Sectoral Balances and Financial Crises in the Last 150 years

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This paper examines the relationship between the private sector financial balance, defined as the difference between aggregate saving and investment, and financial crises using macrohistory data of 18 countries covering the period 1870 to 2020. The empirical analysis shows that the private sector financial balance is a significant predictor of financial crises over the last 150 years. The probability of a financial crisis increases significantly when the private sector runs a deficit, in particular during periods of high private credit growth. The empirical results suggest that the private sector financial balance is a useful macroeconomic leading indicator that can capture financial fragility.

Keywords: private sector financial balance, financial crises, credit growth

JEL classification: E2, F3, G01, E62, G18

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1. Introduction

Financial crises can have a lasting and prolonged adverse impact on the real economy. Consequently, 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.

This paper shows empirically that the private sector financial balance, defined as the difference between aggregate saving and investment, is a significant predictor of financial crises in 18 advanced economies over the past 150 years. To the best of my knowledge, this paper is the first study to provide a comprehensive empirical analysis of the relationship between private sector financial balance and the probability of a financial crisis using a large historical database (Jordà-Schularick-Taylor Macrohistory Database) that covers most of modern finance history in 18 countries from 1870 to 2020. The results of the present study confirm empirically that the private sector financial balance is a useful indicator for monitoring financial stability.

The sectoral balance approach is based on the simple macroeconomic identity that links the financial positions (surpluses and deficits) of the three sectors in the economy, i.e., the private sector, the government sector and external sector. 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).

$$S = I + (G - T) + CA \quad (1)$$

Expression (1) simple says that the net worth of the private sector (households, firms, financial sector) increases due to the creation of new real assets or due to the accumulation of financial claims against the government and/or the accumulation of financial claims against the external sector.[1] The private sector financial balance is defined as private saving net of investment, $S - I = (G - T) + CA$, 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. When the private sector is in financial surplus it acquires more assets than liabilities (net lending), while when the private sector is in financial deficit it acquires more liabilities than assets (net borrowing).[2] For example, in a closed economy, the private sector can increase its financial assets (in the form of government bonds) only if the government runs a deficit.[3] In an open economy the private sector can increase its holdings of foreign assets when the current account is positive.

The private sector financial balance is a useful macroeconomic indicator that can capture financial fragility. A decrease in the private sector's financial balance will tend to deteriorate its solvency and that may contribute to a higher probability of a future financial crisis, while an accumulation of financial assets improves solvency and makes financial crisis less probable.

[1] Since the private sector is aggregated the assets and liabilities are only between sectors (private, government and external), while assets and liabilities within the private sector cancel out (e.g, a loan as a bank asset cancels out with a loan as household liability).

[2] Following the so called "New Cambridge" approach to macroeconomic modeling the positive private financial balance is often termed as "net acquisition of financial assets" or NAFA (see Godley and Cripps (1983)).

[3] Barro (1974) argues that under certain conditions government bonds do not constitute net financial wealth for the private sector. The intuition behind this "neutrality result", also known as "Ricardian equivalence", is that rational forward looking agents will perceive that an increase in government deficit will lead to in an equivalent increase in future tax obligations levied to the private sector and therefore in present value terms the net change in the financial wealth of the private sector would be zero. The usual response to the Ricardian equivalence is that the economy typically operates below full employment and government deficits will lead to more output and more tax revenues without having to raise taxes (see, for example, Rowthorn 2020).The results in the current paper show that government deficits decrease the probability of a financial crises occurring and provide some additional empirical evidence towards the rejection of the "neutrality" of government deficits.

Changes in the financial balance of the private sector are related to changes in the government's fiscal position and country's external position. For instance, a deterioration of the private sector's financial balance may be related to fiscal consolidation policies and/or related to country's deficits in the current account.

The sectoral balance framework is an integral component of stock-flow consistent models and one of the main macroeconomic policy tools used by heterodox economists such as post-Keynesian economists (see, for example, Godley and Lavoie (2007), Nikiforos and Zezza (2017)) and more recently by modern money theorists (MMT) (see, for example, Wray (2019) and Tymoigne (2023)). The sectoral balance approach is also a macroeconomic framework used by economists in some investment banks. A well known proponent of the sectoral balance approach is the chief economist of Goldman Sachs (see Hatzius (2018)).

The sectoral balances framework has been used extensively by Wynne Godley for the purposes of macroeconomic analysis and forecasting. Before the eruption of the 2008 global financial crisis in a series of papers Goldley (see, for example, Goldley 1999; 2003; 2005) warned that that the US economy was on an unsustainable path that could eventually lead to a severe recession. He based his macroeconomic forecasts on the unprecedented deterioration of the US private sector financial balance since the mid 90s due to the increase in the current account deficit and the fiscal consolidation took place during the late 90's, combined with a significant increase in debt to income ratios. Godley (2003) notes that *" It is well known to students of the National Accounts that the surplus of private disposable income over expenditure is equal to the government balance (written as a deficit) plus the current balance of payments (written as a surplus). While these balances are related to one another by a system of accounting identities, each has, to some extent, a life of its own that is reconciled with the other two via the* *aggregate income flow. The way the balances evolve provides a useful armature around which to organise a narrative account of economic developments, because any one of them is necessarily implied by the other two. Furthermore, the balances may give an early warning that unsustainable processes are taking place, for any high or rising balance implies a change in public, private, or foreign debts, which cannot grow without limit relative to income*

Several empirical studies in the literature, especially after the 2008 crisis, show that financial crises are to some extent predictable events. Schularick and Taylor (2012) and Jordà, Schularick, and Taylor (2013) use an extended macroeconomic database of advanced economies that spans the period from the late 19th century until the recent period and find that the most significant predictor of financial crises is credit growth. Mian, Sufi and Verner (2017) show empirically that an increase in household debt predicts also lower GDP growth. Borio and Lowe (2002) examine the period from 1970 to 1999 and find that rapid credit growth combined with a significant increase in asset prices is associated with an elevated probability of financial instability episodes. Kiley (2021) also uses the Jordà-Schularick-Taylor Macrohistory Database and finds that the current account deficit and increases in equity and house prices are leading indicators of financial crises. Greenwood, Hanson, Shleifer, and Sørensen (2022) also find that in the post-WW2 period rapid credit growth and asset price growth are significant precursors of financial crises. Muller and Verner (2023) construct a cross country novel data set and show empirically that in the post-WW2 period the allocation of credit across sectors matters for financial fragility. They find that credit expansions to the non-tradable sector are a significant predictor of financial crises, while credit expansions to the tradable sector are not associated with a higher probability of financial crises. Sufi and Taylor (2021) provide a comprehensive literature review on financial crises.

The empirical finding that rapid credit growth is associated with a higher risk of financial crises is consistent with the work of Minsky (1986) and Kindleberger (1978) who argue that during periods of euphoria and over-optimism the leverage of the private sector goes up and asset prices increase to unsustainable levels and that eventually leads to financial fragility and crises. According to Minsky's (1986) "financial instability hypothesis" a continued rise in the debt-to-income ratio increases the risk of financial instability as the private sector gradually moves from a hedge, to a speculative, and finally to a "Ponzi" position where cashflows for outstanding debt commitments cannot be serviced. [4]

The financial balance approach reflects the private sector's solvency because it captures changes in its net worth in relation to the government's and the external sector's position and along with credit growth it is a useful measure to gauge financial fragility. For example, an increase in credit growth and private sector's debt is less destabilizing when it is accompanied by a surplus in the current account that increase private sector's net worth. In fact, the empirical data in the Schularick-Taylor Macrohistory Database show that the frequency of financial crises increases significantly during periods of high credit growth and deficits in the financial balance of the private sector.

The empirical analysis in this paper uses standard OLS and logit regressions to test if the private sector financial balance is a significant predictor of financial crises as recorded in the Jordà-Schularick-Taylor Macrohistory Database. The empirical analysis shows that the private sector financial balance is a significant predictor of financial crises. The model estimates suggest that a drop of 1% in the private sector financial balance increases the probability of a financial

[4] Dafermos (2018) develops synthesizes the views of Godley and Minsky by incorporating the financial balance approach into a simple macroeconomic model that allows the net debt of the private sector to evolve endogenously according to Minsky's credit cycles.

crises episode occurring over the next year by about 0.42%. Looking at the two components of the private sector financial balance the model estimates show that government deficits reduce the probability of a financial crisis, while current account deficits have the opposite effect and increase the probability of a financial crisis. According to the empirical results obtained from a series of regression estimations the private sector financial balance contains more information and has better predictive ability than its two individual components (government's position and external position) and it is a significant leading indicator of financial crises.

The remainder of the paper proceeds as follows. Section 2 first provides some stylized facts with respect to the evolution of sectoral balances from 1870 to 2020 and then examines the relationship between private sector financial balance and financial crises using liner probability models and logit regressions. Section 3 discusses the policy implications of the empirical findings and the final Section concludes and suggests avenues for future research.

2. Data and Empirical Results

2.1 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.[5] The data are annual and span the period from 1870 to 2020. Table 1 report the countries included in the panel data set and the periods for which data on the private sector financial balance is available. The private sector financial balance (PFB) is computed as a percentage of GDP using the available data on the

[5] See Jordà, Schularick, and Taylor (2017) for a detailed description of the database. The database is available here: www.macrohistory.net/data.

Macrohistory Database with respect to current account, government revenue and government expenditure.[6]

[Insert Table 1]

Figure 1 depicts the evolution of the cross sectional average of the three sectoral balances as a percentage of GDP from 1870 to 2020. The graph neatly summarizes the monetary developments in the global economy over the past 150 years. In the first part of the sample that depicts the classical gold standard period (1870-1914), the government balance is almost flat and movements in the private sector balance mainly follow changes in the balance of the external sector (their correlation is equal to 0.95). This reflects the well known fact that under the classical gold standard system and fixed exchange rates the adjustments in the external sector where the driving force of macroeconomic equilibrium. During the WW1 and WW2 periods the extended war financing elevated fiscal deficits significantly with a corresponding increase in the private sector financial balance. The Bretton-Woods period from 1950 to 1973 shows a somehow more symmetric comovement in sectoral balances, while the floating exchange rate period from 1974 to 2020 is characterized by big swings in the fiscal balance and the corresponding balance of the private sector. The same patterns also emerge by looking at the evolution of sectoral balances at the country level from 1870 to 2020 as depicted in see Figure 2.

[Insert Figure 1]

[Insert Figure 2]

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[6] Private sector balance=(ca-(revenue-expenditure))/gdp using the respective variables in the Macrohistory Database.

Figure 3 is a scatter plot of the private sector balance (horizontal axis) against government sector balance (horizontal axis). The diagonal 45 degrees line shows all the combinations of private sector and government sector balances for which the balance of the external sector is zero. On the upper side of the diagonal the external balance is positive (current account > 0) and on the lower side of the diagonal the external balance is negative (current account < 0). The scatter plots in Figure 3 correspond to three different time periods; the classical gold standard period from 1870 to 1914, the Bretton-Woods period from 1950 to 1973 and the floating exchange rate period from 1974 to 2020.

[Insert Figure 3]

Figure 3 reaffirms the stylized facts of sectoral balances discussed with respect to Figure 1. During the gold standard period the average fiscal balance is close to zero and the private sector financial balance is mainly correlated with the balance of the external sector. There is significant variability with some countries having a positive private sector balance (e.g., Netherlands), while others having negative (e.g., Canada). During the Bretton-Woods period the variability between countries with positive and negative private sector balances is attenuated and the government balance shows a somewhat larger variability.

In the period from 1974 to 2020 fiscal deficits are the norm. The majority of countries display an average positive private sector financial balance accompanied by a negative government balance (14 countries out of the 18). In some cases the positive private sector balance is strengthened further by a surpluses in the external sector (e.g., Japan), while in other cases the private sector financial balance is more moderate because of deficits in the external sector (e.g., USA).[7]

2.2 Financial Crises, Sectoral Balances and Credit Growth

In the Jordà-Schularick-Taylor Macrohistory Database 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. Figure 4 shows for the time period of 1870 to 2020 the number of countries per annum experiencing a systemic banking crisis. In the sample there are 88 events of banking crises in a total of 2,391 country/year observations (about 3.7%). From the total number of financial crises events 63 of them occurred in the pre-WW2 period and 25 occurred in the post-WW2 period. Note that during the Bretton-Woods period of 1950 to 1973 there were no banking crises events in the countries under consideration. The largest number of countries (11 in total) experiencing a banking crisis occurs during the global financial crises of 2008.

[Insert Figure 4]

Figure 5 plots the cross sectional average of private credit (bank loans to the non-financial sector) as a percentage of GDP for the time period 1870-2020. In the ensuing empirical analysis credit growth is used as a control variable for assessing the predictive ability of the private sector financial balance with respect to the occurrence of a financial crisis. As also previously described by Schularick, and Taylor (2012), the ratio of loans-to-GDP ratio displays an upward trend during the gold standard period and a significant drop after the great depression in the 30s due to

[7] A notable exception in the empirical data under consideration is Norway. In the period 1974-2020 Norway displays a positive balance in the external sector (of about 5% of GDP) that is almost offset by a positive balance in the government sector (fiscal surplus) and consequently the private sector balance is close to zero. Note that the fiscal surplus is returned to Norway's sovereign wealth fund.

private sector deleverage. The post-WW2 period is characterized by a steep increase in the loans-to-GDP ratio and a deleverage phase is observed after the eruption of the global financial crisis of 2008.

[Insert Figure 5]

Figure 6 plots the level of the private sector financial balance against annual log changes in the ratio of loans-to-GDP. The graph shows that private sector financial balance and credit growth are negatively correlated, i.e., when the private sector financial balance deteriorates the growth of credit tends to increase. In the full 1870-2020 sample the correlation is equal to -0.24 and in the most recent sample of 1974-2020 the negative correlation is stronger and equal to about -0.3.

[Insert Figure 6]

Figure 7 report the percentage of financial/banking crises that occur over the next year conditional on different quintiles of the private sector financial balance. The data are split into four quintiles from low to high according to the level of the private sector financial balance. The results in Figure 7 provide some prima facie evidence that financial crises tend to occur during periods of low private sector financial balance. For example, conditional on the first quantile (low private sector finance balance) the percentage of financial crises occurring over the next year is about 45% of the total number of crises episodes in the sample, while conditional on the fourth quantile (high private sector balance) only about 11% of financial crises episodes occur over the next year. In order to take into consideration the role of credit growth, each quintile is further divided into high and low credit growth using the log changes of the loans-to-GDP ratio. The bottom graph in Figure 7 shows that in the low quantile of the private sector balance the percentage of financial crises occurring over the next year depends on the state of credit growth (low versus high). In particular, 32% of financial crisis episodes occur one year after states of low private sector financial balance accompanied by high credit growth and about 13% of financial crisis episodes occur one year after states of low private sector financial balance accompanied by low credit growth.

[Insert Figure 7]

2.3 Discussion of Empirical Results

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.

$$\text{OLS Linear Probability: } p_{it} = \alpha_i + bX_{it-1} + \varepsilon_{it} \quad (2)$$

$$\text{Logit: } \text{logit}(p_{it}) = \alpha_i + bX_{it-1} + \varepsilon_{it} \quad (3)$$

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.

Table 2 reports the coefficient estimates from the linear probability model for the full sample period of 1870-2020 and the post-WW2 period, respectively. In each regression specification the explanatory variables are the one-year lag of private sector financial balance (PFB), government sector financial balance (GFB) and external sector financial balance (EFB), respectively.

[Insert Table 2]

The PFB coefficient is highly significant both in the full sample period and in the post-WW2 period. In the top panel with fixed effects the coefficient is equal to -0.330 in the full sample and in the bottom panel without fixed effects the coefficient is equal to -0.265. The relevant F-statistics suggest that in the linear probability model the fixed effects are insignificant. Taking into consideration that the standard deviation PFB is about 5.7% in the full sample, the coefficient of -0.265 implies that a one-standard deviation negative shock in PFB increase the probability of a financial crisis over the next year by about 1.5%. Note that this is a significant increase given that the unconditional probability of a financial crisis in the 1870-2020 sample is about 3.7%. Table 2 also reports the estimated coefficients of the two components of PFB, i.e., the financial balance of the government sector (GFB) and the financial balance of the external sector (EFB). The coefficient of the GFB variable is positive and statistically significant. This result suggests that the reduction of fiscal deficits or the generation of fiscal surpluses increase the probability of a financial crises occurring. The coefficient of EFB is negative and statistically significant, i.e., surpluses (deficits) in the current account reduce (increase) the probability of a financial crisis.

A common criticism of linear probability models is that the dependent variable is not bounded to be between zero and one as basic probability laws dictate. To address this issue, Table 3 reports the coefficient estimates using a panel logit regression with fixed effects. Table 3 also reports the Mc Fadden R-squared and the area under the curve (AUC). The AUC is a useful statistic in order to assess the predictive ability of the logit model. The AUC takes values between 0 and 1. A value of AUC close to 0.5 indicates that the model has predictive ability similar to that of a random coin tossing, while a value close to 1 implies perfect predictability. The McFadden R-squared is often used as a measure of model comparison in classification problems. Models that attain higher McFadden R-squared are considered to have better predictive ability.

[Insert Table 3]

Table 3 reports the estimated coefficient from the logit regression using as explanatory variables the PFB, GFB and EFB, respectively. To shed more light on the relationship between sectoral balances and financial crises over the last 150 years, the logit regression is estimated separately using data for the full sample period of 1870 to 2020, the post-WW2 period, the post-Bretton-Woods period (1974-2020), the gold standard period (1870-1913), the period 1914-1949 (WW1, interwar period and WW2) and the 1870-1949 period.

In the full sample period the coefficient of PFB is negative and highly significant with a t-statistic of -5.39. The estimated coefficient is equal to -13.665 and therefore a decrease of 1% in the PFB increases the odds of a financial crisis by about 1.14. The computed average marginal effect of PFB is -0.42, i.e., a 1% reduction in PFB increases the probability of a crisis by 0.42%. In line with the results obtained from the linear probability model, the coefficient of GFB is statistically significant with a positive sign. Government deficits reduce the probability of a financial crisis over the next year, while external deficits have the opposite effect since the coefficient of EFB is negative and statistically significant.

The AUC is above 0.5 in all predictive models with sectoral balances and attains its highest value when the predictive variable is the private sector financial balance (AUC= about 64%). Looking at the various sub-periods some interesting conclusions emerge. The PFB remains highly statistically significant in all periods with the exception of the gold standard period (1870-1913). In the gold standard period the PFB is weakly significant (t-statistic = -1.92), while GFB and EFB are not statistically significant. The coefficient of PFB is becoming more negative in the recent period of 1974-2020, while the coefficient of GBF is becoming more positive in the same period. The results suggest that the private sectoral financial balance plays a more important role in the recent era of floating rate exchange rates, where changes in private sector financial balance are mostly correlated with changes in the financial balance of the government sector (see also the discussion in Section 3.1).

Table 4 reports the estimated coefficients from the logit regression without the use of fixed effects. The coefficient of PFB is negative and remains highly statistically significant in the full period and the pre- and the post-WW2 period. The GFB also remains statistically significant with a positive sign, while the coefficient of EFB is statistically significant in the full period but in the post-WW2 period it is only statistically significant at the 10% significance level.

[Insert Table 4]

2.4 Additional Control Variables - Credit, House and Equity Prices

The logit regression is also estimated using as explanatory variables the one-year lag of PFB and the one-year lag of credit growth (log change of bank loans to the non-financial sector as a percentage of GDP). Table 5 reports the coefficient estimates with and without fixed effects for the full period, the post-WW2 period and the recent period 1974-2020. The coefficient of PFB remains statistically significant and the addition of credit growth increases the value of the AUC. For example, in the period 1974-2020 the addition of credit growth in the specification with fixed effects increases the AUC from 0.63 when only PFB is included in the regression (see Table 3) to about 0.73. This result indicates that periods of deterioration in the PFB accompanied by high credit growth signal heightened financial fragility and increased probability of financial instability episodes.

[Insert Table 5]

Table 6 reports the coefficient estimates of the logit regression using as explanatory variables the one-year lag of GFB and one-year lag of credit growth and Table 7 reports the respective coefficients using as explanatory variables the one-year lag of EFB and one-year lag of credit growth. Table 6 and Table 7 report the coefficient estimates with and without fixed effects for the full time period, the post-WW2 period and the recent period 1974-2020. After the inclusion of credit growth GFB remains statistically significant in most cases, while the coefficient of EFB in the case of the pooled logit regression model without fixed effects is not statistically significant in the post 1950 period. This result is consistent with the results of Jordà, Schularick and Taylor (2011) who find that in the post-WW2 period credit growth dominates external imbalances as a predictor of financial crises.

[Insert Table 6]

[Insert Table 7]

Table 8 reports the estimates from the logit regression using one-year lagged values of three-year difference in PFB and three-year log changes in credit. The coefficient of PFB is statistically significant in the regression specification with fixed effects and also in the regression specification without fixed effects. Both PFB and credit growth coefficients are highly significant, especially in the post- WW2 period.

[Insert Table 8]

Table 9 reports the logit regression estimates with and without fixed effects using one-year lagged values of three-year difference in PFB, three-year log changes in real house prices and three-year log changes in real equity prices.[8] The coefficient of PFB remains highly significant. Additionally, real house price growth is also significant, especially during the 1974-2020 period, and its inclusion increases the explanatory power of the regression specification as measured by AUC.

Table 10 report the logit regression estimates with and without fixed effects using as dependent variables the one-year lagged value of PFB and the one-year lagged value of the slope of the yield curve. The slope (SLOPE) of the yield curve is defined as the difference between the long-term interest rate and the short-term interest rate in the Jordà-Schularick-Taylor Macrohistory Database. The PFB remains highly significant and similar to Bluwstein et al. (2023) the SLOPE is also a significant predictor of financial crises both in the full sample and the various sub-samples and the two variables together attain an AUC up to 0.69 in the 1974-2020 period.

Overall the empirical results suggest that the PFB contains more information and has better predictive ability than its two individual components (GFB and EFB), and can signal states of financial fragility and elevated probability of financial crises, especially when combined with credit growth.

3. Some Policy Implications

The empirical results in this paper suggest that the private sector financial balance is a significant predictor of financial crises. One of the main conclusions of the present study is that

[8] House price growth is computed using cpi and house price index data (hpnom variable) and equity price growth is computed using cpi and equity total return (eq_tr variable) in the Jordà-Schularick-Taylor Macrohistory Database.

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.

Recent studies in the literature examine the costs and benefits of “leaning against the wind” macroprudential policies that aim to minimize the risks of financial instability caused by excessive growth on credit or asset prices (see, for example, Richter, Schularick and Wachtel, 2021). 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 balance and the financial fragility of the private sector is often underappreciated or totally ignored in the design of fiscal policies. The empirical results of this study suggest that periods of excessive credit growth accompanied by deterioration in the financial balance of the private sector are particularly dangerous and signal states of elevated probability of an eminent financial crisis Hence, the design of fiscal policies needs to be taking into consideration the impact they have on the financial balance of the private sector particularly when the country’s current account is in deficit and credit growth is high. Countries that have to generate fiscal surpluses for debt sustainability purposes they need to increase their competiveness and generate surpluses in the external sector to preserve the solvency of the private sector. Another useful tool to deal with excessive deficits in the external sector that deteriorate the financial balance of the private sector is the design and implementation of appropriate industrial policies.

The sectoral balance approach emphasizes the interlinkages between the financial positions of the economy's sectors and the empirical result in this paper suggest that the sectoral balance approach is a useful tool in order to analyze fiscal policy choices and their consequences.

4. Conclusion

This paper examines the relationship between sector financial balances and financial crises using an extended dataset that covers modern finance history in developed countries from 1870 to 2020. The sector financial balances is a simple macroeconomic framework that links the financial positions (surpluses and deficits) of an economy's sectors and shows how changes in the financial balance of the private sector are linked to changes in the government's fiscal position and country's external position.

The empirical analysis uses panel linear probability models and panel logit regression model and shows that the private sector financial balance is a significant predictor of financial crises, in particular during periods of high credit growth. The main policy implication that emerges from the current study is that the fiscal stance and competitiveness as reflected in the external sector are both import components that affect financial stability. Fiscal consolidation policies need to be carefully designed, especially when the current account is in deficit and private credit growth is high, in order to preserve financial stability.

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. That would certainly shed more light on the role of private sector financial balance as a leading indicator of financial crises and provide additional empirical evidence with respect to the relation between sectoral balances and credit cycles.

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Table 1

This table reports the countries that comprise the panel dataset and the periods for which data on the private sector balance is available.

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

Table 2

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).

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
observations	2391	2500	2466	1256	1256	1260

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
observations	2391	2500	2466	1256	1256	1260

Table 3

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).

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
observations	2391	2500	2466	1186	1186	1190

	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
observations	782	782	782	591	638	649

	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
observations	324	411	330	1015	1121	1129

Table 4

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).

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
observations	2391	2500	2466	1256	1186	1260

	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
observations	828	828	828	591	678	677

	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
observations	457	519	477	1135	1121	1129

Table 5

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).

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

Table 6

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).

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

Table 7

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).

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

Table 8

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 (Δ_3PFB) and three-year credit growth (Δ_3CREDIT).

Fixed effects

	1870-2020	**1950-2020**	**1974-2020**
Δ_3PFB	-6.816	-23.007	-18.552
	(-3.390)	(-3.950)	(-3.03)
Δ_3CREDIT	1.552	4.651	5.874
	(3.090)	(2.910)	(3.03)
Pseudo R2	0.041	0.164	0.175
AUC	0.557	0.677	0.698

Without fixed effects

	1870-2020	**1950-2020**	**1974-2020**
Δ_3PFB	-6.398	-21.076	-17.092
	(-4.020)	(-5.580)	(-4.460)
Δ_3CREDIT	1.629	4.051	4.571
	(2.910)	(3.150)	(3.070)
Pseudo R2	0.038	0.125	0.127
AUC	0.605	0.678	0.706

Table 9

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 (Δ_3PFB) and three-year real house growth (Δ_3HOUSE) and three-year real equity growth (Δ_3STOCK).

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

Table 10

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.

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

Figure 1

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

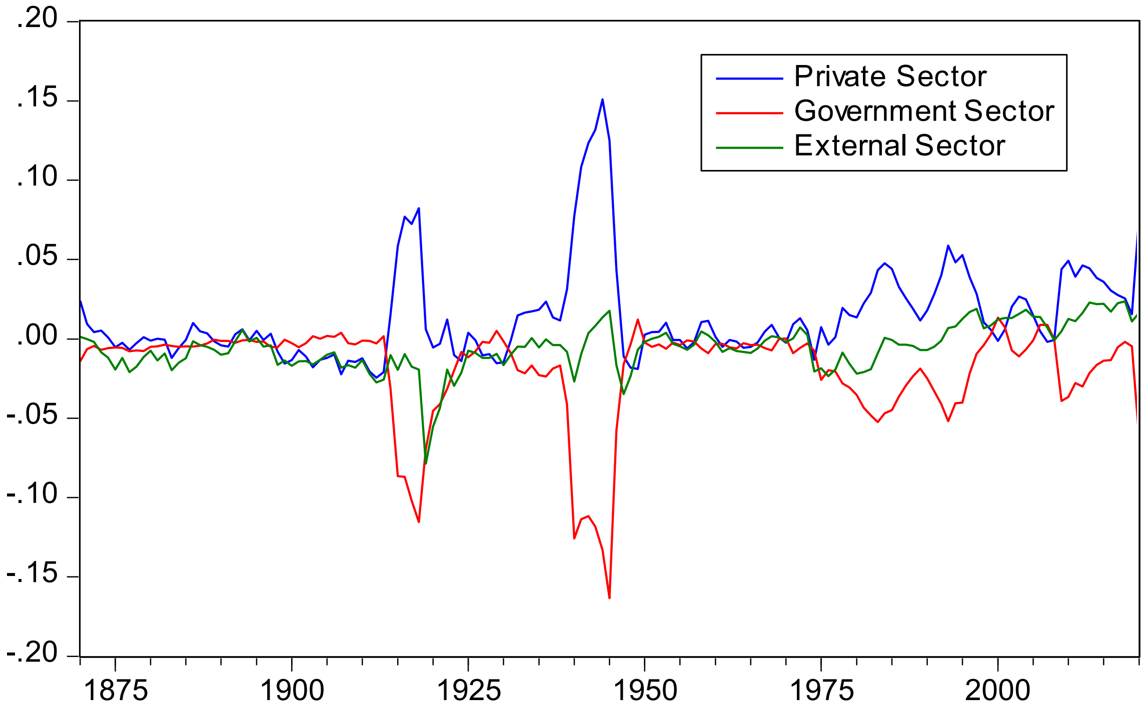


Figure 2

Annual time series of private sector, government sector and external sector financial balances at the country level for the time period 1870-2020.

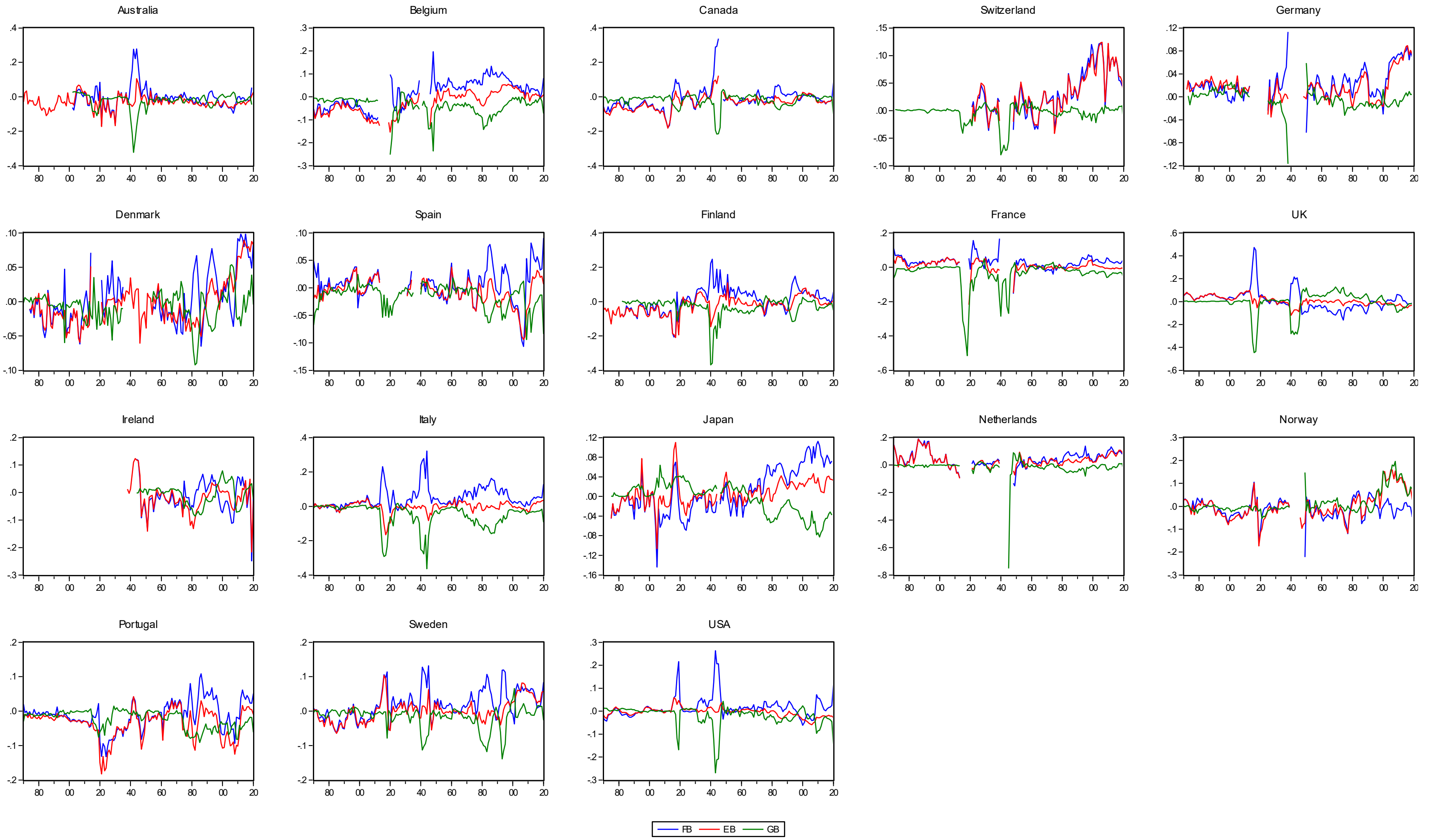
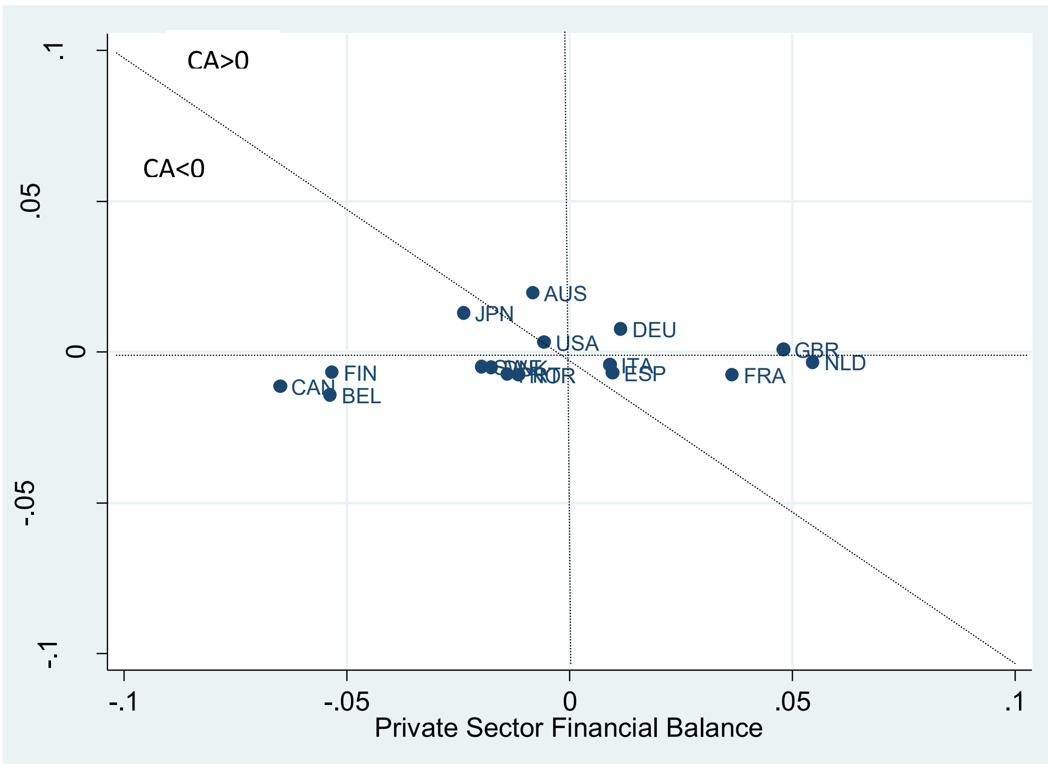


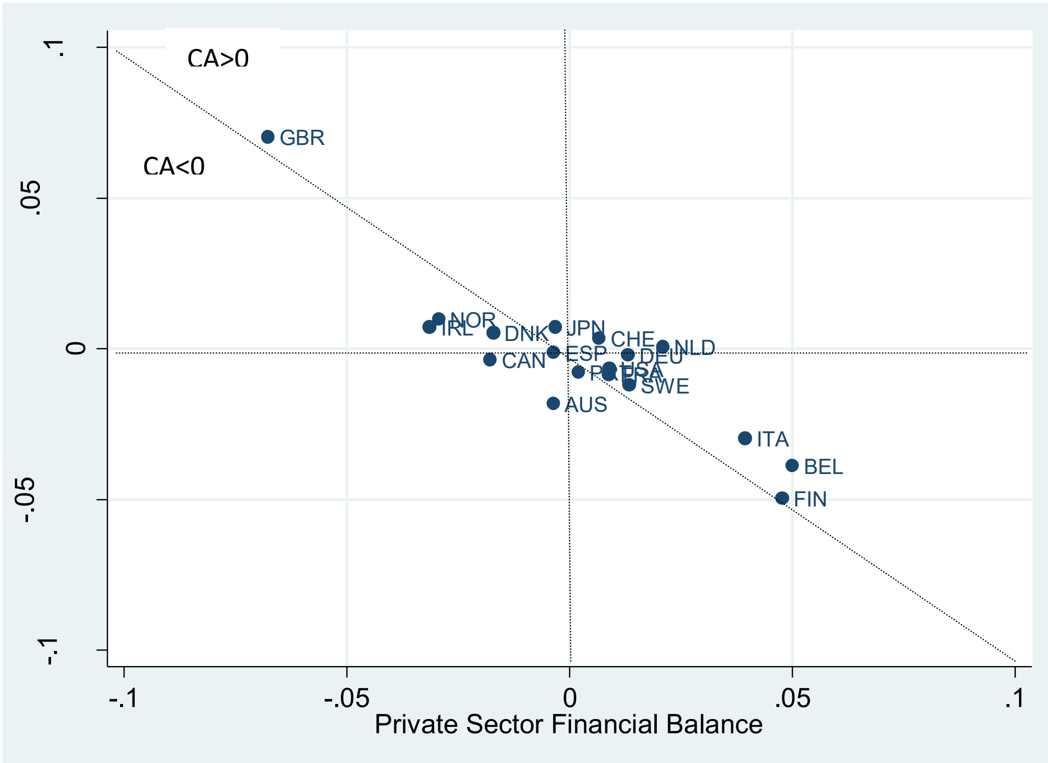
Figure 3

Scatter plot of private sector financial balance (horizontal axis) against government sector financial balance (horizontal axis). The diagonal 45 degrees line shows all the combinations of private sector and government sector balances where the external balance is zero. On the upper side of the diagonal the external balance is positive (current account > 0) and on the lower side the external balance is negative (current account < 0).

1870-1913 Period (Gold Standard)



1950-1973 Period (Bretton-Woods)



1974-2020 Period

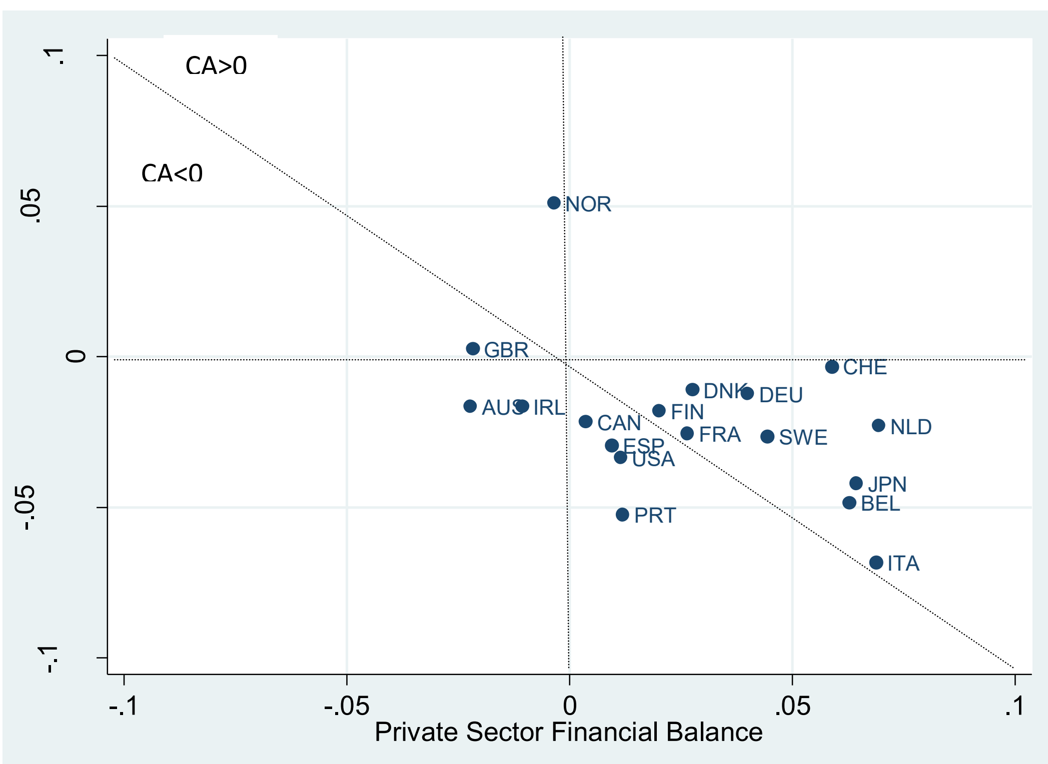


Figure 4

Number of countries (per year) experiencing a banking crises for the time period 1870-2020.

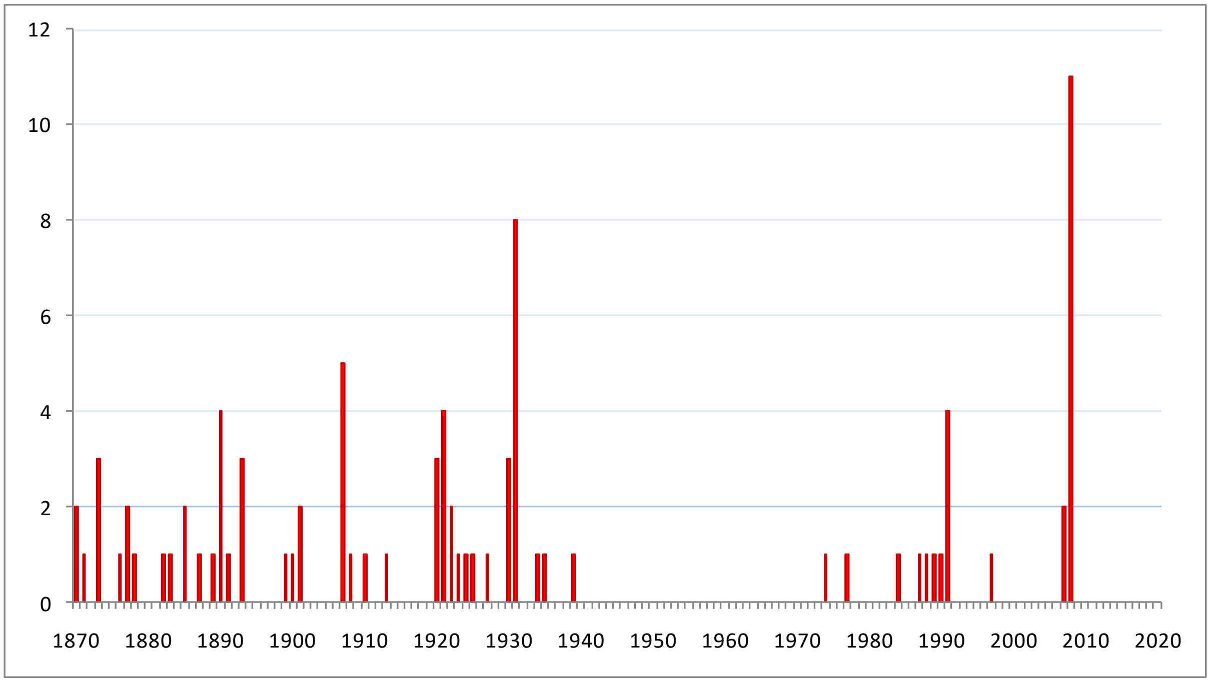


Figure 5

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.

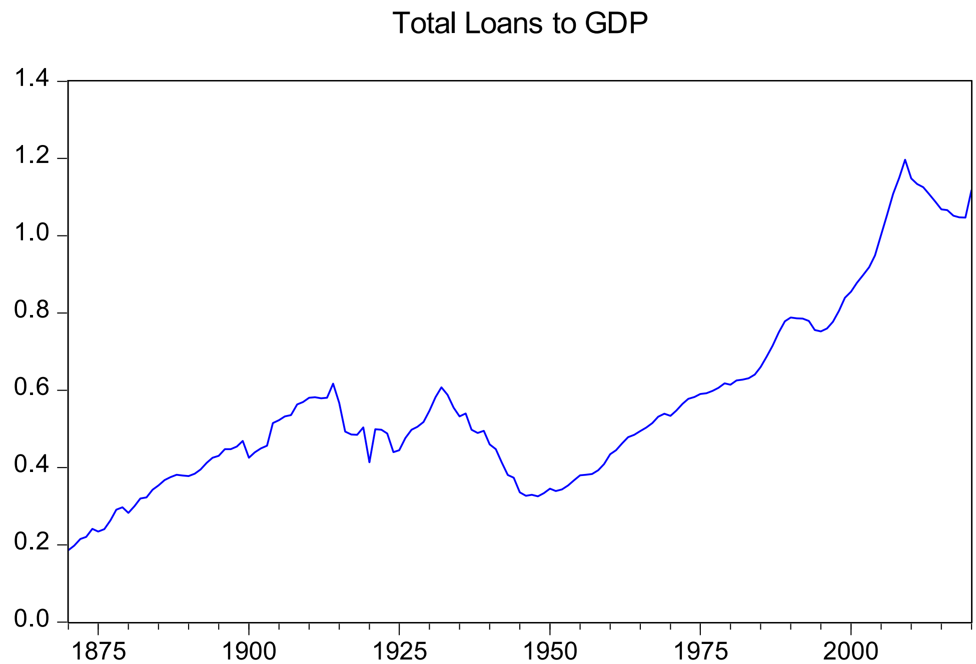
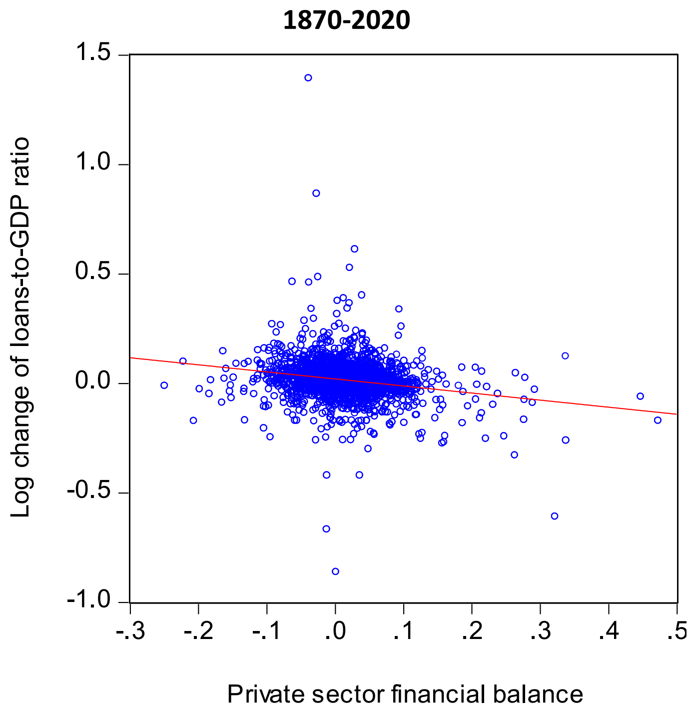


Figure 6

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.



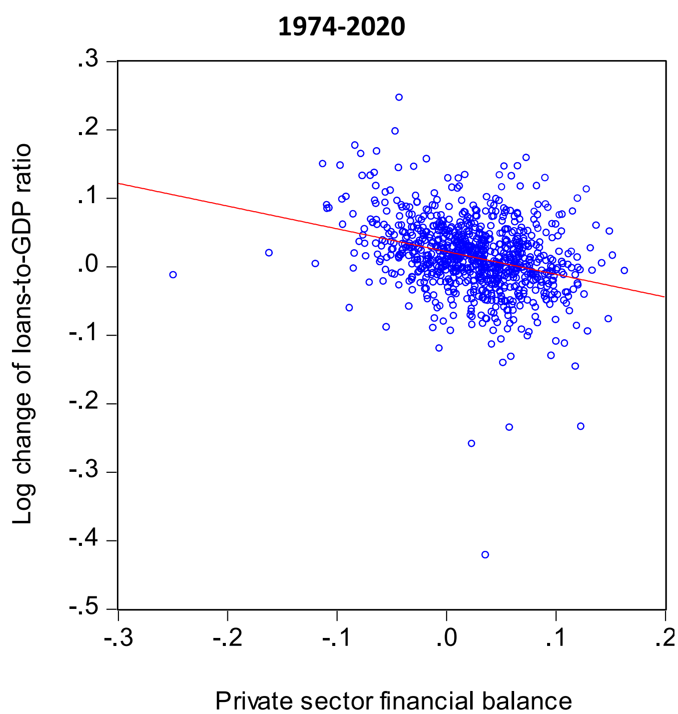


Figure 7

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 bottom 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.