD Log Cons.			0.48*** (0.13)	0.50*** (0.13)		0.54*** (0.14)
FD Int. Rate	-0.01*** (0.002)	-0.01*** (0.002)	-0.01*** (0.002)	-0.01*** (0.002)	-0.01*** (0.002)	-0.01*** (0.002)
Lagged FD Log M2	0.33*** (0.08)	0.35*** (0.08)	0.27*** (0.09)	0.25** (0.10)	0.33*** (0.09)	0.24** (0.10)
FD Top 10		0.49 (0.33)		-0.23 (0.33)		
FD Top 1					0.07 (0.37)	-0.32 (0.41)
Constant	0.01*** (0.005)	0.01** (0.005)	0.01** (0.01)	0.01** (0.01)	0.01*** (0.005)	0.01* (0.01)
Observations	101	101	101	101	101	101
R ²	0.36	0.37	0.33	0.34	0.36	0.34
Adjusted R ²	0.34	0.35	0.31	0.31	0.33	0.31

Note:

* p<0.1; ** p<0.05; *** p<0.01

Table: USA: Remunerated Accounts (M2-M1) and Inequality, First Difference Regression

	<i>Dependent variable:</i>					
	FD Log (M2-M1)					
	(1)	(2)	(3)	(4)	(5)	(6)
FD Log GDP	0.09 (0.15)	0.21 (0.16)			0.08 (0.15)	
FD Log Cons.			0.61** (0.24)	0.61** (0.24)		0.66** (0.26)
FD Int. Rate	-0.005 (0.005)	-0.01 (0.005)	-0.01 (0.005)	-0.01 (0.005)	-0.01 (0.005)	-0.01 (0.005)
Lagged FD Log M2	0.23** (0.10)	0.23** (0.10)	0.15 (0.10)	0.14 (0.10)	0.23** (0.10)	0.14 (0.10)
FD Top 10		1.45** (0.69)		1.08* (0.62)		
FD Top 1					0.29 (0.76)	-0.44 (0.79)
Constant	0.03*** (0.01)	0.03*** (0.01)	0.02* (0.01)	0.02* (0.01)	0.03*** (0.01)	0.02* (0.01)
Observations	101	101	101	101	101	101
R ²	0.06	0.10	0.12	0.14	0.06	0.12
Adjusted R ²	0.03	0.07	0.09	0.11	0.02	0.08

Note:

*p<0.1; **p<0.05; ***p<0.01

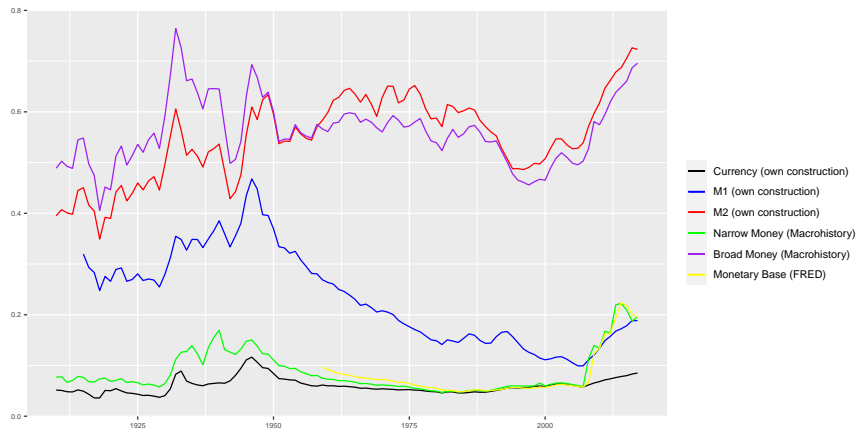
Table: USA (Subsample 1946-1973): Remunerated Accounts and Inequality, First Difference Regression

	<i>Dependent variable:</i>					
	FD Log (M2-M1)					
	(1)	(2)	(3)	(4)	(5)	(6)
FD Log GDP	0.44** (0.18)	0.47*** (0.17)			0.42** (0.18)	
FD Log Cons.			0.50 (0.38)	0.27 (0.45)		0.45 (0.44)
FD Int. Rate	-0.01** (0.01)	-0.01** (0.005)	-0.01** (0.01)	-0.01* (0.01)	-0.01** (0.01)	-0.01* (0.01)
FD FD Lagged Log M	0.04 (0.15)	0.01 (0.15)	-0.15 (0.20)	-0.10 (0.20)	0.05 (0.16)	-0.13 (0.22)
FD Top 10		1.58* (0.77)		1.03 (1.04)		
FD Top 1					0.46 (1.08)	0.29 (1.32)
Constant	0.02** (0.01)	0.02** (0.01)	0.03* (0.01)	0.03* (0.02)	0.02** (0.01)	0.03 (0.02)
Observations	28	28	28	28	28	28
R ²	0.30	0.41	0.18	0.21	0.31	0.18
Adjusted R ²	0.21	0.31	0.08	0.08	0.19	0.04

Note:

* p<0.1; ** p<0.05; *** p<0.01

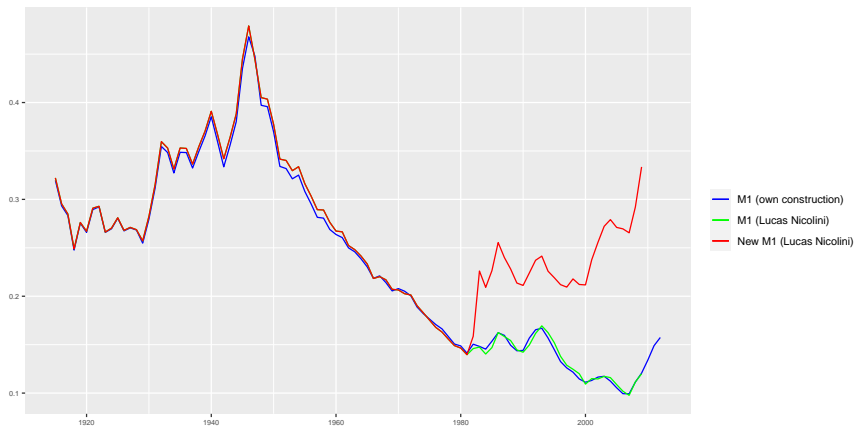
USA Data: Monetary Aggregates (as a fraction of GDP)



Source: Own calculation based on several sources (see appendix) and Macrohistory database (Jordà-Schularick-Taylor).

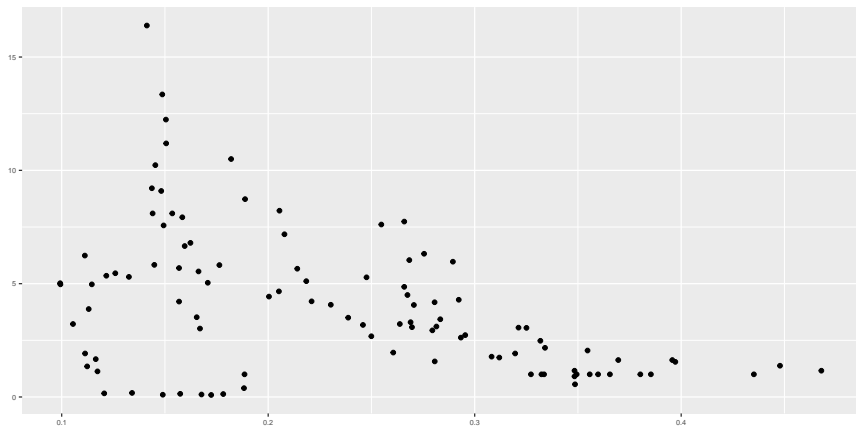
Note: $k = \frac{M}{PY} = \frac{1}{V}$ ("Cambridge equation").

USA Data: “New M1” Measure (Lucas-Nicolini [2015])



Source: Own calculation based on several sources (see appendix) and Lucas-Nicolini [2015] database.

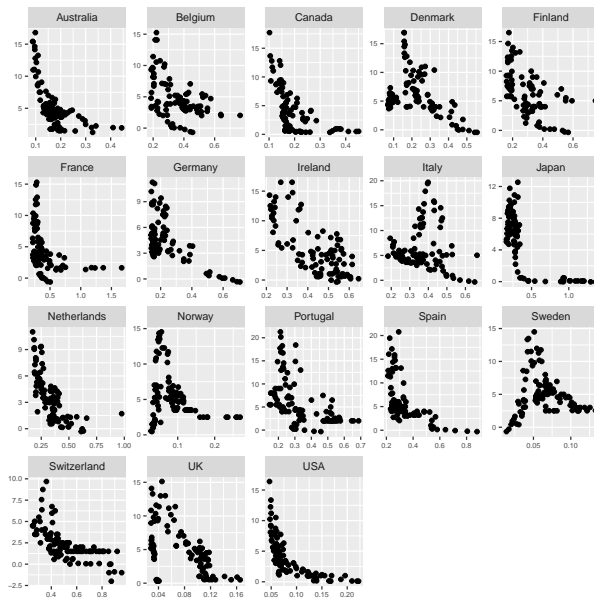
USA Data: Money and interest rates



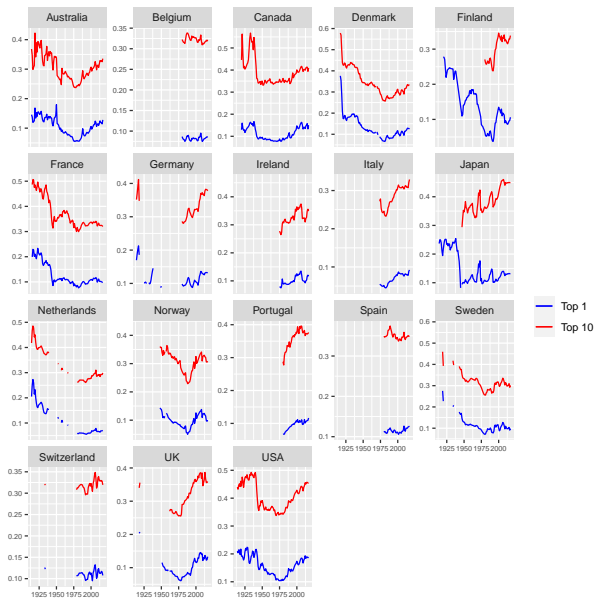
Source: Own calculation based on several sources (see appendix) and Macrohistory database (Jordà-Schularick-Taylor).

Note: $k = \frac{M}{PY} = \frac{1}{V}$ ("Cambridge equation") and interest rate.

International data



International data: inequality.



Bootstrap

Table: USA: Bootstrap for Regression in First Difference for 1914-2016

Inequality Measure	Transacion Measure	Regression Estimate	P-Val
Top 10	GDP	0.15	0.40
Top 1	GDP	0.10	0.39
Top 10	Consumption	-0.38	0.34
Top 1	Consumption	0.08	0.40

Table: USA: Bootstrap for Regression in First Difference for 1944-2016

Inequality Measure	Transacion Measure	Regression Estimate	P-Val
Top 10	GDP	-0.68	0.41
Top 1	GDP	-0.98	0.37
Top 10	Consumption	-1.04	0.37
Top 1	Consumption	-0.94	0.37
Gini	GDP	0.00	0.49