Sectoral Balances and Financial Crises in the Last 150 years

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Research Question and Contribution

- A fundamental research question is whether financial crises are purely random and unpredictable events or whether financial crises are predictable events that are preceded by changes in conditions in the financial sector and the macroeconomy that increase the risk of financial instability.
- Several empirical studies in the literature, especially after the 2008 crisis, show that financial crises are predictable to some extent. See, for example, Jordà, Schularick, and Taylor (2013).
- Rapid credit growth combined with a significant increase in asset prices is associated typically with an elevated probability of financial instability episodes (Sufi and Taylor (2021) provide a comprehensive literature review on financial crises).
- **The most significant predictor of financial crises is credit growth and elevated asset prices.**

Research Question and Contribution

- In his Nobel Prize lecture Tobin (1982) writes that there are three sources of supply of new wealth (S) to the private sector: (i) the net accumulation of inventories and productive capital (I), (ii) government deficits (G-T), i.e., government expenditures (G) minus total taxes net of government transfers (T) and (iii) surpluses in the current account from transactions with other countries (CA):

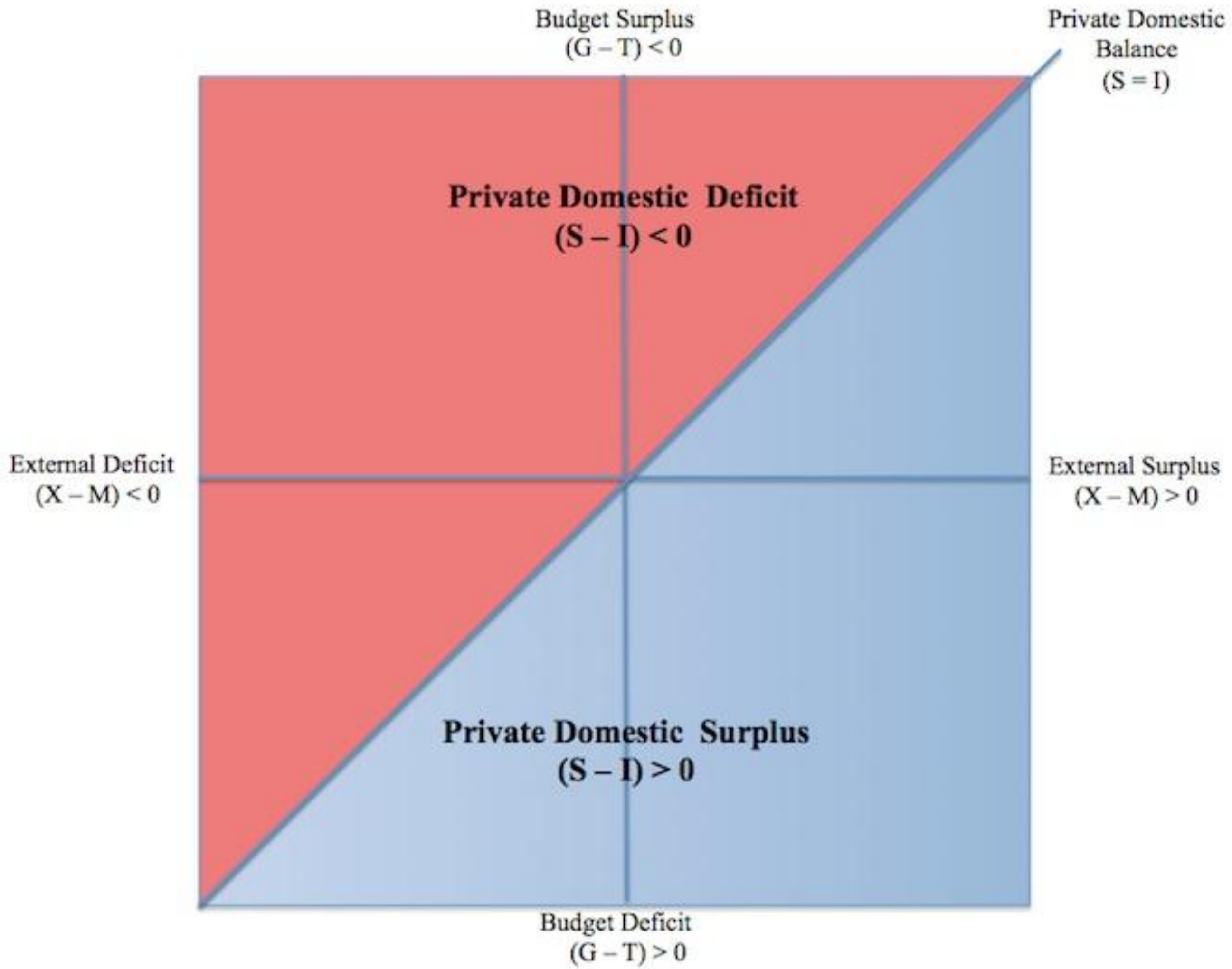
$$S = I + (G - T) + CA$$

- The private sector financial balance is defined as private saving net of investment:

$$\mathrm{S} - \mathrm{I} = (\mathrm{G} - \mathrm{T}) + \mathrm{CA}$$

and reflects changes in the net worth of the private sector due to changes in the holdings of financial claims against the government or the external sector.

Private Sector Financial Balance



Research Question and Contribution

- This paper employs a sectoral balances framework and shows empirically that the private sector financial balance is a powerful predictor of financial crises in 18 advanced economies over the past 150 years.
- The empirical results suggest that the private sector financial balance is a useful macroeconomic leading indicator that can capture financial fragility.
- The role of public deficits is a controversial topic in the extant literature.
- The sectoral balance framework is an integral component of stock-flow consistent models (Godley and Lavoie (2007)). The chief economist of Goldman Sachs, Jan Hatzius, is also well-known proponent of the sectoral balances approach.

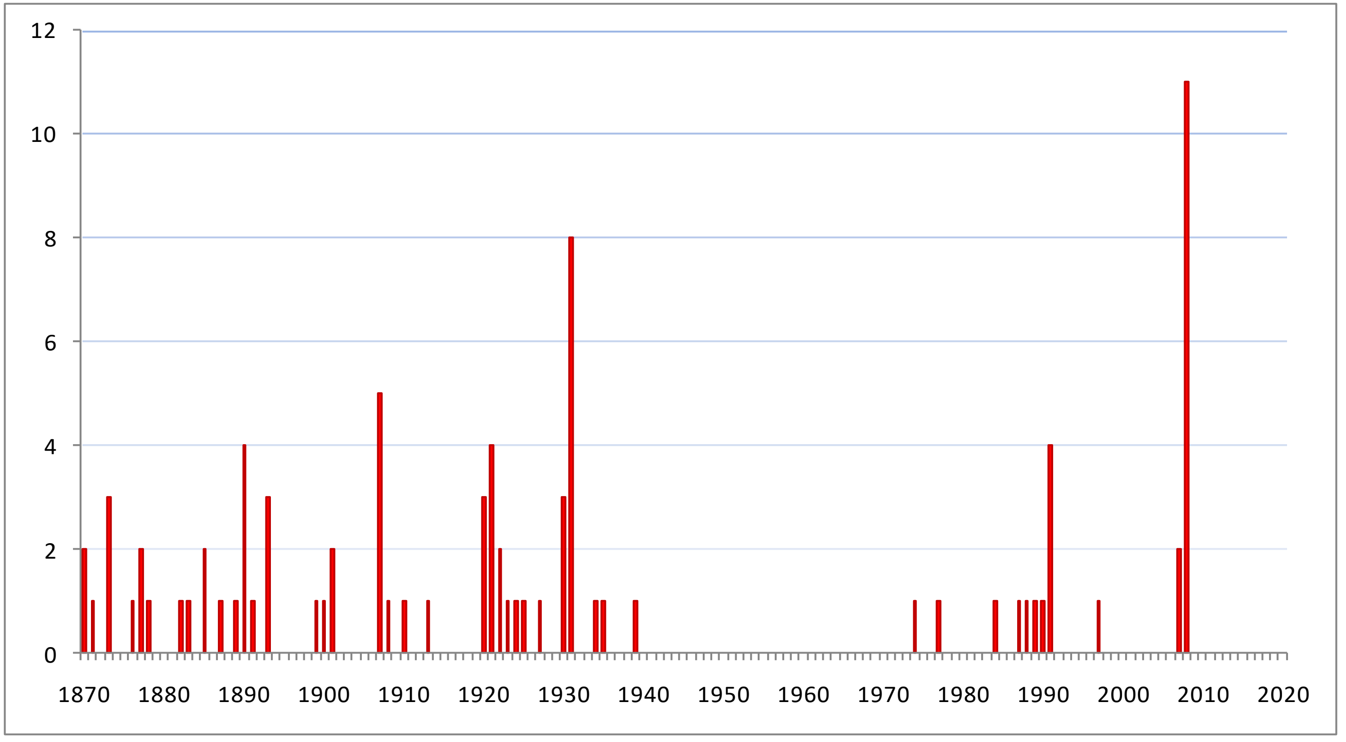
Stylized Facts of Sectoral Balances

- The empirical analysis is based on a panel data set of eighteen (18) developed countries provided by the Jordà-Schularick-Taylor Macrohistory Database. The data are annual and span the period from 1870 to 2020.

Country	ISO	Private Sector Balance data availability
Australia	AUS	1902-2020
Belgium	BEL	1870-2020
Canada	CAN	1870-2020
Switzerland	CHE	1921-2020
Germany	DEU	1873-2020
Denmark	DNK	1874-2020
Spain	ESP	1870-2020
Finland	FIN	1882-2020
France	FRA	1870-2020
UK	GBR	1870-2020
Ireland	IRL	1938-2020
Italy	ITA	1870-2020
Japan	JPN	1875-2020
Netherlands	NLD	1870-2020
Norway	NOR	1870-2020
Portugal	PRT	1870-2020
Sweden	SWE	1870-2020
USA	USA	1870-2020

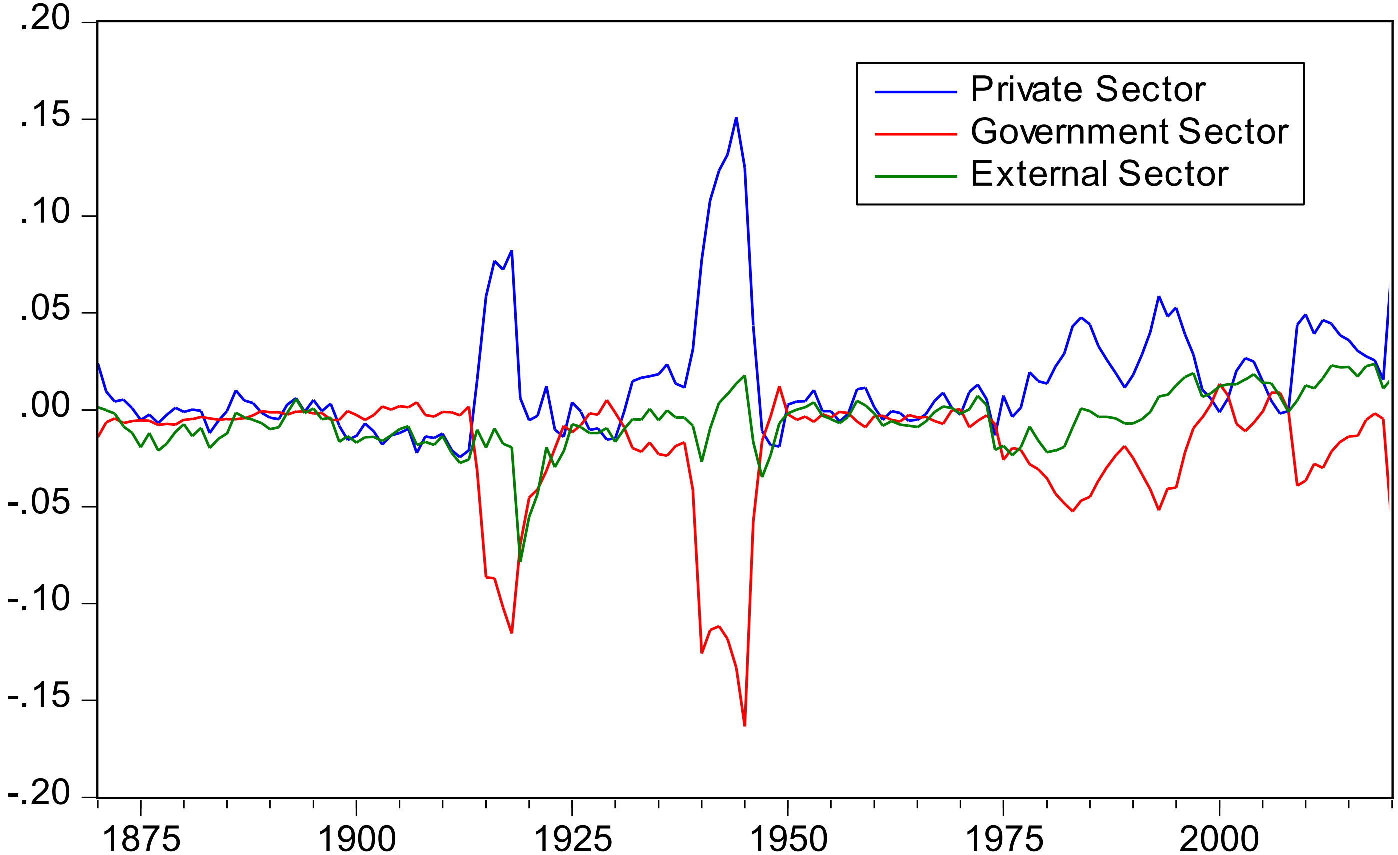
Stylized Facts of Sectoral Balances

- Number of countries (per year) experiencing a banking crises during the period 1870-2020. The financial crisis indicator is a dummy variable that takes the value of one the first year a systemic banking crisis occurs in a country and takes the value of zero otherwise



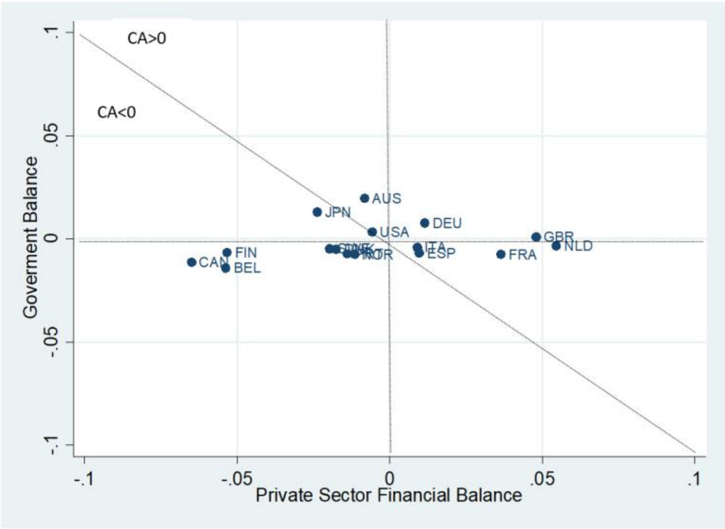
Stylized Facts of Sectoral Balances

- Annual time series of the cross sectional averages of private sector, government sector and external sector financial balances for the time period 1870-2020.

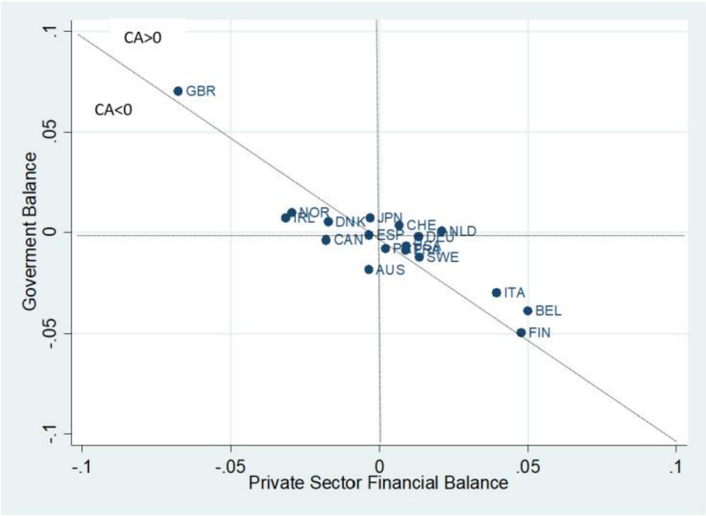


Stylized Facts of Sectoral Balances

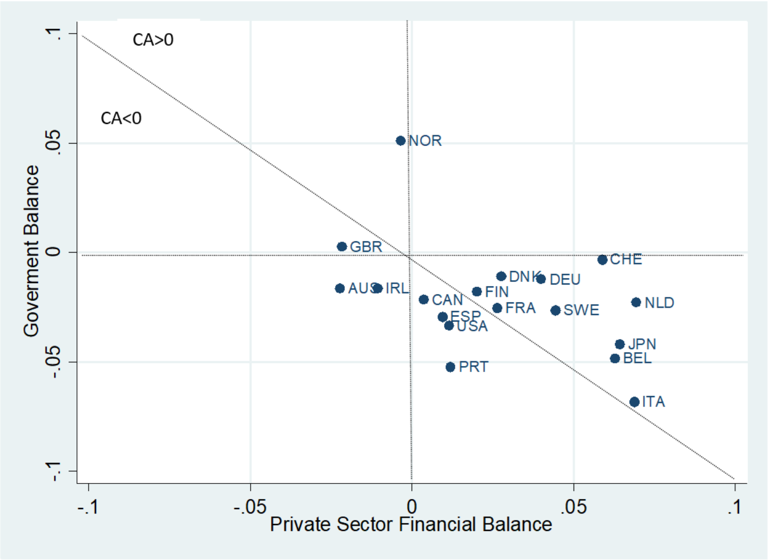
1870-1913 Period (Gold Standard)



1950-1973 Period (Bretton-Woods)

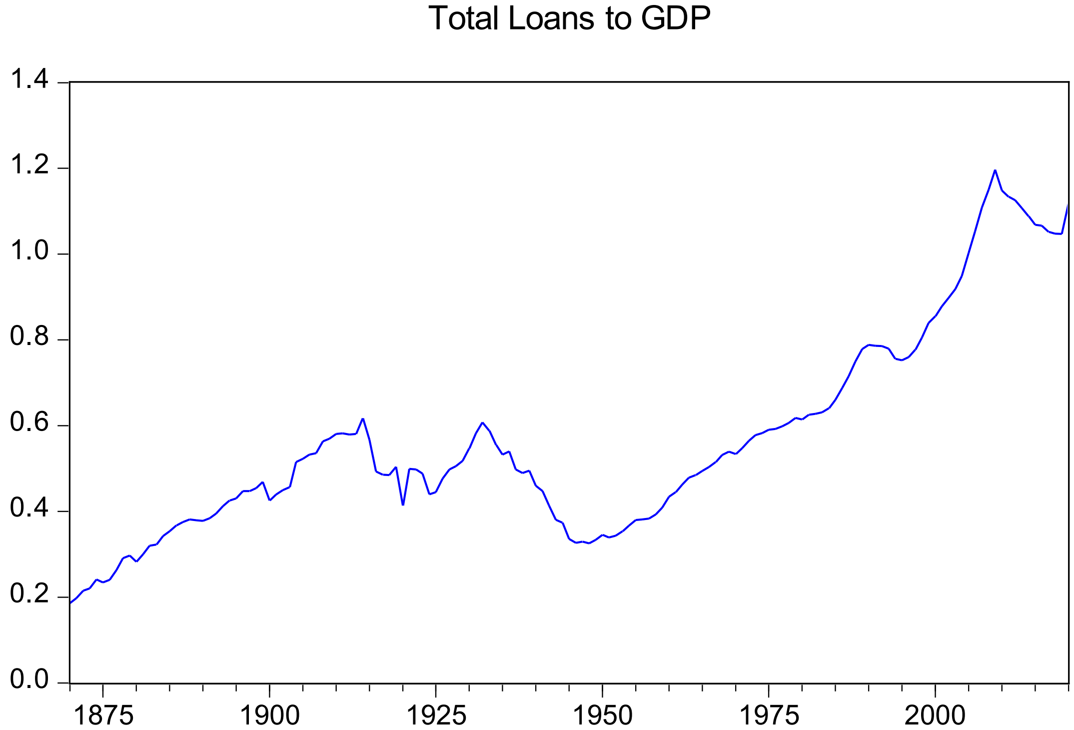


1974-2020 Period



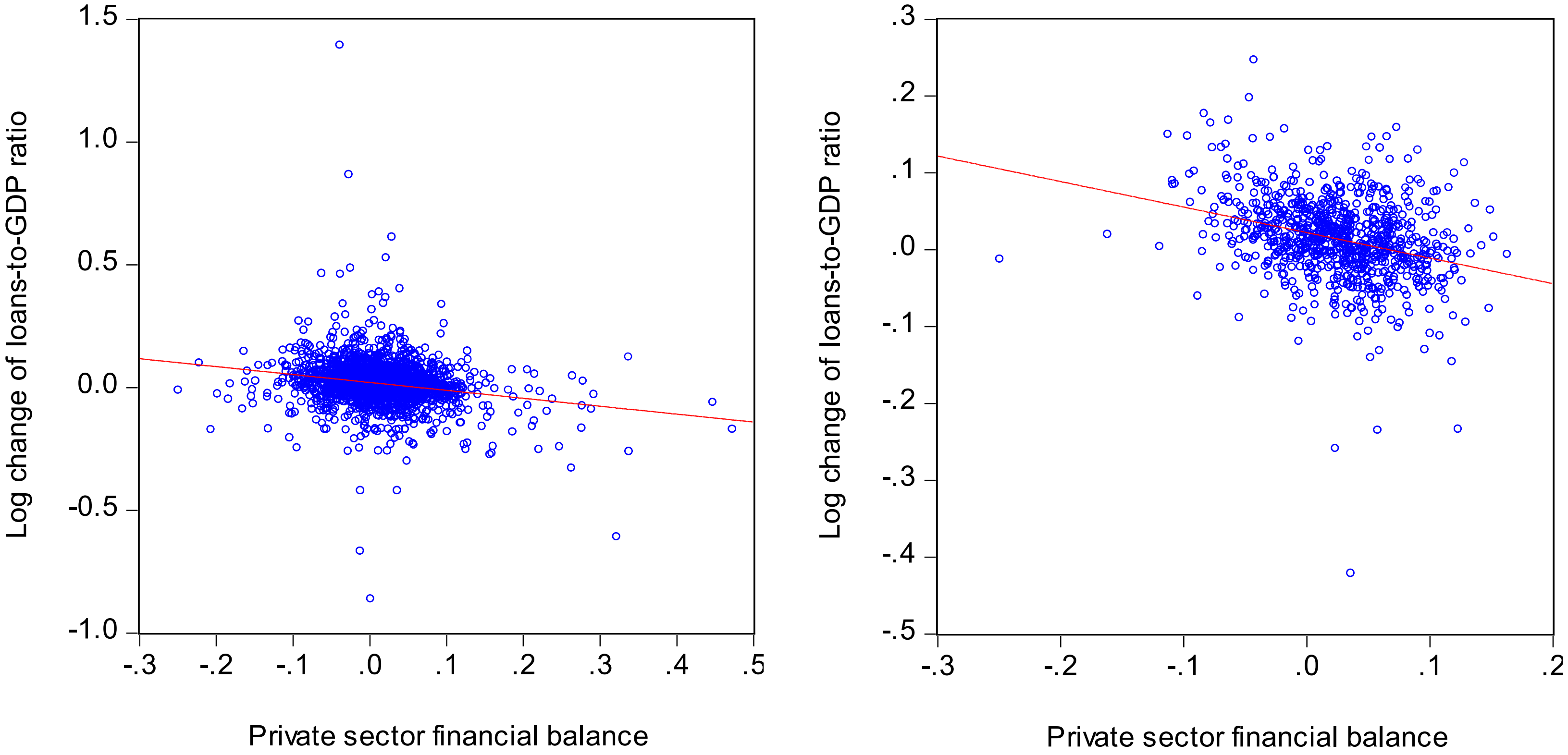
Private Credit

- Annual time series of the cross-sectional averages of total loans to non-financial private sector as a percentage of GDP for the time period 1870-2020.



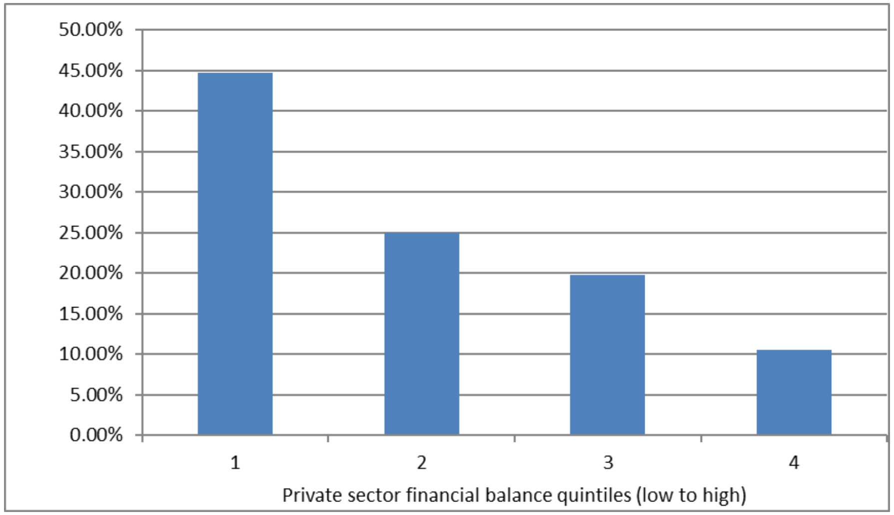
Private Sector Financial Balance and Credit

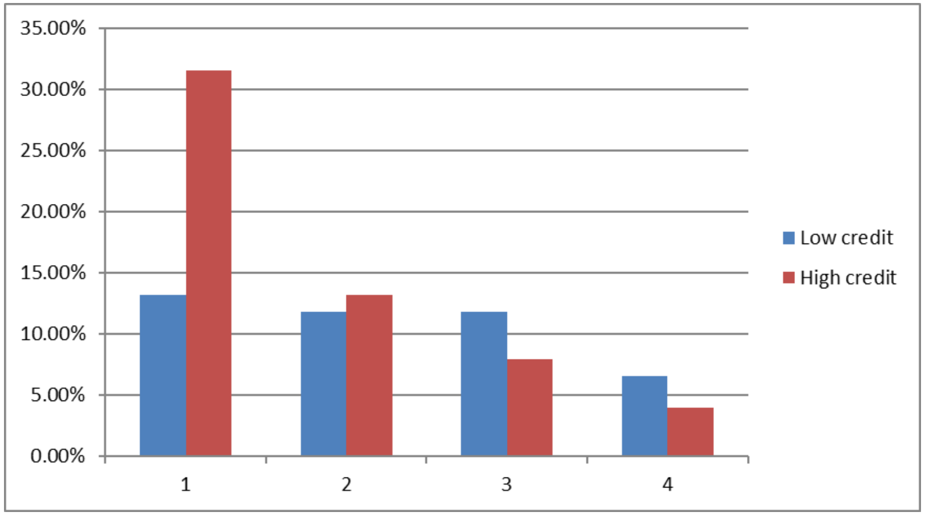
- Scatter diagram of the log change of loans-to-GDP ratio against the private sector financial balance for the time period 1870-2020 and 1974-2020.



Private Sector Financial Balance and Credit

- Percentage of banking crisis occurring over the next year for four different private sector financial balance quintiles (low to high) for the time period 1870-2020. The right graph reports the percentage of banking crisis occurring over the next year for each private sector financial balance quintile conditional on low and high credit growth.





Estimation of Logit Regressions

- The empirical analysis follows Jordà, Schularick and Taylor (2013) and use panel OLS and logit regression models to estimate the probability of financial crisis in country i using lagged values of sector financial balances:

$$\text{OLS Linear Probability: } p_{it} = \alpha_i + bX_{it-1} + \varepsilon_{it}$$

$$\text{Logit: } \mathrm{logit}(p_{it}) = \alpha_i + bX_{it-1} + \varepsilon_{it}$$

where logit(p) = ln(p/(1-p)) is the log of the odds ratio, X_{t-1} is a vector with the explanatory variables and α_i is a country fixed effect term.

Linear Probability Model

Fixed effects

	Full sample			1950-2020		
PFB	-0.330			-0.403		
	(-4.930)			(-3.610)		
GFB		0.191			0.256	
		(3.800)			(2.400)	
EFB			-0.291			-0.291
			(-4.060)			(-2.30)
Pseudo R2	0.01	0.003	0.003	0.002	-0.006	-0.005

Without fixed effects

	Full sample			1950-2020		
PFB	-0.265			-0.276		
	(-4.690)			(-3.070)		
GFB		0.151			0.205	
		(3.540)			(1.97)	
EFB			-0.225			-0.190
			(-3.150)			(-1.850)
Pseudo R2	0.007	0.001	0.003	0.007	0.002	0.002

This table reports the coefficient estimates and the respective robust t-statistics using a linear probability model with and without fixed effects with a financial crisis dummy as the dependent variable. The full sample period is from 1870-2020 and the explanatory variables are private sector financial balance (PFB), government sector financial balance (GFB) and external sector financial balance (EFB).

Logit Regression (fixed effects)

Fixed effects

	Full sample			1950-2020		
PFB	-13.665			-18.456		
	(-5.390)			(-3.700)		
GFB		11.026			12.752	
		(3.03)			(1.970)	
EFB			-9.589			-15.886
			(-3.450)			(-2.440)
Pseudo R2	0.050	0.017	0.018	0.067	0.021	0.029
AUC	0.641	0.542	0.611	0.648	0.543	0.621

	1974-2020			1870-1913		
PFB	-19.551			-15.547		
	(-4.000)			(-1.920)		
GFB		17.025			14.709	
		(2.410)			(0.760)	
EFB			-14.788			-12.141
			(-2.470)			(-1.450)
Pseudo R2	0.095	0.039	0.035	0.0180	0.003	0.010
AUC	0.649	0.546	0.620	0.644	0.545	0.616

	1914-1949			1870-1949		
PFB	-8.577			-8.988		
	(-2.380)			(-2.650)		
GFB		11.247			8.365	
		(2.040)			(1.720)	
EFB			-1.490			-4.265
			(-0.33)			(1.170)
Pseudo R2	0.045	0.037	0.001	0.022	0.011	0.004
AUC	0.629	0.542	0.581	0.631	0.538	0.596

This table reports the coefficient estimates and the respective robust t-statistics using fixed effects logit regression models with a financial crisis dummy as the dependent variable. The full sample period is from 1870-2020 and the explanatory variables are private sector financial balance (PFB), government sector financial balance (GFB) and external sector financial balance (EFB).

Logit Regression (pooled)

Without fixed effects

	Full sample			1950-2020		
PFB	- 9.569			-12.786		
	(-5.020)			(-2.700)		
GFB		6.957			9.040	
		(3.040)			(2.370)	
EFB			-6.849			-9.795
			(-3.110)			(-1.590)
Pseudo R2	0.028	0.009	0.011	0.04	0015	0.014
AUC	0.604	0.519	0.591	0.629	0.533	0.641

	1974-2020			1870-1913		
PFB	-12.252			-5.793		
	(-2.950)			(-1.570)		
GFB		8.330			15.813	
		(2.840)			(1.190)	
EFB			-8.435			-3.064
			(-1.650)			(-0.970)
Pseudo R2	0046	0.016	0.015	0.007	0.004	0.002
AUC	0.674	0.596	0.639	0.571	0.517	0.535

	1914-1949			1870-1949		
PFB	-8.664			-6.999		
	(-4.150)			(-3.900)		
GFB		8.139			6.692	
		(2.419)			(2.180)	
EFB			-5.314			-4.064
			(-1.790)			(-1.840)
Pseudo R2	0.041	0.023	0.011	0.018	0.008	0.005
AUC	0.562	0.492	0.560	0.560	0.489	0.543

This table reports the coefficient estimates and the respective robust t-statistics using pooled logit regression models without fixed effects with a financial crisis dummy as the dependent variable. The full sample period is from 1870-2020 and the explanatory variables are private sector financial balance (PFB), government sector financial balance (GFB) and external sector financial balance (EFB).

Private Sector- Controlling for Credit Growth

Fixed effects

	1870-2020	1950-2020	1974-2020
PFB	-13.460	-16.472	-17.494
	(-5.070)	(-3.110)	(-3.360)
CREDIT	1.232	5.342	8.575
	(1.150)	(1.660)	(1.970)
Pseudo R2	0.053	0.079	0.117
AUC	0.625	0.668	0.730

Without fixed effects

	1870-2020	1950-2020	1974-2020
PFB	-9.109	-11.343	-9.664
	(-4.380)	(-2.380)	(-2.330)
CREDIT	1.654	5.478	7.904
	(1.700)	(2.650)	(2.660)
Pseudo R2	0.031	0.052	0.063
AUC	0.593	0.652	0.706

This table reports the coefficient estimates and the respective robust t-statistics using fixed effects logit regression models and pooled logit regression models without fixed effects with a financial crisis dummy as the dependent variable. The full sample period is from 1870-2020 and the explanatory variables are private sector financial balance (PFB) and credit growth (CREDIT).

Government Sector-Controlling for Credit Growth

Fixed effects

	1870-2020	1950-2020	1974-2020
GFB	10.550	9.295	13.516
	(2.790)	(1.400)	(1.860)
CREDIT	1.486	7.278	11.054
	(1.390)	(2.280)	(2.620)
Pseudo R2	0.021	0.044	0.078
AUC	0.529	0.595	0.653

Without fixed effects

	1870-2020	1950-2020	1974-2020
GFB	-9.106	7.649	6.377
	(-4.380)	(1.860)	(1.980)
CREDIT	1.654	6.675	10.311
	(1.700)	(2.930)	(3.290)
Pseudo R2	0.031	0.033	0.048
AUC	0.593	0.608	0.668

This table reports the coefficient estimates and the respective robust t-statistics using fixed effects logit regression models and pooled logit regression models without fixed effects with a financial crisis dummy as the dependent variable. The full sample period is from 1870-2020 and the explanatory variables are government sector financial balance (GFB) and credit growth (CREDIT).

External Sector - Controlling for Credit Growth

Fixed effects

	1870-2020	1950-2020	1974-2020
EFB	-9.482	-14.388	-13.326
	(-3.190)	(-2.120)	(-2.040)
CREDIT	1.901	7.836	11.103
	(1.990)	(2.55)	(2.660)
Pseudo R2	0.024	0.057	0.080
AUC	0.579	0.697	0.715

Without fixed effects

	1870-2020	1950-2020	1974-2020
EFB	-6.148	-8.462	-6.068
	(-2.420)	(-1.360)	(-1.230)
CREDIT	2.239	7.145	9.963
	(2.440)	(3.270)	(3.290)
Pseudo R2	0.016	0.034	0.046
AUC	0.568	0.641	0.658

This table reports the coefficient estimates and the respective robust t-statistics using fixed effects logit regression models and pooled logit regression models without fixed effects with a financial crisis dummy as the dependent variable. The full sample period is from 1870-2020 and the explanatory variables are external sector financial balance (EFB) and credit growth (CREDIT).

Private Sector- Controlling for House and Stock Growth

Fixed effects

	1870-2020	1950-2020	1974-2020
Δ_3PFB	-12.851	-23.007	-19.986
	(-4.140)	(-3.950)	(-3.140)
Δ_3HOUSE	1.019	2.304	3.382
	(1.550)	(1.780)	(2.100)
Δ_3STOCK	0.000	-0.211	-0.234
	(-0.020)	(-0.570)	(-0.620)
Pseudo R2	0.051	0.127	0.147
AUC	0.661	0.634	0.635

Without fixed effects

	1870-2020	1950-2020	1974-2020
Δ_3PFB	-6.993	-21.728	-19.379
	(-3.570)	(-5.180)	(-4.100)
Δ_3HOUSE	1.306	1.943	3.307
	(2.160)	(2.200)	(2.340)
Δ_3STOCK	-0.429	-0.254	-0.292
	(-1.550)	(-0.960)	(-1.140)
Pseudo R2	0.030	0.104	0.123
AUC	0.659	0.677	0.672

This table reports the coefficient estimates and the respective robust t-statistics using fixed effects logit regression models and pooled logit regression models without fixed effects with a financial crisis dummy as the dependent variable. The full sample period is from 1870-2020 and the explanatory variables are three-year changes in private sector financial balance (Δ3PFB) and three-year real house growth (Δ3HOUSE) and three-year real equity growth (Δ3STOCK).

Private Sector- Controlling for Yield Curve Slope

Fixed effects

	1870-2020	1950-2020	1974-2020
PFB	-12.099	-16.176	-20.671
	(-4.470)	(-3.560)	(-4.130)
SLOPE	-22.967	-31.080	-28.095
	(-3.360)	(-3.170)	(-2.700)
Pseudo R2	0.065	0.104	0.143
AUC	0.687	0.693	0.696

Without fixed effects

	1870-2020	1950-2020	1974-2020
PFB	-8.944	-10.780	-12.562
	(-4.060)	()-2.390)	(-2.880)
SLOPE	-23.289	-28.917	-22.783
	(-4.100)	(-4.360)	(-3.540)
Pseudo R2	0.052	0.070	0.082
AUC	0.688	0.688	0.685

This table reports the coefficient estimates and the respective robust t-statistics using fixed effects logit regression models and pooled logit regression models without fixed effects with a financial crisis dummy as the dependent variable. The full sample period is from 1870-2020 and the explanatory variables are the private sector financial balance (PFB) and the slope of the yield curve (SLOPE) defined as the difference between the long-term interest rate and short-term interest rate.

Conclusions

- Financial crises are not only preceded by changes in financial markets, such as rapid changes in credit growth and high asset prices, but also by changes in the macroeconomy as reflected in the difference between aggregate saving and investment and the financial balance of the private sector.
- From a macroeconomic policy perspective, the twin deficits, i.e., fiscal deficits and current account deficits are often mentioned as potentially dangerous states of the economy. However, the effect of fiscal consolidation or austerity policies on the financial fragility of the private sector is often underappreciated.
- Countries that have to generate fiscal surpluses for debt sustainability purposes they need to increase their competitiveness and generate surpluses in the external sector to preserve the solvency of the private sector (the case of Greek economy).
- A useful extension of the present analysis would be to further decompose the private sector into households, financial sector and non-financial sector and examine how each sector's financial balance is related to the probability of a financial crisis