Public credit and the financial cycle*

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Abstract

Credit granted by state-led institutions (i.e. public credit) plays a major role in the financial cycle. By drawing on central banks' archives and statistical reports for thirteen major economies over the post-war period, I build the first dataset on total state loans to firms and households. The data is quarterly and covers the 1950-2020 period. I put forward three main findings. First, public credit accounts for a large share of total credit (particularly in developing countries). Second, public credit is immune to the Global Financial Cycle. Following a US monetary policy tightening, private credit contracts while public credit is not affected. Finally, in financially developed economies, public credit is countercyclical: it expands during private busts, and contracts during booms. Consequently, the decline in total credit and output during a bust is lower when the ex-ante share of public credit in total credit is higher.

JEL codes: E5, F33, G23, G28, H81, N2

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Credit fluctuations can be detrimental for the economy. This is the finding of a burgeoning literature in macro-finance (Schularick and Taylor, 2012; Gourinchas and Obstfeld, 2012; Mian et al., 2017). A second, related finding, is that national credit cycles have a strong international component (Rey, 2013; Miranda-Agrippino and Rey, 2020). As shown in Calvo et al. (1996), international spillovers increase the destabilizing potential of national credit cycles: monetary tightening (loosening) abroad can lead to an excessive contraction (expansion) of credit during bad (good) times. For this reason, macroprudential policies include both measures to control international spillovers (e.g. capital controls), and to prevent excessive risk taking on the part of domestic banks (e.g. liquidity ratios, countercyclical capital requirements).

The macro-finance literature has overlooked the role of state-led (i.e. public) credit in the financial cycle. By drawing on central banks' archives and statistical reports for thirteen major economies over the post-war period, I build the first dataset on total state loans to firms and households. I show that public credit (i.e. credit granted by state-led institutions to the private sector) has two main stabilizing properties. First, public credit markets are immune to foreign monetary shocks. Following a US monetary tightening, private credit contracts while public credit is not affected. Public credit can thus be used to isolate selected groups of borrowers from the Global Financial Cycle. Second, in financially developed economies, public credit is countercyclical: it expands during busts and contracts during booms. Consequently, the decline in total credit and real GDP during the bust is lower when the ex-ante share of public credit is higher. On the other hand, in countries with extensive state control of the financial sector, public credit is strongly procyclical (and a larger share of public credit before the bust no longer predicts lower output loss during the bust).

In a repressed financial system, public and private credit markets are segmented. Medium and long-term loans are the prerogative of public institutions, while private loans are mostly short-term (Monnet, 2018, Chapter 7). As restrictions on banks and financial markets are dropped, private loans become available for medium and long-term investments.[1] Public credit thus becomes a *substitute* to private credit. Mechanically, the demand for public loans increases during private busts and dries out during private booms. This property is particularly useful to prevent constrained borrowers from being cut-off credit markets during a bust.

Today, most public credit institutions draw their funds directly from the market

[1] Jordà et al. (2017) document that banks mortgage loans to household account for the "lion's share" of the increase in bank credit to GDP since 1980.

(i.e. by issuing state-guaranteed bonds). A notable exception is the US (and to a minor extent Japan and South-Korea) where public loans are funded from the federal (or regional) budget.[2] During a credit crunch, public credit thus provides a useful alternative to expansionist fiscal policies.

The stabilizing properties of public credit have been neglected by macroeconomists, in great part due to the absence of data. Data on public credit institutions are particularly difficult to find because most of these institutions are not banks. In national and international statistics, banks are defined as financial institutions with short-term liabilities. Most public credit institutions do not fit this definition. Public funds (e.g. Mexico's Fideicomiso de Fomento Mineiro) are funded directly through fiscal receipts. Specialized credit institutes (e.g. France's Credit National) and most development banks (e.g. Korea Development Bank) are funded primarily through long-term bonds or central bank loans. None of these institutions qualify as banks. Likewise, loans by government agencies (e.g. US' Small Business Administration) and direct loans from the Treasury or the central bank do not appear in banking statistics. In many countries, bank-like public credit institutions have become more common following financial liberalization, but they remain the exception rather than the rule.[3]

Most public credit institutions are therefore excluded from international credit databases (Dembiermont et al., 2013; Monnet and Puy, 2021; Jordà et al., 2017; Müller and Verner, 2021). By digging into central banks' archives and statistical reports, this article assembles the first long-run quarterly series of public credit for a group of 13 major economies, both developed and emerging.[4] For 7 of these 13 countries, data start in the 1950s. For the remaining 6, data are available from the 1960s onwards. Sample selection was dictated by the quality and consistency of statistical reporting, rather by the size of the public credit sector. Even in countries where public credit accounts for a relatively large share of total credit (like Brazil or the Netherlands),[5] sources were often too incomplete to assemble a continuous series.

A first group of public credit institutions was created around the 1930s Great De-

[2]To be sure, public credit generates fiscal costs even when public institutions are funded through the market (e.g. due to borrowers defaulting on public loans, Jiménez et al. (2018)).

[3]In France, Italy, South-Korea, Spain, and Thailand most public credit institutions are considered as banking institutions in national and international statistical reports (e.g. IMF Financial Statistics) since the 1980s and 1990s.

[4]The sample includes Austria, France, Germany, Greece, Indonesia, Italy, Japan, Mexico, Norway, United-States, South-Korea, Spain, and Thailand. These 13 countries account for 44% of world GDP today, and 9 of them are among the world's 20 largest economies (IMF, 2022).

[5]Bonomo et al. (2016) estimate that between one third and one half of total loans to the private sector are government loans in Brazil.

pression,[6] but the majority was established after the Second World War. By reaching back to the 1950s, I thus cover the near-universe of public credit for the 13 countries in my sample. Overall, public credit represents on average 22% of total bank loans to the private sector across the sample, and is considerably higher in emerging (32%) than in developed (18%) economies. Before 1990, more than 1 loan to the private sector out of 4 (27%) came from a public institution. The share then dropped to 17% after the 1990s.[7]

My first result is that public and private credit cycles are positively correlated when government control of the financial sector is high. On the other hand, in economies with moderate state intervention, public and private cycles are negatively correlated. The contracyclical property of public credit can be particularly useful in the bust phase of the cycle, to alleviate the constraint on overly indebted borrowers.[8] Indeed, I find that credit busts are less painful when the ex-ante share of public credit in total credit is larger.

In addition, I demonstrate that public credit is immune to the Global Financial Cycle. Using Local Projections, I find that a 1pp shock on the US short-term rate decreases the real growth rate of private credit by 2pp after 8 quarters; while it has no effect on public credit. This result is robust both across emerging and developed countries, and across sub-periods (pre-financial liberalization era VS post-financial liberalization era).

Drawing on these results, I conclude that public credit has been used as an effective tool for smoothing the financial cycle: (a) it is not affected by global financial spillovers, and (b) it increases during busts and contracts during booms. While the

[6] A few public credit institutions existed prior to the Great Depression. The most ancient had been set up in the first part of the 19th century. France's Caisse des Dépôts et Consignations (CDC) and Italy's Cassa Depositi e Prestiti (CDP) were created in 1816 and 1850 respectively. However, providing credit to the private sector was not part of their original mission. The CDC was tasked with the amortization of public debt, while the CDP was responsible for funding public projects.

[7] These figures slightly *underestimate* the sample share of public credit because a small fraction of public financial institutions are banks. Loans by public banks are systematically included in private credit aggregates. Whenever possible, I exclude public banks from private credit (see Section 1.2).

[8] Since constrained borrowers often have a high marginal propensity to consume (Mian and Sufi, 2015), providing them with debt relief can have large positive aggregate demand effects. To present a full picture of government-led credit, one would also need to measure its budgetary cost. In particular, interest rate subsidies on public institutions' private borrowing can be a drain on the budget in times of high interest rates (Pontolillo, 1972). Nowadays, public credit institutions in developed countries no longer enjoy explicit subsidies on their private debt (this kind of subsidy still exists in some emerging economies). In any case, aggregate data like mine is not well suited to measuring the cost of public credit. Constructing a bank-level database would be very insightful, but it falls outside the scope of this paper.

former is unconditional, the latter is true only in economies where restrictions on private financial institutions and markets are low. Importantly, these patterns can only be seen clearly through a long-run sample, like the one assembled here.

My results speak to the growing literature on credit cycles. Particularly related with my work are papers on the Global Financial Cycle (Rey, 2013; Miranda-Agrippino and Rey, 2020; Obstfeld et al., 2019; Mian et al., 2017), and on the link between credit cycles and crises (Mian and Sufi, 2009; Gourinchas and Obstfeld, 2012; Schularick and Taylor, 2012).

Studying the properties of public credit is important for this literature because public credit markets represent a significant share of total credit (particularly in developing countries). More importantly, public credit can be used to finance borrowers who are below or close to the credit constraint (e.g. households, SMEs, students...). These borrowers play a disproportionate role in the transmission of credit shocks to the real economy (Eggertsson and Krugman, 2012; Guerrieri and Lorenzoni, 2017; Mian and Sufi, 2018). Understanding the macroeconomic properties of public credit, and identifying the circumstances for public credit to behave contracyclically is therefore crucial, both for academics and policymakers.

Second, my findings inform the debate on government ownership of credit institutions. This debate has been framed mostly along the following question: do government banks allocate funds efficiently? The "political" view is that the allocation of public loans is politically motivated and inefficient (Shleifer and Vishny, 1994; La Porta et al., 2002). A second view is that public credit institutions address market failures and improve the allocation of financial resources (Stiglitz, 1993). By focusing on the cyclical properties of public credit, this paper takes a radically different perspective.[9]

The paper is organized as follows. The first section provides an historical perspective on public credit. It also introduces the sources, and the methodology used to assemble the database. The second and third sections examine the behavior of public credit in the financial cycle. Section 2 studies its reaction to foreign monetary shocks. Section 3 looks at its behavior during episodes of boom and bust of private credit. Section 4 discusses the policy implications of my findings, and section 5 concludes.

[9] A few papers have looked at public credit institutions from a macroeconomic perspective (Micco and Panizza, 2006; De Luna-Martínez and Vicente, 2012; Brei and Schclarek, 2013). However, these papers systematically rely on a sub-sample of countries' public credit institutions, which prevents them from drawing conclusions on the *aggregate* behavior of public credit.

1 Public credit in historical perspective

1.1 Public credit institutions

Public credit institutions share two defining characteristics: a public ownership, *and* a mandate from the state to fulfill economic, political, social, or developmental objectives. Most public credit institutions are funded through long-term debt, and do not qualify as banks. During the era of high state regulation, public credit was financed through special financial circuits. These circuits were characterized by a significant degree of regulation, segmentation from the rest of the financial market, and substantial government subsidy (Hodgman, 1973; Zysman, 1983; Monnet, 2018). Their main objective was to guarantee public credit institutions a constant flow of funds at a low and stable rate of interest.[10] Different types of circuits existed. Long-term loans from the central bank or the treasury are one example. Some public credit institutions tapped into the flow of households savings through the Post Office (e.g. Japan's Fiscal Loan Fund, France's Caisse des Dépôts et Consignations), or drew their funds directly from the market by issuing state-backed long-term bonds.[11] In the latter case, the price of the bonds was kept artificially high by requiring private commercial banks to invest a significant share of their assets in public bonds. Often, the interest rate cost was subsidized by the government.[12] These sources of cheap funding enabled public credit institutions to lend at below-market interest rates. In addition, the rate on public loans were often completely disconnected from private rates (see Figure 1).

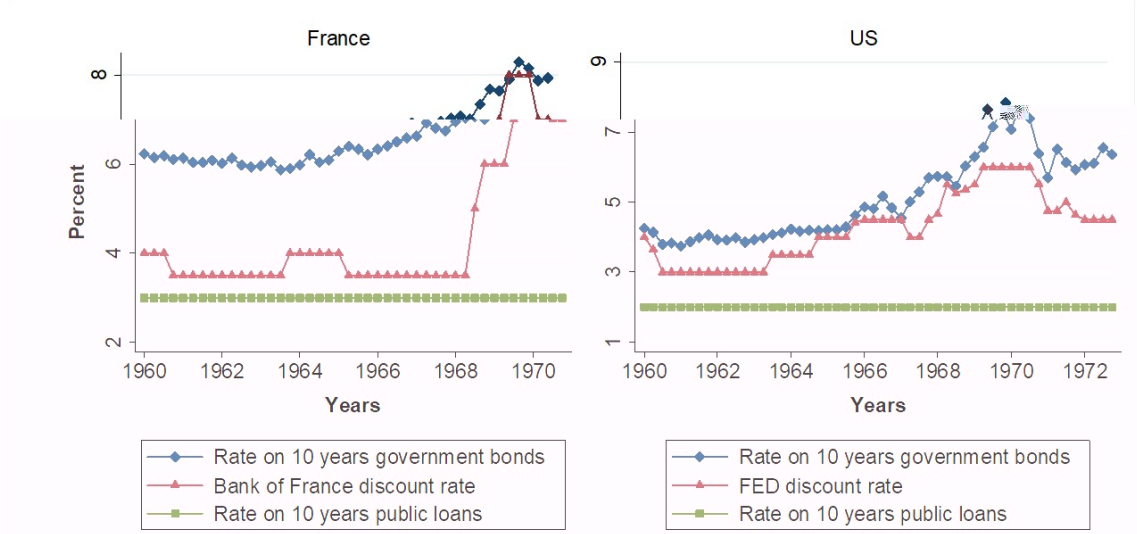
One of the consequences of financial liberalization was the dismantling of these special financial circuits. Public credit institutions therefore turned to the market for funds. The move towards market-based funding translated into a higher reliance on bonds and, occasionally, on medium and short-term funds (Musacchio et al., 2017).

[10] See e.g. "Credit to Agriculture in the E.C. Member States": "*In order to provide agriculture with a regular flow of credit and protect it from interest fluctuations, active government intervention is required and this takes place either by allocating budget revenue to the* [public credit] *institutions in question or by issuing State-guaranteed bonds on these institutions.*" (EEC Commission, February 1977 No. 28, p54.).

[11] See e.g. "Methodological Supplement" to the OECD Financial Statistics (1980 edition): "[Japanese government financial institutions] *do not accept deposits, although some of them do obtain funds through bond issues. Their investments and lending are, in the main, financed from funds collected by about 23000 Post Offices throughout the country in the form of Post Office savings and premiums for Post Office life insurance and annuities*".

[12] In Belgium, the Société Nationale du Logement (SNL) for example paid an interest rate of 1.5% on its bonds. The cost accruing from the difference between the market rate and the rate paid by the SNL was covered by the state (EEC Commission Working Document, 1963, p15.).

Figure 1: Market segmentation and interest rates 1#



Notes: Public loans are 10 years agricultural loans by the Caisse Nationale de Crédit Agricole for France, and 10 years loans to local administrations by the Rural Electrification Administration (REA) for the US.
Sources: Data on the central bank's discount rate and on 10 years government bonds' rate are drawn from the IMF International Financial Statistics. Data on public loans' interest rate are drawn from the annual reports of the Caisse Nationale de Crédit Agricole for France, and from the annual reports of the Rural Electrification Administration (REA) for the US.

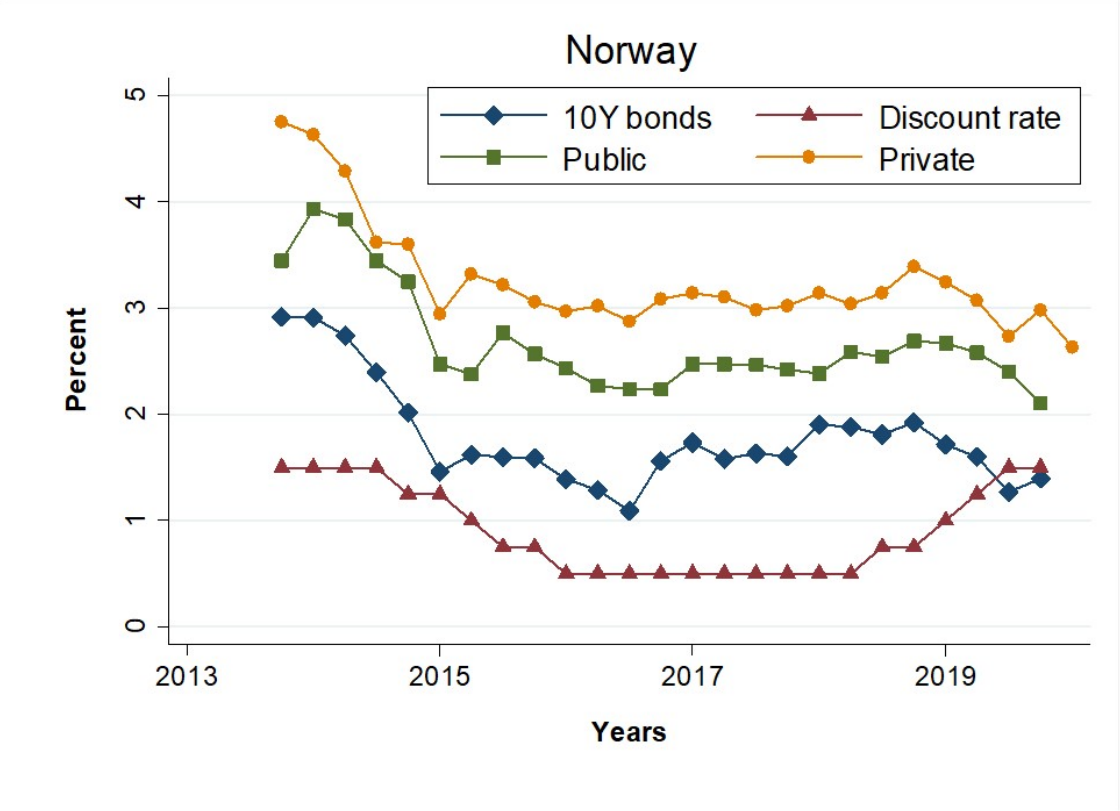
In some countries, this transformation into bank-like institutions was endorsed by law. In France, the 1984 banking code abolished the distinction between bank and non-bank financial institutions (the latter had been a synonym for "public credit institutions" until then).[13] Public credit institutions were then grouped into a new category. The same happened in 1993 in Italy, when the "specialization" of credit was officially terminated (De Bonis et al., 2012). This time, remaining public institutions were privatized or merged with commercial banks. Still, even today, the majority of public credit institutions remain non-banks.[14]

Borrowing directly from the market did not affect the ability of public credit institutions to keep their lending rates below market levels. Although explicit subsidies are no longer in use, public credit institutions still enjoy an implicit subsidy in the form of government guarantee on their debt. State-guaranteed bonds sell at a premium, and this allows public credit institutions to keep their lending rates close to the rate on government debt, and below market rates for private loans (see Figure 2).

[13] Bank of France "Bulletin Trimestriel" March-April 1987, Number 62, p45.

[14] This is true of US government agencies, of the French Caisse des Dépôts et Consignations, of Japan's Fiscal Loan Fund and government financial institutions, of Mexico's development banks and fondos de fomento, of Norway's state lending institutions, and of South-Korea's main development banks.

Figure 2: Market segmentation and interest rates 2#



Notes: Public loans are 10 years housing loans by the Husbanken (State Housing Bank). Private loans are mortgage loans by banks and mortgage companies.
Sources: Data on the central bank's discount rate and on 10 years government bonds' rate are drawn from the IMF International Financial Statistics. Data on public loans' interest rate are drawn from the annual reports of the Husbanken (State Housing Bank), and from Statistics Norway's website for the interest rate on private loans https://www.ssb.no/en/statbank/table/10748.

1.2 A new database on public credit

Data on public credit is particularly hard to find precisely because most public credit institutions are not banks. Non-bank public credit institutions are usually not supervised by the banking authority, and are not required to publish regular balance sheets. By digging into central banks' archives and statistical publications, I managed to overcome this limitation for a sample of 13 countries. Data availability prevented me from extending the sample any further. In most countries, the statistical record of public credit is indeed patchy or altogether inexistent; even when public institutions play a prominent role in credit allocation (e.g. Brazil, see Lazzarini et al. (2015)). In the 13 countries of my sample, quarterly data on public credit institutions were collected by the central bank, but not always published. Whenever the data were published, I use historical editions of the central bank' statistical reports. Otherwise,

I rely on the central bank's archives or database. A country-by-country list of the sources used to construct my series is provided in Appendix A.2. Importantly, the sources systematically provide *aggregated* data. That is, public credit institutions are already grouped by the central bank under a distinct category. Institutions found in this category share two essential attributes: public ownership, and a public mandate. While the former can be defined with a simple criteria, the latter involves an element of judgment on the part of the central bank. For example, it has been argued that Germany's state-owned Landesbanken and Sparkassen were used by local governments to fulfill public policy objectives (Deeg, 1999; Behn et al., 2015). Yet, they are not included among Germany's public credit institutions by the Bundesbank. While the concept of "public mandate" is open to debate, the central bank is in the best position to make the call. Table 1 gives an overview of the institutions considered as public credit institutions, for each country of the sample. As we would expect, nationalized commercial banks operating on a for-profit basis are systematically excluded.

In addition to loans by public credit institutions, I also include credit to the economy by the central bank and the treasury, which are often reported separately in the sources. In Japan, South-Korea, and in the US, treasury loans are an important source of public credit. Historically, several central banks were also involved in direct credit to the economy.[15]

This is the first time long-run series of public credit are assembled. Iannotta et al. (2007) and Micco and Panizza (2006) provide bank-level balance sheet data (including data on loans), but with a very limited coverage. The data is available for less than 5 years, and covers a restricted sample of public banks. Verdier (2000) collects data on the total assets of public credit institutions in 20 countries, at several points in time (over the last 150 years), but the data does not distinguish between different types of assets. Another issue with existing studies is that they define "public" institutions as state-owned institutions (a notable exception is Xu et al. (2020), but they do not provide credit data). This is problematic because many public banks (e.g. nationalized commercial banks) operate according to profit-maximisation motives (Monnet, 2018). Since profit expectations are a key driver of credit cycles (Richter and Zimmermann, 2019), for-profit public banks might tend to lend pro-cyclically. Relying on the central bank's classification allows me to exclude commercially oriented public credit institutions.

[15]Until the early 2000s, the Bank Indonesia extended direct loans to firms and households (see Indonesian Financial Statistics, published by the Bank Indonesia).

Table 1: Public credit institutions

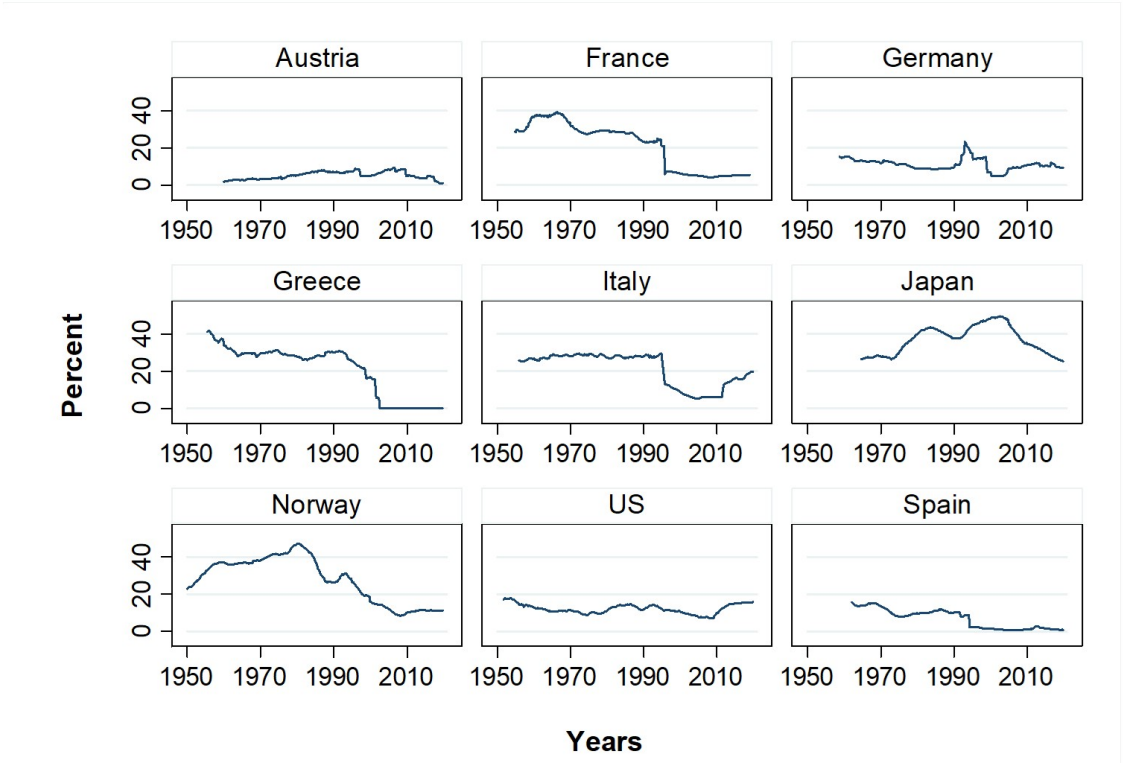
Country	Type of institution
Austria	Special credit institutions
France	Non-bank financial institutions (later named "institutions financières spécialisées")
Germany	Banks with special, development and other central support tasks
Greece	Specialized credit institutions
Indonesia	Central bank State banks Regional development banks
Italy	Istituti di credito speciale
Japan	Fiscal Loan Fund Government financial institutions
Mexico	Development banks Development funds ("fondos de fomento")
Norway	State lending institutions
US	Government (federal, state, and local)
South-Korea	Government (central) Specialized banks Development institutions
Spain	Instituto de Crédito Oficial
Thailand	Specialized financial institutions

Notes: In Italy, the distinction between special (public) credit institutes and private banks is abolished in 1993, and most special credit institutes are privatized shortly after. From 1994 onwards I focus on loans by the Cassa Depositi e Prestititi (CDP). In France, data on specialized financial institutions are no longer reported after 1995. From December 1995 onwards, I focus on loans by the Caisse des Dépôts et Consignations (CDC). See Appendix A.1 for a more detailed presentation of each country's public credit institutions.
Sources: See Appendix A.2.

In terms of time coverage, my database competes with existing quarterly series of private credit. In line with most empirical works on credit, I use the IMF International Financial Statistics "claims on the private sector from domestic banks" as my definition of private credit (Monnet and Puy, 2021). This definition is equivalent to the BIS' "bank credit to the private non-financial sector" (Dembiermont et al., 2013). Both the IMF and the BIS database report credit granted by domestic banks. The same holds for the database assembled in Müller and Verner (2021).

Since a small fraction of public credit institutions are banks, public and private

Figure 3: Public credit in % of total credit - Developed Economies



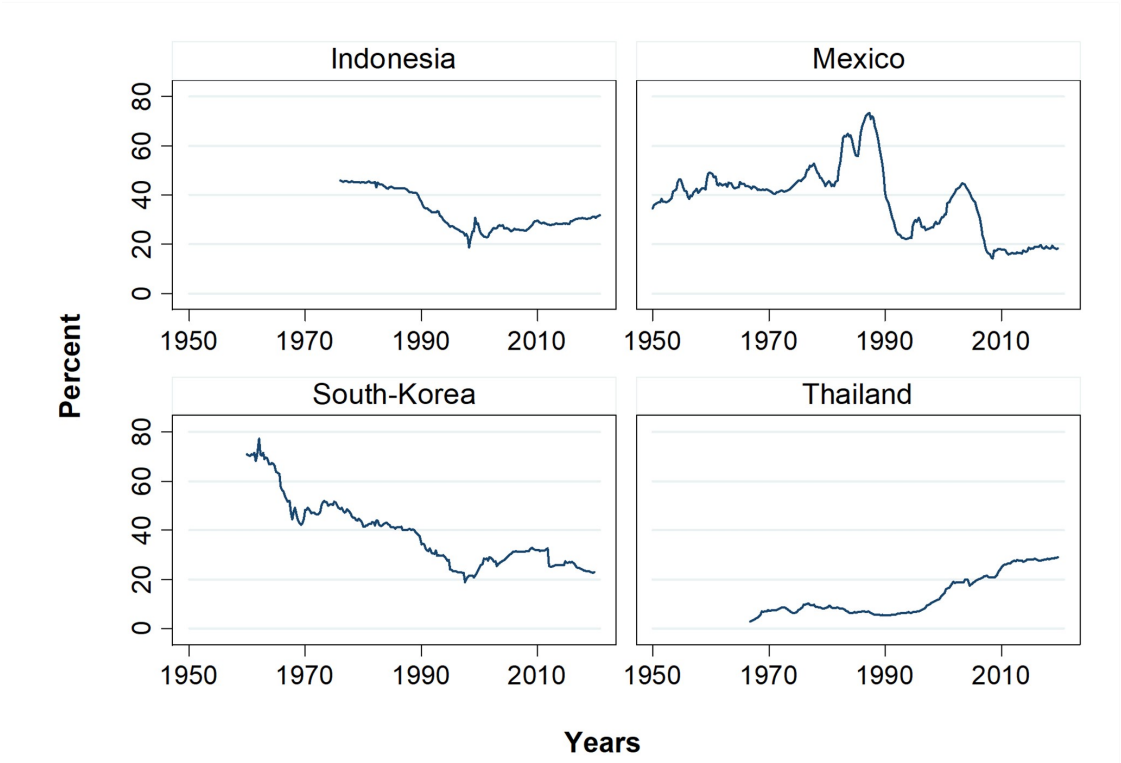
Notes: Total credit is the sum of private and public credit. Private credit data are drawn from Monnet and Puy (2021). From 1995 onwards, only biannual public credit data are available for Italy, I therefore exclude these observations from the empirical analysis (sections 2 and 3). In Greece, the share of public credit drops to 0 in 2002 (see Appendix A.1).
Sources: See Appendix A.2.

credit overlap (i.e. loans by bank-like public credit institutions appear both in public and private credit aggregates). To minimize this overlap, I subtracted credit by bank-like public credit institutions from private credit whenever possible.[16] Doing so required going through the International Financial Statistics documentation to understand which public institutions were included in private credit, and for what period. In many cases, the documentation was too imprecise to implement any correction on the data. Some minimal overlap therefore remains.

Figure 3 and 4 gives us a first glimpse of the data. Figure 3 plots the share of public credit in total credit for developed countries, over the 1950-2020 period. Figure 4 does the same for emerging countries. Total credit is calculated as the sum of private and public credit. It should be kept in mind that these figures slightly *underestimate* the true share of public credit. Two main stylized facts emerge. First,

[16] I did so for Austria, Germany, South-Korea, and Thailand. See Appendix A.1.

Figure 4: Public credit in % of total credit - Emerging Economies



Notes: Total credit is the sum of private and public credit. Private credit data are drawn from Monnet and Puy (2021). For Indonesia, public credit data start in 1966, but private credit data are available only from 1976 onwards.
Sources: See Appendix A.2.

public credit is more important in emerging economies than in developed economies. This was the case before the 1990s, when the share of public credit in total credit was 39% on average in emerging economies, and 23% in developed economies; and it is still the case today (25% vs 13%).

Second, large public credit aggregates are associated with extensive regulation of the financial sector. Historically, public credit reached its climax during the postwar decades at a time when the state intervened massively in the financial system. Where financial regulation was relatively mild, the postwar period was not associated with a large public credit sector. The United States, where public credit credit accounted for only 10% of total credit in 1975, is a paradigmatic example. In countries where private financial markets were more strictly regulated, the share of public credit was higher (e.g. 28% in France, 29% in Italy, and 32% in Japan in 1975), but it declined markedly following financial liberalization. Sometimes the decline occurred quite brutally, as

in France and Italy. The only exception to this pattern is Thailand, where the share of public credit actually increased markedly after financial liberalization (Thailand's case is particularly interesting, I come back to it below). Importantly, the relative decline of public credit is not only driven by financial deepening. As can be seen from Figures B1 and B2 in the Appendix, the ratio public credit to nominal GDP decreases or levels off with financial liberalization.

1.3 Public credit and financial liberalization

In tightly controlled financial systems, public credit is relatively large because most medium and long-term credit in the economy is public. In the aftermath of the Second World War, private finance for long-term investments was altogether unavailable, given the scarcity of private capital and collateral. Market segmentation then persisted, sometimes until the 1990s. Government-controlled long-term credit became a permanent feature of mixed economies (Zysman, 1983; Wade, 1990; Amsden, 2001; Monnet, 2018), while short-term credit markets remained the prerogative of commercial banks. The removal of restrictions on commercial banks and financial markets, during the 1980s and 1990s, freed up alternative sources of long-term finance. As a result, public credit institutions were made redundant, and many were closed-down or merged with commercial banks. Yet, demand for public credit did not dry out. Today, demand for public loans comes from sectors with no (or irregular) access to private finance: households (e.g. mortgage loans), Small and Medium Enterprises, agriculture, and students. Appendix A.1 indicates the principal sector of activity of some of the main public credit institutions in each country.

However, financial liberalization is not systematically associated with a decline of public credit. In Thailand, the share of public credit in fact increased from 9% in 1975 to 16% in 2000, and 29% today. Thailand's case suggests that political factors also matter. Politicians have an incentive to use public enterprises (including credit institutions) to engage in patronage and maximise support for the government (Shleifer and Vishny, 1994). This incentive is particularly strong in politically unstable regimes (Herrera et al., 2020). The fact that Thailand is the only autocracy in the sample should thus not appear as a coincidence.[17]

[17]The three other emerging economies in the sample successfully transitioned to democracy in the 1980s (South-Korea) or 1990s (Mexico and Indonesia).

2 Public credit and the Global Financial Cycle

Uncovering aggregate data on public credit allows me to examine its *macroeconomic* behavior. I begin by studying its reaction to foreign interest rate shocks. Interest rates in the United States affect capital flows, credit growth, bank leverage, and asset prices worldwide. International spillovers are a key driver of domestic credit cycles (Calvo et al., 1996; Rey, 2013; Miranda-Agrippino and Rey, 2020). For example, Baskaya et al. (2017) find that 43% of cyclical loan growth in Turkey can be explained by the Global Financial Cycle. This is a concern for policymakers because it can lead to excessive credit creation or retrenchment, and destabilize the financial system. The effects of the Global Financial Cycle are particularly strong in emerging economies. This vulnerability is explained by a range of structural weaknesses: higher reliance on foreign debt (in particular on foreign-currency denominated debt), fear-of-floating, less-developed financial markets... (Gourinchas and Obstfeld, 2012). At the country level, borrowers near their funding constraint are particularly vulnerable to foreign interest rate shocks.

Macroeconomists have dramatically neglected the role of public credit in the Global Financial Cycle. My hypothesis is that public credit markets are not sensitive to global financial conditions. The main reason behind this hypothesis is that public credit institutions enjoy an explicit or implicit subsidy on their debt. This allows them to lend at below-market rates (see Figure 1 and 2). Since the rate on public loans is not binding on borrowers, public credit institutions can control the quantity of credit extended independently of interest rate changes (see e.g. Bonomo et al. (2016) on Brazil's public banks).

In addition, public credit institutions face different incentives than private institutions. In particular, they are not rewarded for extending more (or less) loans because their profits are absorbed by the state. Lower (higher) US short-term rate need not translate into higher (lower) leverage and risk exposure on the part of public institutions (Bruno and Shin, 2015). Last, public credit markets are likely less sensitive to the credit channel of international monetary policy transmission (Bernanke and Gertler, 1995; Cesa-Bianchi and Sokol, 2022). The credit channel operates through borrowers' balance sheet. An increase in the Fed's rate leads to a deterioration of borrowers' net worth. As a result, credit supply contracts. Providing credit to borrowers with inadequate collateral and low net worth (low-income households, students, SMEs, agriculture...) is precisely the aim of most public credit institutions today. For these reasons, I suspect that public credit is independent from foreign monetary

shocks.

I use as benchmark the reaction of private credit to world interest rate shocks in countries with open capital accounts *and* fixed exchange rates. This setting, derived from the sacrosanct Mundell-Fleming model (Fleming, 1962; Mundell, 1963), is widely used in international economics (Shambaugh, 2004; Frankel et al., 2004; Obstfeld et al., 2005; Bluedorn and Bowdler, 2010; Klein and Shambaugh, 2015; Aizenman et al., 2016; Jordà et al., 2015, 2020). Focusing on countries with both open capital accounts and fixed exchange rates is a way to stack the odds against my hypothesis: I choose the setting where the domestic financial system is the *most* exposed to foreign spillovers. Flexible exchange rates indeed provide some insulation (albeit imperfect) from the Global Financial Cycle (Obstfeld et al., 2019; Han and Wei, 2018). In addition, looking through the lenses of the trilemma is more consistent with a long-run sample like mine, since the Global Financial Cycle is a recent phenomenon.

I define the sub-population of open pegs by relying on two indicators. First, I use the exchange rate flexibility indicator from Ilzetzki et al. (2019) to identify countries with fixed exchange rates.[18] In my sample, this includes currencies pegged not only to the US dollar, but also to the DM, and to the euro. Following Jordà et al. (2020), I treat Germany as the base for the euro area after 1999. Second, I rely on Quinn and Toyoda (2008) and on Chinn and Ito (2008) (and updates thereto) to define capital account openness.[19] As in Obstfeld et al. (2019), I include countries with at least partially open capital accounts.

As can be seen from Table 2, the sub-population of open-pegs cuts across periods of low and high financial development. Historically, public credit and capital controls were both part of the same policy package. Yet, the most severe restrictions on capital flows were dropped quite early in the postwar. This allows me to study the reaction of public credit before and after financial liberalization.

The next step in my empirical strategy is to construct a measure of interest rate shocks for base currencies. To do so, I draw on Jordà et al. (2020). For each of the base currencies in the sample, I isolate unpredictable variations in the domestic three-month interest rate. This unpredictable component is defined as the residual from a simple regression of the first difference in the country's three-month interest

[18] In line with the literature, I define as "pegged" countries with an exchange rate flexibility index inferior or equal to 9.

[19] The indicator is scaled from 0 to 4. I select observations associated with a capital account openness index superior or equal to 2. In effect, this amounts to eliminating the bottom 23% of the index sample distribution.

Table 2: The sub-sample of open-pegs

Country	Open-pegs	Average share of public credit
Austria	1962Q1-1968Q4 1970Q1-2020Q4	5%
France	1956Q3-2020Q4	21%
Germany	1954Q2-1972Q4	13%
Greece	1962Q1-1981Q2 1984Q3-2020Q4	18%
Indonesia	1978Q4-1997Q2 2007Q3-2010Q4	37%
Italy	1956Q1-1975Q3 1983Q1-2020Q4	24%
Japan	1960Q1-1977Q3	29%
Mexico	1950Q1-1981Q4 1989Q1-1994Q4	41%
Norway	None	.
US	None	.
South-Korea	1981Q2-1997Q3	35%
Spain	1963Q1-2020Q4	7%
Thailand	1956Q1-1964Q4 1968Q1-1969Q4 1990Q1-1996Q4	6%

Notes: Pegs are countries with an exchange rate flexibility index inferior or equal to 9 (Ilzetzki et al., 2019). To define capital account openness, I rely on Quinn and Toyoda (2008) and Chinn and Ito (2008) (and updates thereto). The index is scaled from 0 to 4. I consider as "open" countries with an index superior or equal to 2. This is equivalent to dropping the 23% of observations with the lowest index. The US dollar is floating against all other currencies during the entire period; while Norway is never "fixed" and "open" at the same time, both are therefore excluded from the sub-sample. The third column calculates the average share of public credit in total credit, for each country, over the period when the country is both "pegged" and "open".

rate on a broad set of domestic macroeconomic controls. Specifically, I control for up to six lags of the first difference in CPI inflation, long-term interest rate, private credit to GDP ratio, log real GDP, log house prices, log share prices, and exchange rate.[20] I also include up to six lags of the dependent variable.

Using the unpredictable component in the base country's short-term rate is useful to simulate a situation where countries in the periphery are, *on average*, at steady

[20]For the euro, I use the German three-month interest rate as short-term rate.

state when hit by the interest rate shock. This is particularly crucial because private and public credit aggregates might behave differently during upturns and downturns. In particular, public credit institutions might lend contracyclically to tame excessive variations in the business cycle (Cerutti and Bosshardt, 2020). Since my focus is on financial shocks, I need to control for economic cycles. Variations in the base country's interest rate are likely to be correlated with economic fundamentals in the periphery for two reasons: (a) if national economic cycles are synchronized (i.e. if there is some degree of co-movement between inflation and output in the center and in the periphery, independently of interest rate changes), and (b) due to spillover effects (i.e. if changes in the base's short-term rate impact the periphery through channels other than the interest-rate channel). Accounting for (a) and (b) is crucial for my identification strategy.

Policy surprises are, by definition, orthogonal to economic fundamentals in the base country. Working with policy surprises thus reduces the risk that world cycle effects contaminate my results. One limitation of my approach is that I do not control for the information available to policymakers when setting the interest rate. In Appendix C.1.2, I replicate my results using the measure of policy surprises constructed by Romer and Romer (2004) and extended by Miranda-Agrippino and Ricco (2021). I do not use it in my baseline specifications because it restricts the sample considerably.[21] To control for spillover effects, all my specifications include domestic GDP and domestic exports on the right-hand side.

I run the following sequence of quarterly regressions at horizons $h \in [0; 8]$ quarters, where $Credit_{i,t+h}$ is the growth rate of a credit aggregate (private, public or total) between $t-1$ and $t+h$, and $R_{b(i,t)}$ denotes unpredictable movements in country i's base country b short-term interest rate at time t:[22]

$$Credit_{i,t+h} = \alpha_h + \beta_h R_{b(i,t)} + \theta_h(L) X_{i,t} + trend_t + D_i + \varepsilon_{i,t+h} \tag{1}$$

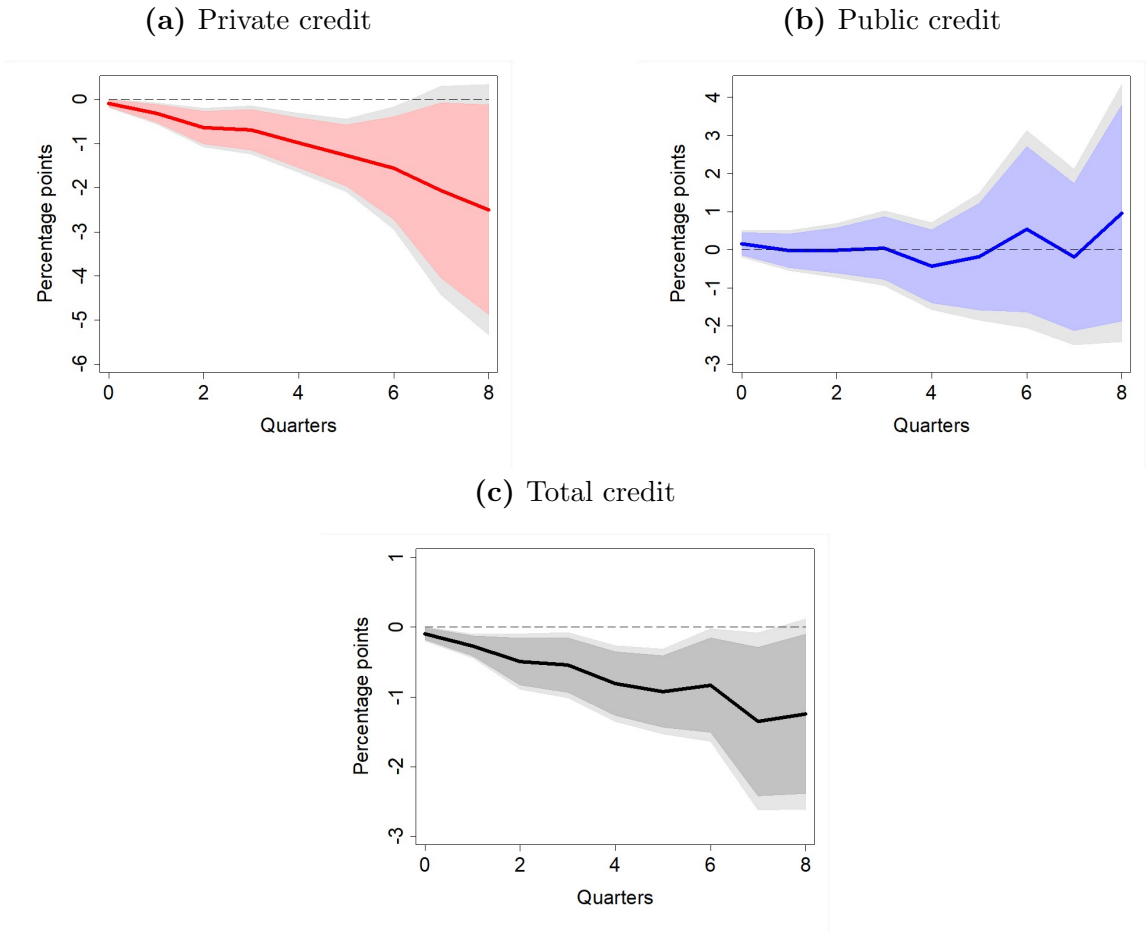
β_h thus traces out Jordà (2005)'s local projection impulse response function of foreign interest rate shocks on subsequent real private (or public) credit growth. α_h is a constant and captures the mean of $Credit_{i,t+h}$ for country i at horizon h, L is a lag polynomial for the control variables captured in $X_{i,t}$, D_i represents country fixed-effects, and $\varepsilon_{i,t+h}$ is the projection's residual. Controls include up to 8 lags of

[21] Miranda-Agrippino and Ricco (2021)'s measure is only available for the US so it implies dropping all non-dollar pegs from the sample. In addition, the series only starts in 1969, and ends in 2007.

[22] For floats, I use the US short-term rate as base rate.

the Impulse and Response variables, of the growth rate of domestic real GDP, world real GDP, domestic exports, and of the first difference of the dollar exchange rate and private credit to GDP ratio. I also include a linear trend to account for non-stationarity. Equation 1 is estimated over the sub-sample of open-pegs (see Table 2), with robust standard errors. I run three sets of regressions with the growth rate of three different credit aggregates as dependent variable: private credit, public credit, and total credit. Total credit is calculated as the sum of private and public credit. Figure 5 presents the results. Panel A, B, and C show the response of private, public and total credit.

Figure 5: Public credit and the trilemma - Partially open economies

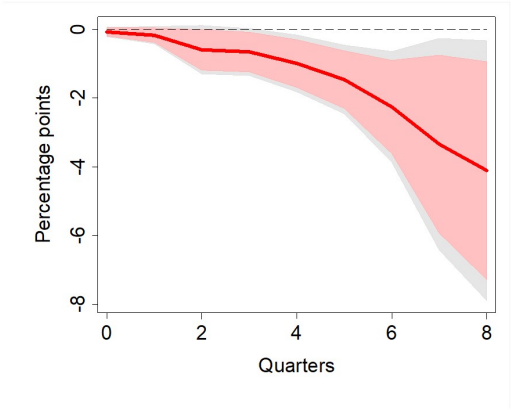


Notes: Cumulative response of the growth rate of real credit to a 1pp shock on the short-term interest rate in the center country. Panel A, B, and C show the response of private, public, and total credit respectively. The sample is restricted to open-pegs (see Table 2). I use a loose definition of capital account openness by including partially open economies in the sample. The capital account openness index comes from Quinn and Toyoda (2008) and Chinn and Ito (2008) (and updates thereto). The index is scaled from 0 to 4, and I consider as "open" countries scoring 2/4 or higher. Pegs are countries with an exchange rate flexibility index inferior or equal to 9 (Ilzetzki et al., 2019). Shaded areas denote 95% and 68% confidence intervals. Standard errors are robust.

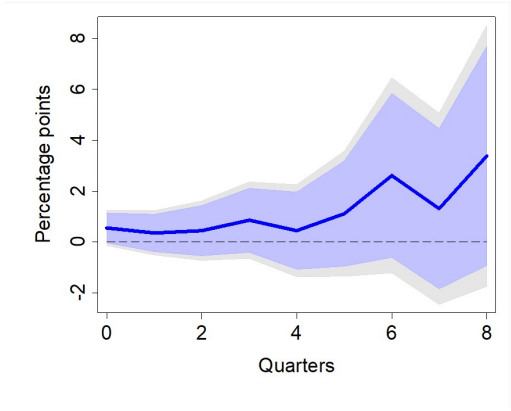
I find (reassuringly) that private credit is sensitive to foreign monetary shocks. Two years after the shock, the real growth rate of private credit is 2.3pp below its normal level. I do not find any effect on public credit (Panel B). In Panel B, the standard error band is centered around 0 and spans across both positive and negative values. Interestingly, Panel C shows that the cumulative response of total credit is only half that of private credit (-1pp in Panel C against -2.3pp in Panel A). Including time fixed-effects and clustering the standard errors does not affect the results.

Figure 6: Public credit and the trilemma - Open economies

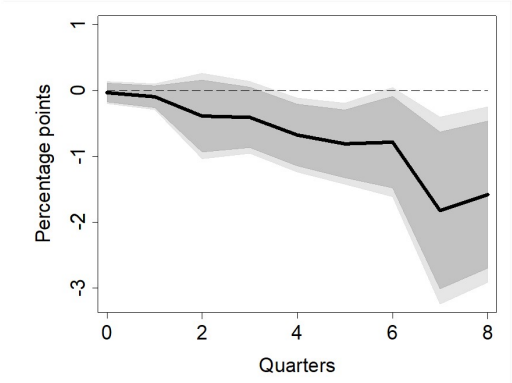
(a) Private credit



(b) Public credit



(c) Total credit



Notes: Cumulative response of the growth rate of real credit to a 1pp shock on the short-term interest rate in the center country. Panel A, B, and C show the response of private, public, and total credit respectively. As in Figure 5, the sample is restricted to open-pegs. This time, I work with a stricter definition of capital account openness, by selecting observations associated with a capital account openness index superior or equal to 2.5. 35% of observations fall below this threshold. The definition of pegs is the same as in Figure 3. Shaded areas denote 95% and 68% confidence intervals. Standard errors are robust.

I then bid up the stakes by using a stricter definition of capital account openness. Figure 6 shows the updated results. As expected, the response of private credit is larger than before. The cumulative effect of a 1pp increase in foreign interest rate on

the growth rate of real private credit jumps to -4.1pp (against only -2.5pp in Figure 5). Public credit remains unaffected but the standard error band is mostly centered on positive values. As a result, the wedge between the cumulative response of private and total credit is even larger than in Figure 5 (-1.6pp in Panel C against -4.1pp in Panel A). Importantly, since all specifications controls for lags of the credit to GDP ratio, the effect of foreign monetary shocks on domestic credit is *independent* of domestic credit cycles. Appendix C.1 provides three sets of robustness checks. First, it explicitly controls for heterogeneity in the response of public credit. I successively interact my measure of foreign policy shocks with three different dummy variables, and show that the cumulative effect on public credit is null across various sub-samples. I compare the following sub-samples: before/after 1990, and periods when the public credit sector is relatively large/small (I look at the variation in the size of the public credit sector both within and between countries). Second, I replicate my results using Miranda-Agrippino and Ricco (2021)'s measure of US policy shocks. Third, I add a broad range of domestic macroeconomic variables as controls: equity prices, house prices, long-term and short-term interest rates. For the last two tests, the sample is considerably smaller due to data availability. In both cases, I find that public credit does not react to foreign policy shocks (although standard errors are considerably higher due to a reduced sample size, particularly when using Miranda-Agrippino and Ricco (2021)'s shocks as Impulse variable).

Public credit markets are immune to foreign policy shocks. As I discuss in section 4, this result has important policy implications. However, international spillovers account for a relatively small share of cyclical loan growth.[23] In the next section, I study the behavior of public credit aggregates during booms and busts of private credit.

3 Public credit and domestic credit cycles

Credit booms have large negative real effects. Many end in financial crises (Gourinchas and Obstfeld, 2012; Schularick and Taylor, 2012) or in severe recessions (Mian et al., 2017; Dell'Ariccia et al., 2020). During the bust, higher leverage is translated into lower aggregate demand, as constrained borrowers cut spending to pay-off existing debt (Fisher, 1933; Guerrieri and Lorenzoni, 2017). Consequently, more credit-

[23] In the sample of open economies (Figure 6), a 1pp shock on foreign interest rates leads to a 4pp decrease of the growth rate of real private credit after 2 years. This is equivalent to 1/6 of the standard deviation of real credit growth.

intensive expansions tend to be followed by deeper recessions (Jordà et al., 2013). As evidenced by Mian and Sufi (2009); Mian et al. (2017), households (in particular poor households) play a key role in the process.

In a bust, public credit can be used to provide debt-relief to borrowers below or near their funding constraint. Jiménez et al. (2018) show that public loans had large positive real effects following the 2008 financial crisis in Spain. Ideally, public credit would contract during private booms and expand during busts to smooth shocks on the credit constraint. However, countercyclical lending should not be taken for granted. In countries with weak political institutions, public credit institutions could be tempted to "ride" the boom (Herrera et al., 2020). Public institutions could also suffer more during the bust, since they tend to have riskier portfolios (and higher default rates) than private institutions.

3.1 Private and public credit cycles: Some descriptive statistics

My long-run dataset allows me to study public credit cycles across different macro-financial environments. Identifying the circumstances for public credit to behave contra-cyclically is crucial to improve the response to financial shocks. I begin with some descriptive statistics on public and private booms. To identify credit booms, I follow Richter et al. (2021). I choose this method because it does not require to select a maximal (or minimal) length for the credit cycle. It is therefore a good starting point to identify the main characteristics of both public and private cycles in the sample.

Richter et al. (2021)'s method works in two steps. To extract the cyclical component of credit I first regress, for each country, the log of real (private or public) credit y_t on its past values y_{t-h} where $h \in [3; 6]$ years (or, equivalently, $h = \{12, 16, 20, 24\}$ with quarterly data like mine).

$$y_t = \beta_0 + \beta_1 y_{t-3} + \beta_1 y_{t-4} + \beta_1 y_{t-5} + \beta_1 y_{t-6} + \varepsilon_t \tag{2}$$

The cyclical component of credit is the residual of Equation 2 ε_t. A boom occurs when the log of real credit exceeds expectations by more than a specific amount, which is defined in terms of the country specific standard deviation of ε_t. Formally, the period t is considered as a boom period if $\varepsilon_t - \lambda \times \sigma(\varepsilon_t) > 0$, where $\sigma(\varepsilon_t)$ is the standard deviation of ε_t. As Richter et al. (2021), I set $\lambda = 0.75$.

When two booms are separated by a non-boom period lasting less than 4 quarters,

Table 3: Credit booms - Private and public (1950-2020)

Country	Nb of private booms	Nb of public booms	Avg length private boom	Avg length public boom	Nb of "bad" private booms
Austria	6	4	3.25 years	2.75 years	3 (50%)
France	8	5	2.25 years	3 years	5 (63%)
Germany	4	4	2.5 years	2 years	3 (75%)
Greece	4	5	5 years	2.5 years	3 (75%)
Indonesia	4	5	1.75 years	2 years	2 (50%)
Italy	6	5	3 years	2 years	5 (83%)
Japan	6	6	2 years	1.75 years	3 (50%)
Mexico	5	6	2.25 years	2.25 years	5 (100%)
Norway	8	7	1.5 years	2 years	6 (75%)
US	9	7	2 years	1.75 years	6 (66%)
South-Korea	3	9	4.5 years	1.5 years	3 (100%)
Spain	7	7	2.5 years	2.25 years	4 (57%)
Thailand	7	3	2.5 years	4 years	4 (57%)
Total number & average length	77	73	2.75 years	2.25 years	52 (67%)

Notes: In the last column, the number in parentheses is the % ratio of "bad" private booms to total private booms. To identify credit booms, I rely on the two-steps procedure introduced in Richter et al. (2021). First, for each country, I de-trend the log of real credit (public or private) y_t by regressing it on its own lagged values y_{t-12}, y_{t-16}, y_{t-20}, y_{t-24} where t is in quarters. I am interested in the residual of this equation ε_t. Second, I code the period t as a boom period if $\varepsilon_t - 0.75 \times \sigma(\varepsilon_t) > 0$ where $\sigma(\varepsilon_t)$ is the standard deviation of the residual of Equation 2 ε_t. In other words, a boom occurs when the log of real credit exceeds expectations by more than a specific amount, which is defined in terms of the country specific standard deviation of ε_t. I refer to the local maximum value of ε_t during a specific boom period (i.e. conditional on Credit Boom=1) as the peak of the credit boom. A "bad" credit boom is a boom followed by **either** a financial crisis **or** a severe recession within three years of the boom's end. The coding of financial crises follows Schularick and Taylor (2012) and Laeven and Valencia (2020). Severe recessions are identified through the same two-steps procedure.

the non-boom period is also categorized as boom. "Bad" private booms are defined as booms followed either by a financial crisis or by a severe recession (see the notes to Table 3 for a more precise description).

Table 3 presents some preliminary statistics on the number of private and public booms, on their average length, and the number of "bad" private booms for each country in the sample.

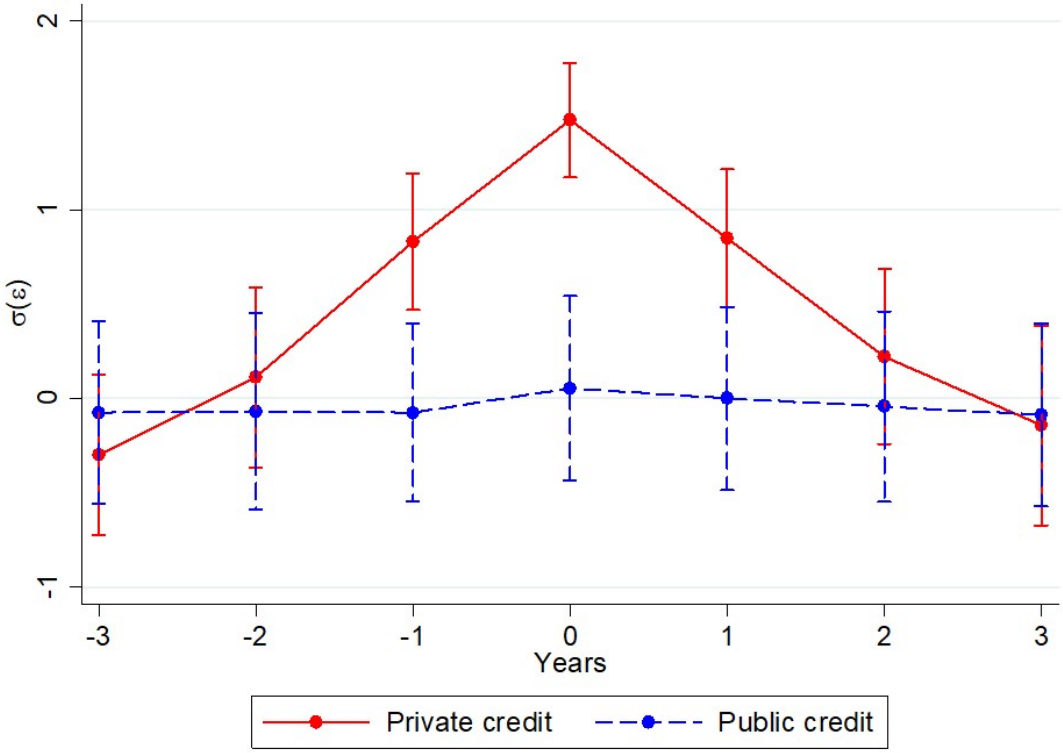
Three comments are in order. First, most private booms are "bad". In the sample, I find that 67% of booms are "bad" booms. This is in line with the findings of Dell'Ariccia et al. (2020), who study a large sample of developed and emerging economies covering the 1970-2014 period. Dell'Ariccia et al. (2020) report that two thirds of booms lead to financial crises or recessions. Second, public and private booms are virtually indistinguishable when one looks at the frequency or the duration of the boom. Nor is there a clear difference in the data between emerging and developed economies.

Looking at the *timing* of the booms, however, reveals an interesting pattern. Figure 7 presents an event study of the cyclical behavior of public and private credit around the peak of a private credit boom. I look at the path of ε_t (the residual of Equation 2) through a 6 years window around the peak of a private boom. To make comparisons across countries possible, I scale ε_t by its country-specific standard deviation $\sigma(\varepsilon_t)$. I then average out the result across the sample for event-3 years, event-2 years,..., event+3 years (where "event" indicates the quarterly date of the peak of the private boom).

Interestingly, during the 6-years window around the peak of a private boom (Year=0), public credit is *below* its normal trend (i.e. the ratio ε_t to $\sigma(\varepsilon_t)$ is on average negative). During the peak (Year=0), public credit goes through a (very) moderate expansion. This first result suggests that public booms are not synchronized with private booms. In Appendix C.2, I reproduce Figure 7 using Gourinchas et al. (2001)'s method for filtering out the trend component of private and public credit growth.

Looking at country case studies, however, reveals considerable heterogeneity both across and within countries. In fact, the blue line in Figure 7 averages out two distinct behaviors. Before financial liberalization, public credit tends to be extremely procyclical. After financial liberalization, public credit becomes clearly contracyclical. Figures 8 to 10 present three sets of country case studies. Each time, I look at the cyclical component of public and private credit, across time. To generate this cyclical

Figure 7: Event study - Public credit and private booms



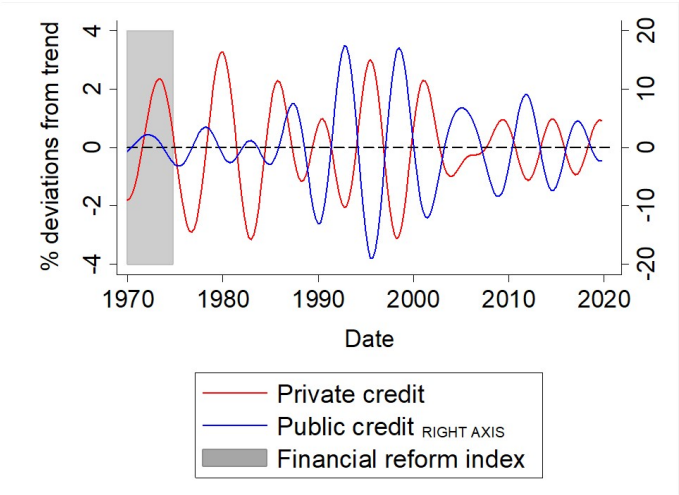
Notes: To construct this figure, I start with the residual of Equation 2 ε_t. I scale ε_t by its country-specific standard deviation $\sigma(\varepsilon_t)$. I then average out the result across the sample, for event-3, event-2,..., event+3 (where "event" indicates the date of the peak of the private boom). The numbers on the Y axis can thus be interpreted in terms of $\sigma(\varepsilon_t)$ of public and private credit. I present 68% confidence bands.

component, I depart from the method of Richter et al. (2021) by using a Christiano and Fitzgerald (2003) filter. This allows me to filter out within-cycle variations in credit. Specifically, I filter out cycles at periods smaller than 18 quarters (4.5 years). I choose this particular value because it is twice the average length of a public boom in the sample (see Table 3).

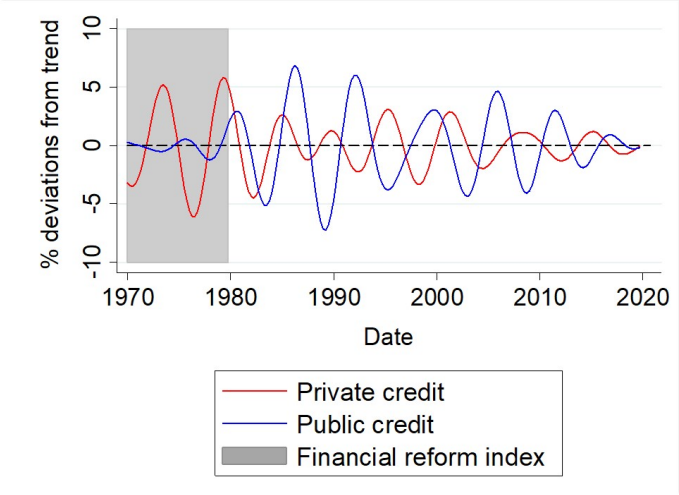
To measure financial liberalization, I use the financial reform index from Abiad et al. (2010) (extended until 2013 by Omori (2022)). This index captures the intensity of the regulations on domestic banks and financial markets (i.e. stock and bond markets). It is available from 1973 onwards. I use the index to distinguish between three different regimes of financial liberalization: low (dark grey shading), medium (light grey shading) and high (no shading). Figures 8 to 10 present three sets of country case studies. Figure 8 shows the cyclical component of both private and public credit, for two countries where financial liberalization occurred (relatively)

Figure 8: Public credit cycles - Early financial liberalization

(a) Germany



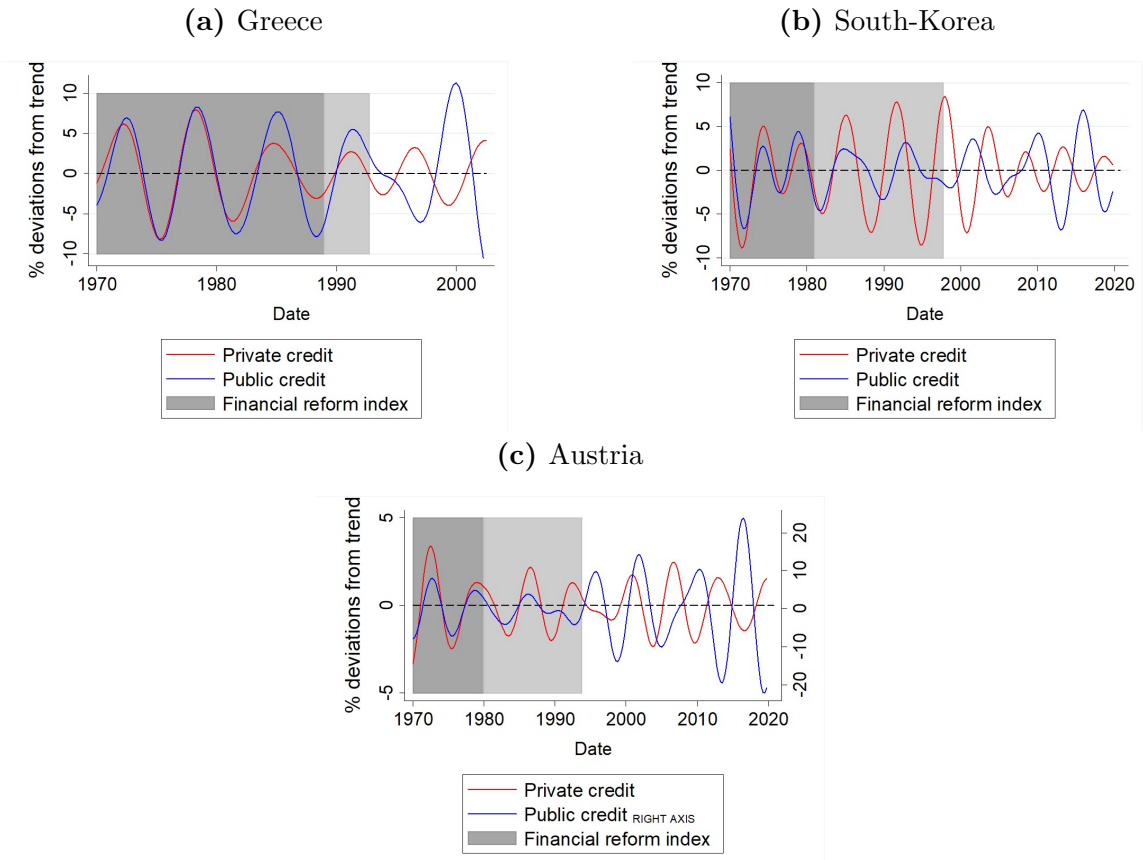
(b) United States



Notes: The red and blue lines show the cyclical component of private and public credit respectively. The cyclical component is generated with the Christiano and Fitzgerald (2003) filter. I filter out cycles with periods smaller than 18 quarters (4.5 years). I choose this particular value because it is equal to twice the length of a public boom in the sample (see Table 3). The shaded area represents different values of a financial liberalization index. I use the index from Abiad et al. (2010) (extended until 2013 by Omori (2022)). The index takes its values between 0 and 21. I use the index to distinguish between three stages of financial liberalization: low ($0 < index \leq 7$), medium ($7 < index \leq 14$), and high ($14 < index$). Dark grey shading represents low financial liberalization, light grey represents medium liberalization, and no shading indicates high liberalization. The index is available from 1973 to 2013. I assume that the index is constant after 2013 and between 1970 and 1973.

early: Germany and the United States. Figure 9 does the same for three countries where liberalization occurred around the 1990s, and Figure 10 presents the case of Indonesia, where financial liberalization has not yet been fully completed.

Figure 9: Public credit cycles - Late financial liberalization



Notes: See Figure 8 for a full description. For Greece, public credit is equal to 0 after 2002.

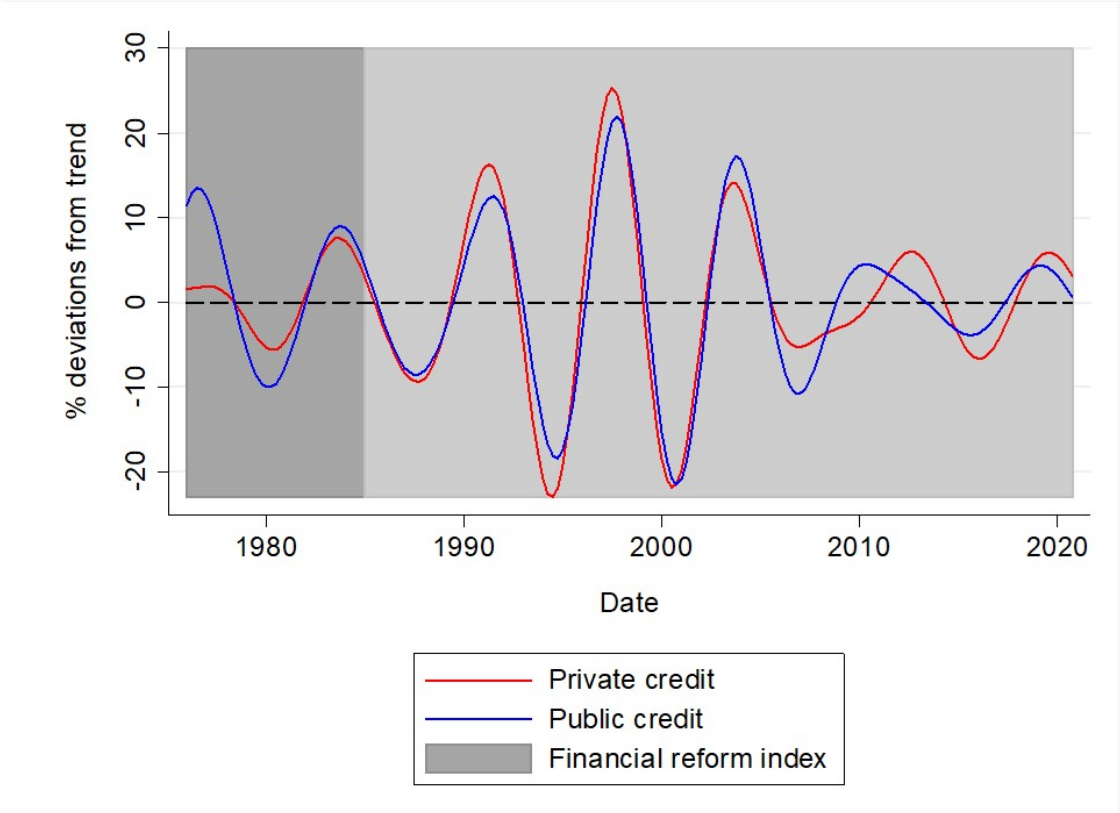
The results in Figure 8, 9 and 10 are quite striking. Each time, the transition from a procyclical to a contracyclical behavior of public credit closely tracks financial liberalization.

The reason behind this result is straightforward. When the financial system is tightly controlled, public and private loans are *complements* (i.e. public loans are long-term and private loans are short-term). Following financial liberalization, public credit becomes a *substitute* to private credit (i.e. public loans are available to borrowers who are excluded from private credit markets).[24] During the boom phase of the cycle, the financial constraint loosens and the demand for public loans dries out. Likewise, in the bust phase of the cycle, the financial constraint tightens and the demand for public loans increases.

During the postwar period, the rise of the public credit sector was part of a

[24]In fact, nowadays, many public institutions require their clients to justify at least one loan rejection from a private bank to be eligible for a public loan.

Figure 10: Public credit cycles - No financial liberalization (Indonesia)



Notes: See Figure 8 for a full description. Private credit data for Indonesia are not available before the late 1970s.

broader policy package designed to direct savings flows towards strategic sectors of the economy (Monnet, 2018; Musacchio et al., 2017). It went hand in hand with a tight regulation of banks and private financial markets. Public and private credit markets were highly segmented: medium and long-term credit markets were the prerogatives of public credit institutions, while private banks focused on short-term credits. Since the 1980s/1990s, financial deregulation led to a progressive decline in the market share of public credit. Many public credit institutions were privatised or merged with private commercial banks, and remaining public institutions lost their prerogative on long-term lending. In this new macro-financial environment, public loans are mostly granted to borrowers with no (or irregular) access to private finance: low-income households, Small and Medium Enterprises (SMEs), students, local administrations, agriculture. This evolution is reflected in the macroeconomic behavior of public credit.

A second important result from Figures 8 and 9 is that, in countries where public credit accounts for a relatively low share of total credit (e.g. Germany and Austria),

the amplitude of public credit cycles is extremely large (from 4 to 10 times higher than the amplitude of private cycles). In times of credit crunch, public credit institutions are stretched to meet the demand for credit.

3.2 An econometric test

To formalize this result, I use the method introduced in Meller and Metiu (2017). I start off with the cyclical component of public and private credit aggregates, identified (as in Figures 8 to 10) with a Christiano and Fitzgerald (2003) filter (and I filter out cycles with periods smaller than 18 quarters). I generate two variables: $Public_{i,t}$ and $Private_{i,t}$ which I use to map out public and private cycles. $Public_{i,t}$ takes a value 1 when public credit is in expansionary phase (when the blue line is above 0), and -1 when it is in contractionary phase (when the blue line is below 0). $Private_{i,t}$ does the same for private credit. I then take the product of these variables, which I call $Sync_{i,t} = Public_{i,t} \times Private_{i,t}$. The variable $Sync_{i,t}$ takes on two different values: 1 if private and credit cycles are on the same phase, and -1 if private and credit cycles are on the opposite phase (for country i at time t). $Sync_{i,t} = 1$ occurs when $Public_{i,t} = 1$ and $Private_{i,t} = 1$, or when $Public_{i,t} = -1$ and $Private_{i,t} = -1$. $Sync_{i,t} = -1$ occurs when $Public_{i,t} = 1$ and $Private_{i,t} = -1$, or when $Public_{i,t} = -1$ and $Private_{i,t} = 1$.

I then take the expected value of $Sync_{i,t}$ across the sample. If public and private cycles are perfectly negatively synchronized, then $\mathbb{E}[Sync_{i,t}] = -1$, if public and private cycles are perfectly positively synchronized then $\mathbb{E}[Sync_{i,t}] = 1$, and non-synchronization is defined by $\mathbb{E}[Sync_{i,t}] = 0$ (that is, public and private credit are equally likely to be on the same phase or in the opposite phase). To estimate the average value of $Sync_{i,t}$, I run the following panel regression:

$$Sync_{i,t} = \beta_0 + \varepsilon_{i,t} \tag{3}$$

The OLS estimate of β_0 is the sample mean of phase synchronization $\mathbb{E}[Sync_{i,t}] = \frac{1}{i \times t} \sum Sync_{i,t}$. The synchronization variable $Sync_{i,t}$ and therefore $\varepsilon_{i,t}$ may be prone to serial correlation, as they inherit their serial dependence structure from the underlying time series. As Meller and Metiu (2017), I use Newey and West (1987) standard errors. I am interested in measuring the expected value of β_0 in periods of low and high financial liberalization. As in Figure 8 to 10, I rely on Abiad et al. (2010) for the indicator of financial liberalization. This time I split the sample into two, based on the sample mean of the financial reform indicator.

Table 4: Public and private credit cycles synchronization

	Low liberalization	High liberalization
β_0	0.440***	-0.225***
	(0.030)	(0.042)
Observations	1911	1210
No. of countries	13	12

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

Notes: Newey–West standard errors are given in brackets. I allow two lags to be considered in the auto-correlation structure. The pre-liberalization sub-sample (column 1) groups all the observations associated with a financial reform indicator below its sample mean. The post-liberalization sub-sample (column 1) groups all the observations with a financial reform indicator above its sample mean. As in Figures 8 to 10, I use the indicator from Abiad et al. (2010) (extended by Omori (2022)).

I therefore compare the expected value of β_0 across two sub-samples: pre-financial liberalization sub-sample (financial reform index below its sample mean), and post-financial liberalization sub-sample (financial reform index above its sample mean). In effect, for the 6 countries studied in Figures 8 to 10, the pre-financial liberalization sub-sample (roughly) corresponds to the shaded area. Results are presented in Table 4.[25] In both sub-samples, the null $\beta_0 = 0$ can be rejected. However, while public and private credit are positively synchronized when financial liberalization is low (column 1), the synchronization turns negative when financial liberalization is high (column 2).

3.3 Public credit and the real effect of credit cycles

During a bust, public loans can prevent constrained borrowers from being cut-off credit markets and forced into rapid deleveraging (Jiménez et al., 2018). In this section, I present evidence that public credit mitigates the decline in total credit and output during private busts. Specifically, I show that the decline in total credit and output during the bust is lower when the ex-ante share of public credit in total credit is higher. Importantly, this result only holds in the post-liberalization sub-sample.

I start with the sample of private credit booms identified, as in Table 3, using the method of Richter et al. (2021). For each boom, I calculate the total credit (output) loss during the subsequent bust as the difference between the cumulative real growth rate of total credit (GDP) over the 5 years following the end of the boom,

[25] I allow two lags to be considered in the auto-correlation structure. But result are robust to different lags.

and the country mean growth rate of total credit (GDP). A positive (negative) loss thus indicates that the growth rate of real total credit (or GDP) over the 5 years following a credit boom is above (below) the growth rate in "normal" times. Note that by taking the difference from the country mean, I allow for different trend growth rates across countries.[26] I then estimate the following regression over the sample of credit booms:

$$Loss_i = \beta_0 + \beta_1 Share_i + \varepsilon_i \tag{4}$$

Where *Loss* represents total credit (or output) loss following boom i, and *Share* is the ex-ante share of public credit (calculated as the % share of public credit in total credit at the end of boom i). Results are presented in Table 5. In the first two specifications, my dependent variable is total credit loss, in specifications (3) to (6) I switch to output loss. In specification (1), (2), (3) and (5) I focus on "bad" booms, while specifications (4) and (6) extend the sample to all booms. Specifications (1), (3) and (4) are estimated over the post-liberalization sub-sample (defined as in Table 4), while specifications (2), (5) and (6) are estimated over the pre-liberalization sub-sample (see the notes to Table 5 for a full description).

Specification (1) reveals that in the post-liberalization sub-sample, a 10 percentage points increase in the ex-ante share of public credit is associated with a 15.9 percentage points increase in the total credit loss (remember that a positive loss means that total credit or GDP grew more than during "normal" times). This is a sizeable effect, as the mean total credit loss in this sub-sample is -16%.[27] In line with the evidence presented in sections 3.1 and 3.2, specification (2) shows that in the pre-liberalization sub-sample, the ex-ante share of public credit has no effect on the path of total credit during a bust.

Turning to the real effect of credit busts, specification (3) shows that (in the post-liberalization sub-sample) output declines less following a "bad" boom when the ex-ante share of public credit is larger. Specification (4) replicates this result using all credit booms occurring in the post-liberalization sub-sample (rather than just "bad"

[26] Results obtained without controlling for country-specific trends in credit or GDP are similar to the one reported here and are available upon request.

[27] Since public credit tends to expand during private busts, a larger share of public credit before the bust leads to a mechanical increase in the growth rate of total credit during the bust. However, as evidenced by Jiménez et al. (2018), an indirect effect can also be at work, whereby public credit crowds-in private credit. In this case, a larger share of public credit before the bust would be associated with a higher growth rate of *private* (and total) credit during the bust. A careful measurement of these two effects would require micro-level data, which is why it is left to future research.

Table 5: Public credit and private busts

	(1)	(2)	(3)	(4)	(5)	(6)
Ex-ante share of public credit	1.587**	0.398	0.619***	0.519***	0.286	0.147
	(0.698)	(0.998)	(0.167)	(0.167)	(0.186)	(0.158)
Constant	-37.065***	-30.820	-12.212***	-8.712***	-11.906**	-6.556
	(11.262)	(28.392)	(2.703)	(2.674)	(5.446)	(4.383)
Observations	23	25	23	30	24	31

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

Notes: The dependent variable is the cumulative credit loss after a credit boom in specifications (1) to (3), and the cumulative output loss in specifications (4) to (6) (credit booms are identified as in Table 3). The cumulative credit (output) loss is calculated as the difference between the growth rate of real total credit (output) over the 5 years following a credit boom, and the country mean growth rate of real total credit (output) over 5 years. A positive (negative) loss thus indicates that the growth rate of real total credit over the 5 years following a credit boom is above (below) the growth rate in "normal" times. Specifications (1), (3) and (4) are estimated over the post-liberalization sub-sample (defined as in Table 4), while specifications (2), (5) and (6) are estimated over the pre-liberalization sub-sample. In specifications (1), (2), (3), and (5) I focus on bad credit booms (defined as in Table 3), while specifications (4) and (6) extend the sample to all booms (i.e. both good and bad booms). Finally, specifications (1), (3), and (4) include a Tequila crisis dummy as control. During the 1995 Tequila crisis Mexico suffered from banking and sovereign debt distress, leading to a collapse of both private and public credit. Total credit contracted by 165% in real terms over 5 years (making it the single largest credit contraction in my sample).

booms). Importantly, this result is robust to controlling for the ratio private credit to GDP, for a financial reform index, or for time fixed effects. Specifications (5) and (6) are a replication of specifications (3) and (4) respectively, over the pre-liberalization sub-sample. Once again, a larger share of public credit *before* the bust does not predict higher output growth *during* the bust.

4 Policy implications

This article puts forward two main results. First, public credit markets are immune to the different channels of international monetary policy transmission. Second, public credit is strongly contracyclical when restrictions on private financial markets and institutions are low. Both results have important policy implications.

4.1 Public credit and the Global Financial Cycle

The first implication of my results is that limited monetary autonomy is possible, even in fixed exchange rate regimes with open capital accounts. Through public credit institutions, states control the allocation of credit to specific sectors of the economy,

independently of world financial conditions. Public credit thus helps governments achieve a middle ground solution to the trilemma/dilemma (Klein and Shambaugh, 2015). This is the case in developing countries, where public credit is part of a policy-mix including limited controls on capital flows and exchange rate flexibility. It it also the case in developed economies, where public credit outlasted other forms of government intervention in the economy. In fact, the persistency of public credit can partly be attributed to the demise of other forms of state intervention. As economic and financial globalization deprived governments of traditional policy instruments, public credit institutions became increasingly used as a flexible tool to carry out industrial and social policies (Mertens et al., 2021).

Second, my results suggest that great care should be taken when implementing financial reforms (Diaz-Alejandro, 1985). Privatizing public credit increases the exposure of the domestic economy to the Global Financial Cycle. Scrapping down public credit institutions can be warranted when the allocation of public loans is inefficient (e.g. in countries with weak or unstable political institutions), but temporary capital controls should be allowed as a buffer against foreign shocks. On the other hand, efficiently run public credit institutions could serve as a substitute to selective controls on capital flows (i.e. by isolating certain segments of the credit market from the Global Financial Cycle).

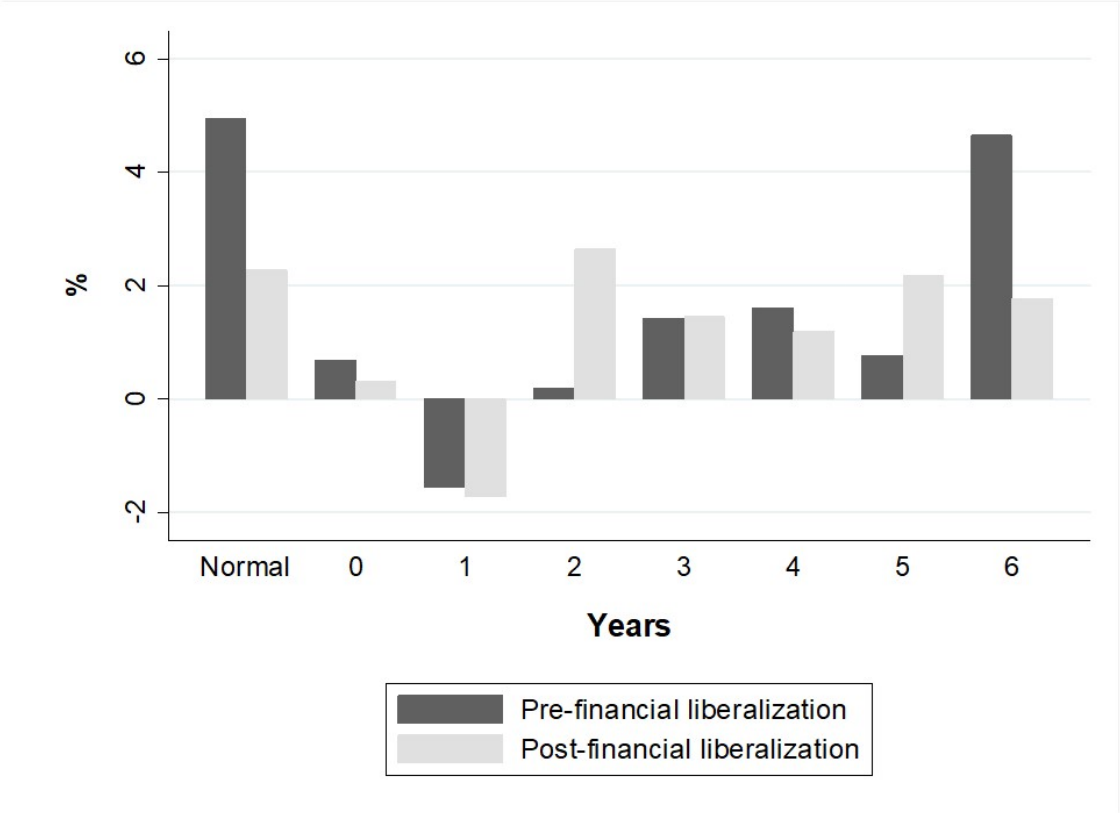
4.2 Public credit and domestic credit cycles

In countries with mature financial systems, public credit has been used as a macroprudential tool. By targeting borrowers with no access to private finance, public credit institutions can tame the real effects of negative credit shocks (Jiménez et al., 2018). In fact, public credit might help explain the puzzle raised by Schularick and Taylor (2012). Schularick and Taylor notice that the real effect of postwar financial crises is surprisingly low given the heavy financialization of the economy. Since, in their sample, all postwar financial crises occur in financially developed economies (where public credit is contracyclical), public credit might go a long way in explaining this result.

Schularick and Taylor's puzzle also shows up in my data. Figure 11 compares the effect of a financial crisis on the growth rate of real GDP in the pre-liberalization sample and in the post-liberalization sample.[28] Specifically, it looks at the yearly

[28]Financial crises are identified following (Schularick and Taylor, 2012) and (Laeven and Valencia, 2020). The pre and post-liberalization sub-samples are identified as in Table 4.

Figure 11: The real effect of financial crises - Pre vs Post-financial liberalization



Notes: The definition of financial crises follows Schularick and Taylor (2012) and Laeven and Valencia (2020). The pre and post-liberalization sub-samples are identified as in Table 4. The bars represent the yearly growth rate of real GDP outside periods of financial crises (i.e. in "normal periods"), and during financial crises (from the year of the crisis to 6 years after the crisis).

growth rate of real GDP outside periods of financial crises (i.e. in "normal periods"), and during financial crises (from the year of the crisis to 6 years after the crisis). In line with Schularick and Taylor (2012), I find that the path of output following a financial crisis is surprisingly similar in both sub-samples. In fact, the relative effect is much stronger in the pre-liberalization phase. In both cases, the economy takes 5 to 6 years to recover from the crisis.

This is particularly puzzling given the relative weight of private credit in the two samples (the average credit to GDP ratio is only 44% in the pre-liberalization sub-sample, against 71% in the post-liberalization sample). My results suggest that public credit could help explain the (relatively) low real effect of financial crises in financially developed economies.

5 Conclusion

This article uncovers a hidden segment of the financial market. Public credit accounts for a large share of total credit, and has stabilizing macroeconomic properties: it is not sensitive to the Global Financial Cycle, and its cycles are opposite to private credit cycles. While the former is unconditional, the latter is true only in economies where restrictions on private financial intermediaries are low.

Today, pervasive financial regulation is generally found in countries with weak governments (La Porta et al., 2002). In these countries, loans by public credit institutions tend to be both inefficiently allocated and (very) procyclical. Cutting down on the public credit sector is therefore warranted. However, policymakers should be aware that privatizing public credit markets increases their sensitivity to foreign shocks.

In countries with free financial markets, however, my results show that public credit smooths negative credit shocks, and helps reduce their real effects. This result opens up fascinating new avenues for research: how large are the effects of public credit on output in a credit crunch? Are the effects on output high enough to outweigh the fiscal costs of public credit, particularly when default rates are high? Existing research shows that the net social return of public credit during a crunch is positive and large (Jiménez et al., 2018), but additional evidence using bank-level data would be extremely insightful.

References

Abiad, Abdul, Enrica Detragiache, and Thierry Tressel, "A new database of financial reforms," *IMF Staff Papers*, 2010, *57* (2), 281–302.

Aizenman, Joshua, Menzie D Chinn, and Hiro Ito, "Monetary policy spillovers and the trilemma in the new normal: Periphery country sensitivity to core country conditions," *Journal of International Money and Finance*, 2016, *68*, 298–330.

Amsden, Alice Hofenberg, *The rise of "the rest": challenges to the west from late-industrializing economies*, Oxford University Press, USA, 2001.

Baskaya, Yusuf Soner, Julian Di Giovanni, Sebnem Kalemli-Ozcan, and Mehmet Fatih Ulu, "International spillovers and local credit cycles," 2017.

Behn, Markus, Rainer Haselmann, Thomas Kick, and Vikrant Vig, "The political economy of bank bailouts," Technical Report, IMFS Working Paper Series 2015.

Bernanke, Ben S and Mark Gertler, "Inside the black box: the credit channel of monetary policy transmission," *Journal of Economic perspectives*, 1995, *9* (4), 27–48.

Bluedorn, John C and Christopher Bowdler, "The empirics of international monetary transmission: identification and the impossible trinity," *Journal of Money, Credit and Banking*, 2010, *42* (4), 679–713.

Bonis, Riccardo De, Fabio Farabullini, Miria Rocchelli, Alessandra Salvio, and Andrea Silvestrini, "A quantitative look at the Italian banking system: evidence from a new dataset since 1861," Technical Report 26 2012.

Bonomo, Marco, Bruno Martins et al., "The Impact of Government-Driven Loans in the Monetary Transmission Mechanism: what can we learn from firm-level data," *Banco Central do Brasil, Texto para discussão nº*, 2016, *419.*

Bosworth, Barry P, Andrew S Carron, and Elisabeth Holmes Rhyne, *The economics of federal credit programs*, Brookings Inst Press, 1987.

Brei, Michael and Alfredo Schclarek, "Public bank lending in times of crisis," *Journal of financial stability*, 2013, *9* (4), 820–830.

Bruno, Valentina and Hyun Song Shin, "Capital flows and the risk-taking channel of monetary policy," *Journal of monetary economics*, 2015, *71*, 119–132.

Calvo, Guillermo A, Leonardo Leiderman, and Carmen Reinhart, "Capital flows to developing countries in the 1990s: Causes and effects," *Journal of Economic Perspectives*, 1996, *10* (2), 123–139.

Cerutti, Mr Eugenio M and Joshua Bosshardt, "Why Did Public Banks Lend More During the Global Financial Crisis?," Technical Report, International Monetary Fund 2020.

Cesa-Bianchi, Ambrogio and Andrej Sokol, "Financial shocks, credit spreads, and the international credit channel," *Journal of International Economics*, 2022, *135*, 103543.

Chinn, Menzie D and Hiro Ito, "A new measure of financial openness," *Journal of comparative policy analysis*, 2008, *10* (3), 309–322.

Christiano, Lawrence J and Terry J Fitzgerald, "The band pass filter," *International economic review*, 2003, *44* (2), 435–465.

Deeg, Richard, *Finance capitalism unveiled: Banks and the German political economy*, University of Michigan Press, 1999.

Dell'Ariccia, Mr Giovanni, Mr Ehsan Ebrahimy, Ms Deniz O Igan, and Mr Damien Puy, "Discerning good from bad credit booms: The role of construction," *International Monetary Fund, Staff Discussion Notes*, 2020.

Dembiermont, Christian, Mathias Drehmann, and Siriporn Muksakunratana, "How much does the private sector really borrow? A new database for total credit to the private non-financial sector," *BIS Quarterly Review*, 2013.

Diaz-Alejandro, Carlos, "Good-bye financial repression, hello financial crash," *Journal of development Economics*, 1985, *19* (1-2), 1–24.

Eggertsson, Gauti B and Paul Krugman, "Debt, deleveraging, and the liquidity trap: A Fisher-Minsky-Koo approach," *The Quarterly Journal of Economics*, 2012, *127* (3), 1469–1513.

Fisher, Irving, "The debt-deflation theory of great depressions," *Econometrica: Journal of the Econometric Society*, 1933, pp. 337–357.

Fleming, J Marcus, "Domestic financial policies under fixed and under floating exchange rates," *Staff Papers*, 1962, *9* (3), 369–380.

Frankel, Jeffrey, Sergio L Schmukler, and Luis Serven, "Global transmission of interest rates: monetary independence and currency regime," *Journal of international Money and Finance*, 2004, *23* (5), 701–733.

Gourinchas, Pierre-Olivier and Maurice Obstfeld, "Stories of the twentieth century for the twenty-first," *American Economic Journal: Macroeconomics*, 2012, *4* (1), 226–65.

_ , Rodrigo Valdes, and Oscar Landerretche, "Lending booms: Latin America and the world," 2001.

Guerrieri, Veronica and Guido Lorenzoni, "Credit crises, precautionary savings, and the liquidity trap," *The Quarterly Journal of Economics*, 2017, *132* (3), 1427–1467.

Han, Xuehui and Shang-Jin Wei, "International transmissions of monetary shocks: Between a trilemma and a dilemma," *Journal of International Economics*, 2018, *110*, 205–219.

Herrera, Helios, Guillermo Ordonez, and Christoph Trebesch, "Political booms, financial crises," *Journal of Political economy*, 2020, *128* (2), 507–543.

Hodgman, Donald R, "Credit controls in Western Europe: An evaluative review," *The Federal Reserve Bank of Boston, Credit Allocation Techniques and Monetary Policy*, 1973, pp. 137–161.

Iannotta, Giuliano, Giacomo Nocera, and Andrea Sironi, "Ownership structure, risk and performance in the European banking industry," *Journal of banking & finance*, 2007, *31* (7), 2127–2149.

Ilzetzki, Ethan, Carmen M Reinhart, and Kenneth S Rogof, "Exchange arrangements entering the twenty-first century: Which anchor will hold?," *The Quarterly Journal of Economics*, 2019, *134* (2), 599–646.

Jiménez, Gabriel, José-Luis Peydró, Rafael Repullo, and Jesus Saurina Salas, "Burning money? Government lending in a credit crunch," *CEPR Discussion paper*, 2018.

Jordà, Òscar, "Estimation and inference of impulse responses by local projections," *American economic review*, 2005, *95* (1), 161–182.

_ , Moritz Schularick, and Alan M Taylor, "When credit bites back," *Journal of money, credit and banking*, 2013, *45* (s2), 3–28.

_ , _ , and _ , "Betting the house," *Journal of International Economics*, 2015, *96*, S2–S18.

_ , _ , and _ , "Macrofinancial history and the new business cycle facts," *NBER macroeconomics annual*, 2017, *31* (1), 213–263.

_ , _ , and _ , "The effects of quasi-random monetary experiments," *Journal of Monetary Economics*, 2020, *112*, 22–40.

Klein, Michael W and Jay C Shambaugh, "Rounding the corners of the policy trilemma: sources of monetary policy autonomy," *American Economic Journal: Macroeconomics*, 2015, *7* (4), 33–66.

Laeven, Luc and Fabian Valencia, "Systemic banking crises database II," *IMF Economic Review*, 2020, *68* (2), 307–361.

Lazzarini, Sergio G, Aldo Musacchio, Rodrigo Bandeira de Mello, and Rosilene Marcon, "What do state-owned development banks do? Evidence from BNDES, 2002–09," *World Development*, 2015, *66*, 237–253.

Luna-Martínez, José De and Carlos Leonardo Vicente, "Global survey of development banks," *World Bank Policy Research Working Paper*, 2012, (5969).

Martín-Aceña, Pablo, Joaquín Cuevas, and Yolanda Blasco, *El Instituto de crédito oficial 1971-2015*, Dextra, 2016.

Meller, Barbara and Norbert Metiu, "The synchronization of credit cycles," *Journal of Banking & Finance*, 2017, *82*, 98–111.

Mertens, Daniel, Matthias Thiemann, and Peter Volberding, *The reinvention of development banking in the European Union: Industrial policy in the single market and the emergence of a field*, Oxford University Press, 2021.

Mian, Atif, Amir Suf, and Emil Verner, "Household debt and business cycles worldwide," *The Quarterly Journal of Economics*, 2017, *132* (4), 1755–1817.

_ and _ , "The consequences of mortgage credit expansion: Evidence from the US mortgage default crisis," *The Quarterly journal of economics*, 2009, *124* (4), 1449–1496.

_ and _ , *House of debt: How they (and you) caused the Great Recession, and how we can prevent it from happening again*, University of Chicago Press, 2015.

_ and _ , "Finance and business cycles: The credit-driven household demand channel," *Journal of Economic Perspectives*, 2018, *32* (3), 31–58.

Micco, Alejandro and Ugo Panizza, "Bank ownership and lending behavior," *Economics letters*, 2006, *93* (2), 248–254.

Miranda-Agrippino, Silvia and Giovanni Ricco, "The transmission of monetary policy shocks," *American Economic Journal: Macroeconomics*, 2021, *13* (3), 74–107.

_ and Hélene Rey, "US monetary policy and the global financial cycle," *The Review of Economic Studies*, 2020, *87* (6), 2754–2776.

Monnet, Eric, *Controlling Credit: Central Banking and the Planned Economy in Postwar France, 1948 1973*, Cambridge University Press, 2018.

_ and Damien Puy, "One Ring to Rule Them All? New Evidence on World Cycles," *CEPR Discussion Paper*, 2021, (15958).

Müller, Karsten and Emil Verner, "Credit allocation and macroeconomic fluctuations," *Available at SSRN 3781981*, 2021.

Mundell, Robert A, "Capital mobility and stabilization policy under fixed and flexible exchange rates," *Canadian Journal of Economics and Political Science/Revue canadienne de economiques et science politique*, 1963, *29* (4), 475–485.

Musacchio, Aldo, Sergio G Lazzarini, Pedro Makhoul, and Emily Simmons, "The role and impact of Development Banks," *World bank working paper*, 2017.

Newey, Whitney K. and Kenneth D. West, "A Simple, Positive Semi-Definite, Heteroskedasticity and Autocorrelation Consistent Covariance Matrix," *Econometrica*, 1987, *55* (3), 703–708.

Obstfeld, Maurice, Jay C Shambaugh, and Alan M Taylor, "The trilemma in history: tradeoffs among exchange rates, monetary policies, and capital mobility," *Review of economics and statistics*, 2005, *87* (3), 423–438.

_ , Jonathan D Ostry, and Mahvash S Qureshi, "A tie that binds: Revisiting the trilemma in emerging market economies," *Review of Economics and Statistics*, 2019, *101* (2), 279–293.

Omori, Sawa, "Introducing the Revised and Updated Financial Reform Database," *Journal of Financial Regulation*, 2022, *8* (2), 230–240.

Pontolillo, V, "Medium-and long-term credit in Italy," *PSL Quarterly Review*, 1972, *25* (102).

Porta, Rafael La, Florencio Lopez de Silanes, and Andrei Shleifer, "Government ownership of banks," *The Journal of Finance*, 2002, *57* (1), 265–301.

Quinn, Dennis P and A Maria Toyoda, "Does capital account liberalization lead to growth?," *The Review of Financial Studies*, 2008, *21* (3), 1403–1449.

Rey, Hélène, "Dilemma not trilemma: the global financial cycle and monetary policy independence," Technical Report, Proceedings - Economic Policy Symposium - Jackson Hole 2013.

Richter, Bjørn and Kaspar Zimmermann, "The profit-credit cycle," *Available at SSRN 3292166*, 2019.

_ , Moritz Schularick, and Paul Wachtel, "When to lean against the wind," *Journal of Money, Credit and Banking*, 2021, *53* (1), 5–39.

Romer, Christina D and David H Romer, "A new measure of monetary shocks: Derivation and implications," *American Economic Review*, 2004, *94* (4), 1055–1084.

Schularick, Moritz and Alan M Taylor, "Credit booms gone bust: Monetary policy, leverage cycles, and financial crises, 1870-2008," *American Economic Review*, 2012, *102* (2), 1029–61.

Shambaugh, Jay C, "The effect of fixed exchange rates on monetary policy," *the Quarterly Journal of economics*, 2004, *119* (1), 301–352.

Shleifer, Andrei and Robert W Vishny, "Politicians and firms," *The quarterly journal of economics*, 1994, *109* (4), 995–1025.

Stiglitz, Joseph E, "The role of the state in financial markets," *The world bank economic review*, 1993, *7* (suppl_1), 19–52.

Verdier, Daniel, "The rise and fall of state banking in OECD countries," *Comparative political studies*, 2000, *33* (3), 283–318.

Wade, Robert, *Governing the market: Economic theory and the role of government in East Asian industrialization*, Princeton University Press, 1990.

Xu, Jiajun, Régis Marodon, and Xinshun Ru, "Identifying and Classifying Public Development Banks and Development Finance Institutions," *International Research Initiative on Public Development Working Paper,[Online]*, 2020, *192*.

Zysman, John, *Governments, markets, and growth: financial systems and the politics of industrial change*, Cornell University Press, 1983.

Appendix A A new database on public credit

To compile this database, I relied on the help and expertise of researchers, archivists, and of central bank and national statistical office statisticians. I would like to thank, without implicating: Kilian Rieder, Thomas Matzinger, Yolanda Blasco, Silvia Mastrantonio, Andrea Silvestrini, Paolo Piselli, Riccardo De Bonis, Federico Barbiellini Amidei, Augusto Rojas Alvarez, Eirin I. Brynestad, Kamila Sommer, Michael Batty, Jun-woo Jeong, Seung-hyun Moon, Yongho Lee, Seong Hyuck Heo, Shunichiro Bessho and Sofia Stefanaki.

A.1 Public credit institutions

Public credit institutions share two main characteristics: public ownership, and a mandate from the state to fulfill economic, social, or political objectives (e.g. for-profit public credit institutions are excluded). To identify public credit institutions, I rely on the categorization used by the central bank.

The following section provides a country-by-country overview of the data used to construct my series of public credit. It includes information on the lenders (public credit institutions), the borrowers, and the type of instrument. Insofar as possible, I focus strictly on credit to the resident non-financial sector. Credit includes loans but excludes debt securities (i.e. holding of bonds and short-term paper). Loan guarantees are also excluded.

For each-country, I list some of the main public credit institutions. The list is non-exhaustive, and it includes institutions that are no longer in operation. For each institution, I indicate the main sector of activity (housing, agriculture, small and medium enterprises, export industries, student loans, or loans to local administrations/public infrastructure). The mention "other" signals that the institution is either not specialized or does not fall in any of the previous categories.

Austria: Direct loans by the sonderkreditunternehmungen (special credit institutions) to domestic non-banks. Loans by the sonderkreditunternehmungen are also

included in the IMF private credit series for the whole sample.

Public credit institutions: Osterreichische Kommunalkredit AG (public infrastructure), Osterreichischer Exportfonds (export industries).

France: Up to 1984Q4, credit to firms and households by non-bank financial institutions (this was the official terminology to designate the long-term credit banks under the authority of the state). In 1984, the distinction between banks and non-banks financial institutions was abolished, and the main public institutions were reclassified as institutions financières spécialisées (IFS) (specialized financial institutions). The Caisse des Dépôts et Consignations (CDC) (which controlled many of the IFS) had a special status, and was not included in the IFS. From 1985Q1 to 1995Q3, I take the sum of the credit to firms and households by the IFS and by the CDC. From 1995Q4 onwards, I focus on housing loans by the CDC (data for the IFS are not available after 1995, but IFS credit to the economy is negligible and decreasing starting in the late 1990s).

Public credit institutions: Crédit National (SMEs), Crédit Foncier de France (housing), Comptoir des Entrepreneurs (SMEs), Caisse des Dépôts et Consignations (housing), Caisse Nationale des Autoroutes (public infrastructure), Crédit Hôtelier Commercial et Industriel (SMEs), Caisse Nationale de l'Energie (public infrastructure), Sociétés de Développement Régional (public infrastructure).

Germany: Lending to domestic non-banks by banks with special, development and other central support tasks. For-profit public banks (e.g. Landesbanken and Sparkassen) are not included in this category. Loans by banks with special, development and other central support tasks are also included in the IMF private credit series for the whole sample.

Public credit institutions: Kreditanstalt für Wiederaufbau (SMEs, housing), Landwirtschaftliche Rentenbank (agriculture), LfA Förderbank Bayern (SMEs), Investitionsbank Berlin (SMEs).

Greece: Total credit to the private sector by specialised credit institutions. This

category disappears in the early 2000s, as most institutions are either privatized (e.g. Agricultural Bank in 2000, Postal Savings Bank in 2006) or merged with commercial banks.

Public credit institutions: Agricultural Bank (agriculture), Consignments and Loans Fund (housing, public infrastructure), National Investment Bank for Industrial Development (SMEs), Hellenic Industrial Development Bank (SMEs), National Housing Bank (housing).

Indonesia: Sum of credit outstanding in rupiah by state banks and regional development banks, and of direct credit by Bank Indonesia (which disappears in the early 2000s).

Public credit institutions: regional development banks (established and owned by the local provincial government), and four state banks: Bank Mandiri (other), Bank Negara Indonesia (other), Bank Rakyat Indonesia (other), and Bank Tabungan Negara (housing).

Italy: Up to 1994Q4, credit to the resident non-financial sector by the istituti di credito speciale (special credit institutions). This category was officially terminated by the 1993 Banking Code. Following the 1993 reform, most public credit institutions were privatized. A few public institutions remained, the largest being the Cassa Depositi e Prestiti (CDP). From 1995Q1 onwards, I focus on CDP loans to the private sector.

Public credit institutions: the istituti di credito speciale were divided between four sub-groups according to their area of specialization: istituti di credito agrario (agriculture), sezioni opere pubbliche (public works), istituti di credito mobiliare (SMEs), and istituti di credito fondiario (housing, agriculture).

Japan: Loans by public financial institutions. Public financial institutions include the Fiscal Loan Fund, and government financial institutions;

Public credit institutions: Development Bank of Japan (SMEs), Japan Finance Corporation (SMEs), Okinawa Development Finance Corporation (public infrastructure),

Japan Student Services Organization (student loans).

Mexico: Total credit by development banks to the resident non-banking sector. Starting in 1985Q3, total credit by the "fondos de fomento" (development funds) to the resident non-banking sector is added.

Public credit institutions: Nacional Financiera (other), Banco Nacional de Obras y Servicios Públicos (public infrastructure), Banco Nacional de Comercio Exterior (export industries), Sociedad Hipotecaria Federal (housing), Banco del Bienestar (other), Banco Nacional del Ejército, Fuerza Aérea y Armada (other), Fondo Nacional de Habitaciones Populares (housing), Fondo Especial para Financiamientos Agropecuarios (agriculture). The last two institutions are development funds (Fideicomisos Públicos de Fomento Económico), the others are development banks.

Norway: Loans and advances by state lending institutions.

Public credit institutions: Fiskarbanken (agriculture), Husbanken (housing), Hypotekbanken (agriculture), Industribanken (SMEs), Kommunalbanken (local administration), Statens lånekasse for utdanning (student loans).

United States: Sum of direct loans by the Federal government and by state and local governments. Government sponsored enterprises (Farm Credit System, Fannie Mae...) are privately held and are thus excluded from the series. For an history of government credit programs in the US, see Bosworth et al. (1987).

South-Korea: Sum of loans by specialized banks and development institutions, and of government loans. Starting in the early 2000s, development institutions (Korea Development Bank and Import-Export Bank) are reclassified as specialized banks. Loans by specialized banks are also included in the IMF private credit series for the whole sample.

Public credit institutions: Korea Development Bank (other), Export-Import Bank of Korea (export industries), Industrial Bank of Korea (SMEs), Citizens National Bank (SMEs), Korea Housing Bank (housing), National Agricultural Cooperatives Federation (agriculture), National Federation of Fisheries Cooperatives (agriculture).

Spain: Loans of the Instituto de Credito Oficial (ICO) to the domestic non-financial sector. Until the early 1990s, the ICO includes the Entidades Oficiales de Credito (EOCs) (see chapters 4 and 5 of Martín-Aceña et al. (2016)).
Public credit institutions: Instituto de Credito Oficial (other), Banco Hipotecario de Espana (housing, agriculture), Banco de Credito Industrial (SMEs), Banco de Credito Local (public infrastructure), Banco de Credito Agricola (agriculture), Credito Social Pesquero (agriculture). These institutions were all part of the Entidades Oficiales de Credito (EOCs), which were privatized in the 1990s. Today, only the Instituto de Credito Oficial remains.

Thailand: Loans by specialized financial institutions. This series is included in the IMF private credit series from December 1994 onwards.
Public credit institutions: Government Saving Bank (other), Government Housing Bank (housing), Bank for Agriculture and Agricultural Cooperatives (agriculture), Export Import Bank of Thailand (export industries), Small and Medium Enterprises Development Bank of Thailand (SMEs), Islamic Bank of Thailand (other), Small Industry Finance Corporation (SMEs), Industrial Finance Corporation (SMEs).

A.2 Coverage and sources

Austria: 1960Q1-2020Q4. Up to 1995Q3, I relied on the Annual Reports of the Oesterreichische Nationalbank (OeNB). From 1989Q1 to 1995Q3, gaps in the Annual Reports are filled using the Statistische Monatshefte of the OeNB. From 1995Q4 onwards, data are available on the OeNB's website at the following address: https://www.oenb.at/isaweb/report.do?report=3.3.3 (accessed September 2022).

France: 1954Q4-2018Q4. Up to 1984Q4, data are drawn from the Annual Reports of the Conseil National du Crédit. From 1985Q1 to 1995Q3, I collected the data from the Bank of France's (BoF) archives (using three monthly statistical publications by the BoF: "Statistiques Monétaires Mensuelles", "Statistiques Monétaires Provisoires" and "Statistiques Monétaires Définitives"). From 1995Q4 onwards, the data were no longer published by the BoF, I therefore relied on the BoF's internal database

(the data can be requested by email from the following address: 2503-acces-donnees-ut@banque-france.fr).

Germany: 1958Q4-2020Q4. The data can be downloaded from the time-series database of the Bundesbank: https://www.bundesbank.de/en/statistics/time-series-databases (accessed September 2022). The series code is: BBK01.OU0425. Before 1964Q4, only biannual data are available.

Greece: 1955Q3-2020Q4. Data are drawn from the Monthly Statistical Bulletin of the Bank of Greece. Public credit is equal to 0 starting in 2002Q2 (see Appendix A.1.).

Indonesia: 1966Q1-2020Q4. Up to 2000Q2, I collected the data from paper editions of the Indonesian Financial Statistics published by the Bank Indonesia. From 2000Q3 onwards, data are available on the Bank Indonesia's website: https://www.bi.go.id/en/statistik/ekonomi-keuangan/seki/Default.aspx (accessed September 2022).

Italy: 1956Q1-2020Q4. Up to 1994Q4, I relied on the Bollettino of the Banca d'Italia. From 1995Q1 onwards, I used the Annual Reports of the Cassa Depositi e Prestiti (CDP), which provide biannual data.

Japan: 1964Q4-2020Q4. The data can be downloaded from the Bank of Japan (BoJ) time series database: https://www.stat-search.boj.or.jp/index_en.html (accessed September 2022). Starting in 1999Q2, I relied on series FF'FOF_FFAS180A200 (which is calculated according to the 2008 SNA). I then retropolated this series before 1999Q2 using series FF'FFSA140A270 (which follows the 1968 SNA).

Mexico: 1950Q1-2020Q4. Up to 1980Q3, I used the Informe Annual of the Banco de Mexico. For the 1980Q4-2020Q4 period, the data was sent to me by the Banco de Mexico (data starting in 1994 is also available on the Banco de Mexico's Economic Information System (SIE)).

Norway: 1950Q1-2020Q4. For the 1950Q1-2001Q3 period, I collected the data based

on different publications of Statistics Norway. Up to 1960Q4, I used the Statistisk Meddelelser. Then, I relied on the Statistisk Manedshefte up to 1997Q3, and on the Bank- og Kredittstatistikk up to 2001Q3. From 2001Q4 onwards, I downloaded the data from Statistics Norway's StatBank: https://www.ssb.no/en/statbank/table/06718/ (accessed September 2022).

United States: 1951Q4-2020Q4. The data can be downloaded from the Data Download Program of the Federal Reserve: https://www.federalreserve.gov/datadownload/ (accessed September 2022). I take the sum of the two following series: Z1/Z1/FL314023005.Q, and Z1/Z1/FL403069305.Q.

South-Korea: 1960Q1-2020Q4. For development banks and specialized banks, I used the Bank of Korea's Economic Statistics Yearbook up to 1999Q4, and the Financial Supervisory Service (FSS) database from 2000Q1 onwards: http://efisis.fss.or.kr/fss/fsiview/indexw.html (accessed September 2022). For government loans, the data are available in the ECOS database of the Bank of Korea from 1975Q1 onwards: https://ecos.bok.or.kr/ (accessed September 2022). The series calculated according to the 2008 SNA is retropolated over the SNA 1993 and the SNA 1968 series.

Spain: 1962Q1-2020Q4. The data can be downloaded from the Banco de Espana's website: https://www.bde.es/webbde/es/estadis/infoest/bolest4.html (accessed September 2022). I take the sum of the two following series: "EC y EFC. Créditos. Del ICO. A AAPP" and "EC y EFC. Créditos. Del ICO. A OSR" in table 4.11.

Thailand: 1966Q4-2020Q1. Up to 1993Q4, I collected the data from the Annual Reports of the Bank of Thailand. From 1994Q1, the data are available on the Bank of Thailand's website: https://www.bot.or.th/English/Statistics/EconomicAndFinancial/Pages/StatMFSSectoralBalanceSheet.aspx (accessed September 2022).

A.3 Other macroeconomic variables

Capital control index: Quinn and Toyoda (2008), and Chinn and Ito (2008) (and updates thereto).

CPI: Monnet and Puy (2021). For Indonesia, I use the IMF International Financial Statistics.

Exchange rates: Ilzetzki et al. (2019).

Exchange rate flexibility index: Ilzetzki et al. (2019).

Exports and Imports: Main Economic Indicators, OECD. For Indonesia and Mexico, I extend the OECD's series back in time using the IMF International Financial Statistics. For Thailand, I rely exclusively on the IMF International Financial Statistics.

Financial reform index: Abiad et al. (2010), extended until 2013 by Omori (2022).

House price index: BIS database.

Long-term interest rate: Monnet and Puy (2021).

Nominal GDP: Quarterly National Accounts, OECD. For Thailand, I use data from the National Economic and Social Development Board (available from 1994Q1 onwards).

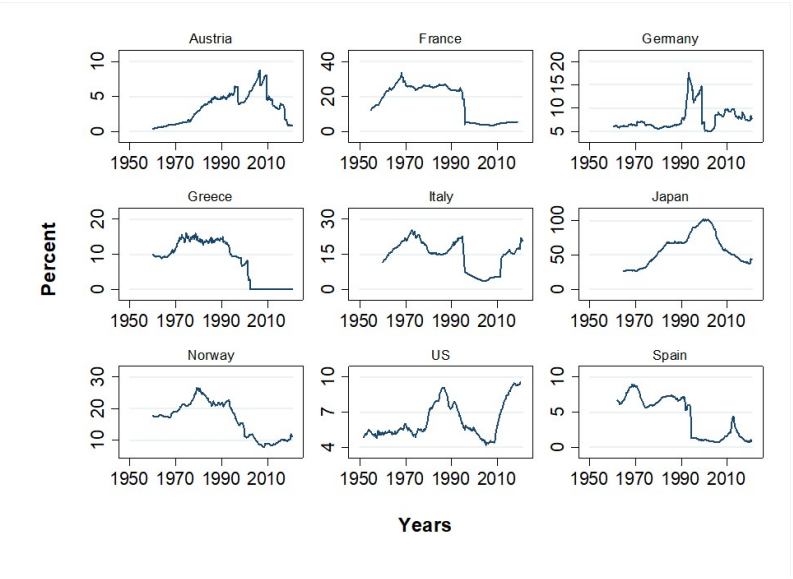
Private credit: Monnet and Puy (2021).

Real GDP: Monnet and Puy (2021). For Indonesia, I use data from the IMF International Financial Statistics (available from 2000Q1 onwards). For Thailand, I use data from the National Economic and Social Development Board (available from 1994Q1 onwards).

Share price index: Monnet and Puy (2021).

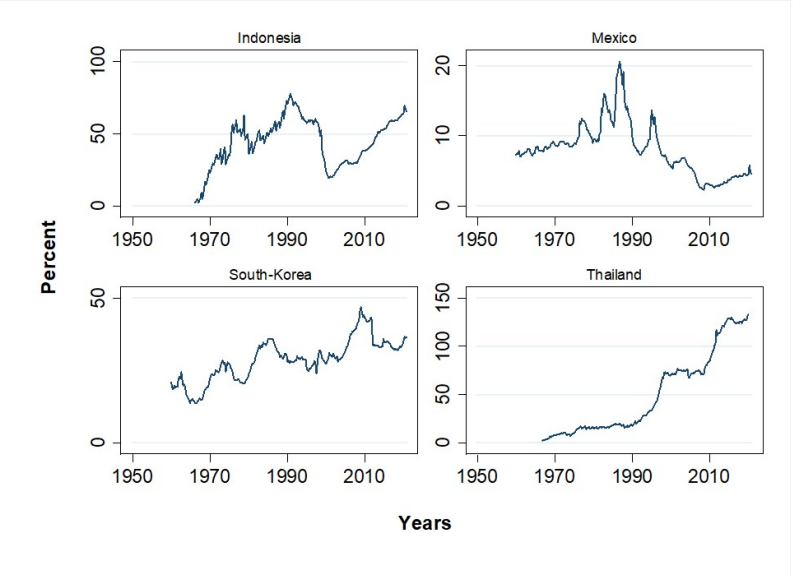
Appendix B Additional graphs

Figure B1: Public credit in % of nominal GDP - Developed Economies



Sources: See Appendix A.2 for public credit, and Appendix A.3 for nominal GDP.

Figure B2: Public credit in % of nominal GDP - Emerging Economies



Sources: See Appendix A.2 for public credit and Appendix A.3 for nominal GDP.

Appendix C Robustness checks

C.1 Public credit and the Global Financial Cycle

C.1.1 Testing for heterogeneity

I specifically test for heterogeneity in the response of public credit to foreign interest rate shocks. My main concern is that the results are driven by the behavior of public credit during the era of financial repression. Public credit institutions were then funded through special financial circuits (see Section 1). I want to make sure that the lack of sensitivity of public credit to foreign monetary shocks is not just a feature of the pre-liberalization world. To address this concern, I go back to equation 1, and I successively interact $\beta_h R_{b(i,t)}$ with three dummy variables: a variable that takes the value 1 for post-1990 observations and 0 otherwise (column 1), a variable that takes the value 1 if the share of public credit in total credit is below the sample average and 0 otherwise (column 2), and a variable that takes the value 1 if the share of public credit in total credit is below the country average and 0 otherwise (column 3).

Unlike in equation 1, I do not estimate a sequence of regressions. I focus only on the last regression of the sequence, for which $h = 8$. That is, I am interested to see if the cumulative effect of a foreign interest rate shock on the real growth rate of public credit after 8 quarters varies according to the financial environment. The sample is the same as in Figure 5 (it includes countries that are pegged and at least partially open).

If my results were driven by the financial repression era, I would expect a positive coefficient on the main effect (i.e. the foreign policy shock) and a negative coefficient on the interaction, possibly larger than the main effect coefficient. Results are presented in Table C.1. None of the interaction terms are significant.

Table C.1: Testing for hetegoneity

	(1)	(2)	(3)
Foreign policy shock	0.253	0.521	1.643
	(1.998)	(2.306)	(2.061)
Interaction post-1990	4.473		
	(4.892)		
Interaction size public credit (1)		1.568	
		(2.050)	
Interaction size public credit (2)			-0.919
			(3.461)
Observations	1130	1130	1130
R-squared	0.187	0.192	0.228
No. of countries	11	11	11

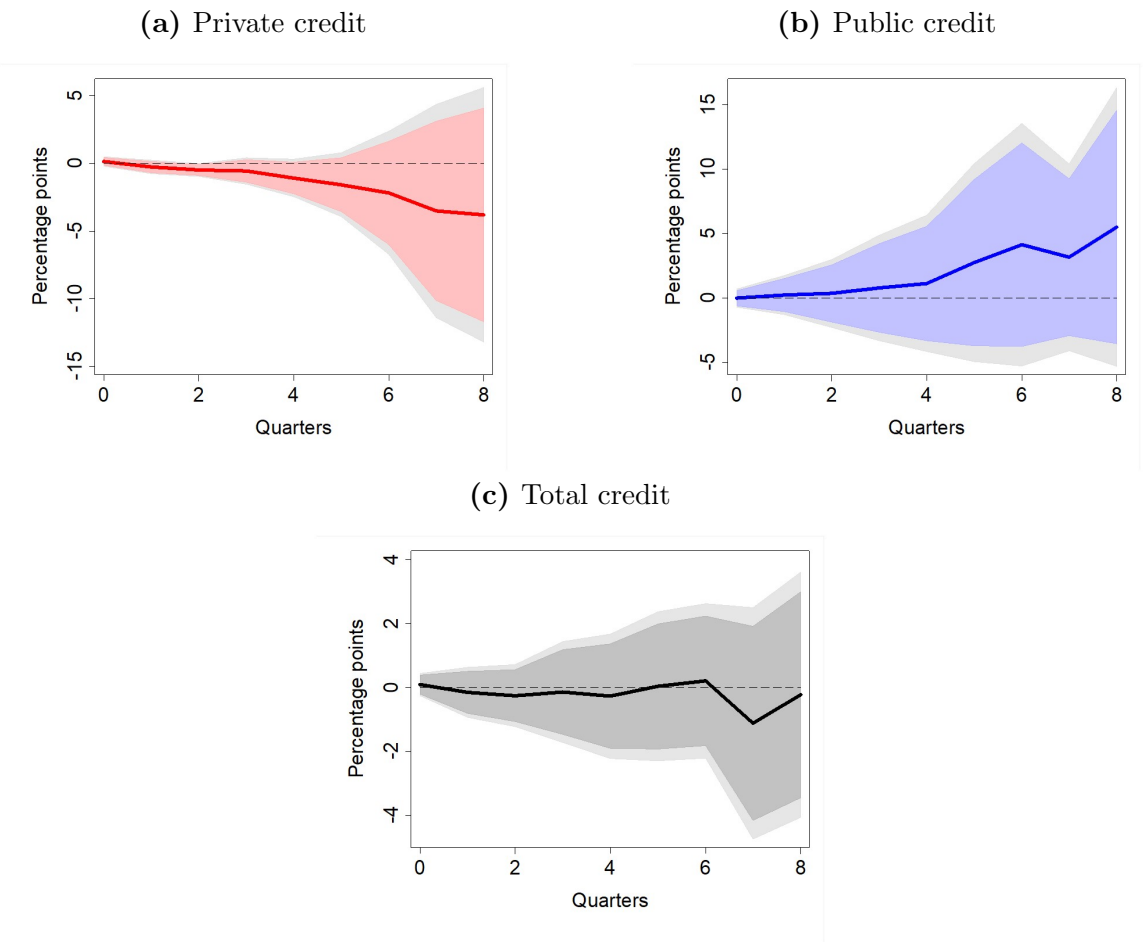
* p<0.1 ** p<0.05 *** p<0.01

Notes: I estimate Equation 1 for $h = 8$, and I successively interact my measure of policy shocks with three dummy variables. In column 1, policy shocks are interacted with a dummy taking the value 1 after 1990 and 0 before. In column 2, I interact it with a dummy taking the value 1 when the share of public credit in total credit is below the sample average, and 0 otherwise. In column 3, the dummy takes the value 1 when the share of public credit is below its country average, and 0 otherwise. The sample is the same as in Figure 5 (pegged and at least partially open countries). The regression includes country fixed effects, and the standard errors are robust.

C.1.2 US policy shocks

Figure C.1 shows the response of real private credit (Panel A), public credit (Panel B) and total credit (Panel C) to a shock on foreign interest rates. I use the measure of US policy shocks constructed by Romer and Romer (2004) and extended by Miranda-Agrippino and Ricco (2021). The sample is restricted to countries pegged to the US (the definition of capital account openness is the same as in my main specifications: see Figure 5). The results are consistent with my main findings: the response of private credit is negative while the response of public credit is positive. However, standard errors band are wider (possibly because the sample size is reduced by 80%).

Figure C.1: US policy shocks



Notes: Cumulative response of the growth rate of real public credit to a 1pp shock on the US short-term interest rate. I use the measure of policy shocks constructed by Romer and Romer (2004) and extended by Miranda-Agrippino and Ricco (2021). Panel A, B, and C show the response of private, public, and total credit respectively. Shaded areas denote 95% and 68% confidence intervals. Standard errors are robust. As in my main specifications, the sample is restricted to open-pegs. Pegs are countries with an exchange rate flexibility index inferior or equal to 9 (Ilzetzki et al., 2019) **and** for which the base country is the United States. I use the same definition of capital account openness as in the main specification (Figure 5).

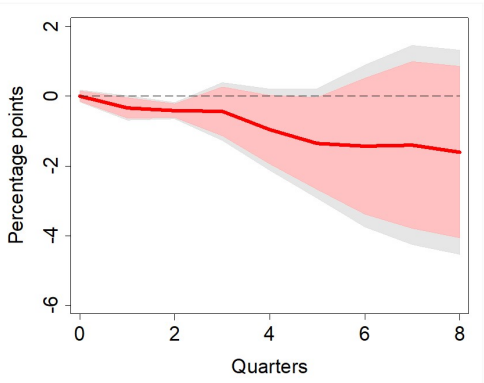
C.1.3 Additional domestic variables as controls

Figure C.2 shows the response of real private credit (Panel A), public credit (Panel B) and total credit (Panel C) to a shock on foreign interest rates. The sample is the same as in Figure 5 (at least partially open economies, pegged either to the dollar or the DM/euro). I use the same measure of policy shocks as in Figure 5 and 6. The only difference is that I add up to 8 lags of the following domestic macroeconomic variables as control: real house prices, real stock prices, and short and long-term

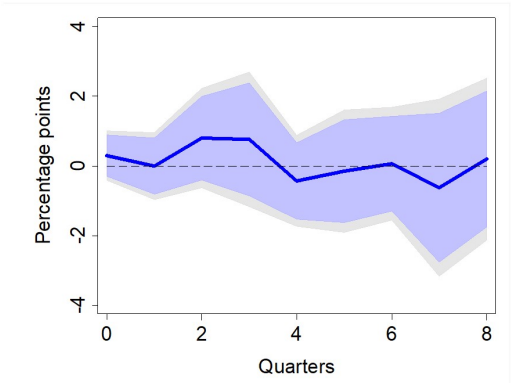
interest rates. Once again, the sample size is reduced drastically (by 85%), but the results are in line with previous ones.

Figure C.2: Additional controls

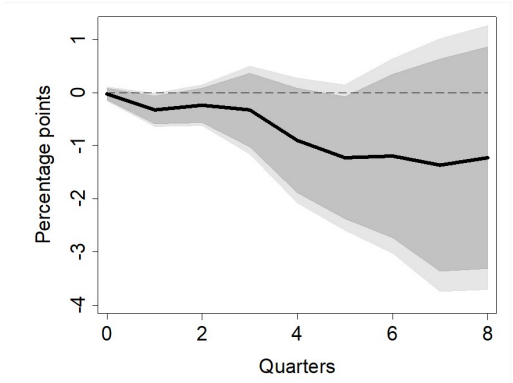
(a) Private credit



(b) Public credit



(c) Total credit



Notes: Cumulative response of the growth rate of real credit to a 1pp shock on the short-term interest rate in the center country. Panel A, B, and C show the response of private, public, and total credit respectively. Shaded areas denote 95% and 68% confidence intervals. Standard errors are robust. The sample is strictly identical to the sample in Figure 5. In additional to the controls in Equation 1, I control for up to 8 lags of the growth rate of real house prices, growth rate of real stock prices, and first difference in short and long-term interest rates.

C.2 Public credit and domestic credit cycles

Figures C.3 replicates Figure 7 from the main text, using instead Gourinchas et al. (2001)'s method for identifying credit cycles. Gourinchas et al. (2001) define a lending boom as an episode of deviation of the ratio between nominal credit and GDP from a rolling retrospective country-specific trend. A boom occurs when the deviation exceeds 1.5 times its rolling retrospective country-specific trend. The peak of the boom is defined as the period for which the deviation is maximum, conditional on $Boom = 1$. Figures C3 plots the average deviation of private and public credit, from 3 years before to 3 years after the peak of a private boom (for simplicity, I scale the deviation by 1 standard deviation, rather than by 1.5 standard deviations).

Figure C.3: Event study - Public and private booms