When Two Become One: Foreign Capital and Household Credit Expansion*

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Abstract

We employ data from financial accounts for 31 countries to trace the flow of financial capital through the economy and identify the ultimate sources of funds behind credit expansions. Removing the veil of financial intermediation reveals that foreign capital has financed most of the secular increase in credit-to-GDP ratios between 1980 and today. In the medium term, household credit financed with foreign capital is the crucial link between credit expansions and future economic performance. An increase in household credit financed from abroad is associated with a contemporaneous reallocation from the tradable to the non-tradable sector, and it predicts lower output and higher unemployment over the following years. Foreign-financed household credit expansion also predicts low returns on bank equities and housing. On the other hand, domestically financed credit neither predicts business cycle dynamics nor returns. Furthermore, household credit financed from abroad is a robust predictor of financial crises and the flight of foreign capital is the major force behind low credit growth after crises.

Keywords: Credit cycles, capital flows, business cycles, financial crises.

JEL classification codes: E44, F34, G01, G15

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1. Introduction

The financial sector in advanced economies has grown enormously over recent decades (Schularick and Taylor, 2012; Greenwood and Scharfstein, 2013; Philippon and Reshef, 2013). At the business cycle frequency, rapid credit expansions are often associated with financial crises and predictably worse macroeconomic outcomes (Mian et al., 2017; López-Salido et al., 2017). However, we know rather little about the sources of funds fueling secular expansion and the business cycle variation in credit (Mian and Sufi, 2018). Based on historical crises and on the more recent experience of the GFC, Kindleberger (1978) and Wolf (2014) have emphasized the role of global financial markets as a source of capital.[1] And, as Rey (2013) notes, inflows of capital from global financial markets are often unrelated to a country's macroeconomic conditions. Many theoretical models echo this emphasis and rely on exogenous inflows of capital from abroad, or low international interest rates, to trigger credit supply expansions and their consequences (Schmitt-Grohé and Uribe, 2016; Mian et al., 2020a). Empirically, however, it has proven difficult to establish this link, mostly because there are no data on the ultimate sources of funds behind credit expansion.

In this paper, we introduce new data based on financial accounts, which allow us to link the sectoral sources of funds fueling a credit expansion to subsequent economic outcomes. We first trace the flow of financial capital through the economy to identify the sources of credit. We then study which sources of funds have financed the secular increase in lending, and which have the most pronounced influence on the business cycle. The approach reveals that household credit ultimately financed from the foreign sector is key: it is both the major driver of the secular increase in credit-to-GDP ratios, and the crucial link between credit expansions and business cycle outcomes. Rapid expansions in household credit financed with capital inflows are associated with reallocation of economic activity from the tradable to the non-tradable sectors and predict low output growth and increasing unemployment. Investors do not account for these relationships: foreign-financed household credit expansion predicts low returns on bank equity and housing. Importantly, domestically financed credit expansion is not associated with these outcomes.

The data also reveal that intermediation between global capital markets and domestic households increases financial sector fragility. Increases in foreign-financed household credit are associated with significantly elevated crisis risk. Moreover, the flight of foreign capital explains the decline in credit after a crisis, while credit ultimately funded by domestic sectors remains stable.

[1] Kindleberger (1978) emphasized the global flows of financial capital: *"any reader of this book will come away with the distinct notion that large quantities of liquid capital sloshing around the world should raise the possibility that they will overflow the container"* (foreword to the 6th edition by Robert M. Solow).

Key to the analysis is an unveiling exercise linking ultimate savers and borrowers as in Mian et al. (2020b) for the United States. In its simplest version, this methodology can be described as allocating one dollar of credit on the asset side of intermediary balance sheets to the different sources of funds of intermediary sector liabilities, lifting the veil of financial intermediation. We divide the ultimate sources of funds into three sectors: domestic households, the government, and the rest of the world (RoTW) including all cross-border exposures. We use OECD financial balance sheets data, for many countries newly digitized for the years before 1995, to decompose credit by origin and destination sector. The first contribution is to show that an unveiling approach – decomposing credit by source sector – can be performed in international data, despite these data being less detailed than those for the US. To confirm the results of this unveiling procedure, we cross-validate the approach against the more granular data for the US and recent cross-country data with counterparty information. The resulting dataset contains information on private credit decomposed by source sector of funds for an unbalanced panel of 31 countries starting in the 1970s.

Equipped with this new dimension of the data, we explore the evolution of credit intermediation over the last 50 years in the first part of our analysis. The textbook model of financial intermediation ties household savings through banking sector balance sheets to investment of non-financial corporates. The data suggests that this model was an adequate description of the credit intermediation process before the 1980s, but it no longer is. On the borrowing side, the domestic household sector plays an increasingly important role as a recipient of funds, as previously documented in Jordà et al. (2016). At the same time, the data shows that there has been a shift away from domestic households to foreigners as the source of savings. The secular increase in credit-to-GDP ratios over recent decades has been financed from abroad. This shift also affected the composition of liabilities, and household deposits have become less important as a funding source for the financial sector, which is consistent with the long-run trends presented in Jordà et al. (2020).

The growing reliance on the foreign sector as a source of funds has important implications for business cycle dynamics, which we study in the second part of the paper. Credit ultimately financed by the rest of the world turns out to be more volatile than domestically financed credit, and as a result credit cycles are mostly driven by the foreign-financed component. Motivated by this finding, we study the role of different source sectors for the relationship between credit expansions and business cycle outcomes documented in, among others, Mian et al. (2017). When decomposing credit by ultimate source of funds, we find that household credit expansions financed by the rest of the world are the main driving force behind the negative association between credit expansion and subsequent

output. The results show that increases in household credit financed by the rest of the world are associated with a short-lived boom in economic activity that is followed by significantly lower output over horizons of more than three years. Importantly, household credit financed by domestic sectors and credit to the corporate non-financial sector are neither associated with a short-lived boom, nor with the subsequent slowdown in economic activity.

The structure of the data also allows us to study the nature of these credit expansions. An expansion in household credit financed from abroad may be due to higher domestic credit demand or due to international capital supply. Following the argument that capital inflows often depend on a global financial cycle, but are unrelated to a country's macroeconomic conditions (Rey, 2013), we can use the global financial cycle as a measure of supply side variation. We therefore instrument domestic household credit expansion with the average change in household credit financed from abroad in all other sample countries, excluding the respective country. This variable reflects the average change in global supply of financial capital, without being linked to demand for credit by domestic households. The results from this approach reinforce our previous findings: the coefficients on instrumented household credit expansion are significantly negative and, if anything, larger than the baseline estimates. This seems plausible, as the latter most likely also capture high credit demand when agents are borrowing against good future fundamentals.

We then shed light on the economic mechanisms underlying the relationship between foreign-financed credit supply expansion and low output growth. Several papers argue that capital inflows from abroad may finance demand booms and that these increases in demand are associated with domestic reallocation to the non-tradable sector, as tradables can be imported from abroad (Schmitt-Grohé and Uribe, 2016; Mian et al., 2020a; Bahadir and Gumus, 2016). This sectoral reallocation may have important consequences. First, a sudden reversal in foreign capital supply will be associated with lower output and increasing unemployment due to downward nominal wage rigidities and short-term reallocation frictions (Schmitt-Grohé and Uribe, 2016). Second, productivity growth is often concentrated in the tradable sector (Duarte and Restuccia, 2010). Hence, capital inflows and reallocation to the non-tradable sector may generate a drop in aggregate productivity growth (Benigno et al., 2020; Kalantzis, 2015; Gopinath et al., 2017). We perform a similar test for the reallocation as in Mian et al. (2020a), but we are able to decompose household credit by source of funds. In line with the above theories, we find that increases in household credit financed by the rest of the world are associated with reallocation from the tradable to the non-tradable sector, measured by the ratio of output or employment in the two sectors. These results also hold when we use the instrument to

isolate supply-driven foreign-financed household credit expansion.

Based on these findings, we may ask why foreigners supply capital in the first place. Are foreign investors, and markets in general, aware of these links at the time they provide financing? We do not observe expectations of foreign investors when they provide funding for such credit expansions. However, based on existing literature, we devise two tests of whether it is likely that agents are aware of and account for the links we have just documented. The first test is adapted from Mian et al. (2017). Here, we ask whether economic forecasts from IMF staff account for the negative relationship between foreign-financed household credit expansion and macroeconomic outcomes. We find that forecasts are unaffected by household lending booms financed with foreign capital, and hence they are overoptimistic during periods of rapid expansions of foreign-financed household borrowing. Our second set of tests is based on the rationale in Baron and Xiong (2017). Do bank shareholders ask for compensation of higher risk during credit expansions? We find that foreign-financed household credit booms are associated with low subsequent returns on the bank index. This suggests that shareholders do not ask for higher compensation despite higher risk during foreign-financed credit booms. We find similar evidence for elevated sentiment in housing markets during these credit expansions: foreign-financed credit expansions predict low growth in real house prices. These results all suggest that inflows of capital lent to the household sector are associated with elevated sentiment in the economy.

In the third part of the paper, we study the relationship between foreign-financed lending booms and financial crises. Reliance on foreign funding may increase financial fragility and concerns about a global savings glut (Bernanke, 2005) and the associated global imbalances preceded the global financial crisis. But empirically it has been difficult to link the current account, as a measure of these imbalances, to financial instability (Jordà et al., 2011).[2] One explanation is that the current account is a measure of net financial flows, and it is actually gross capital from abroad that matters for financial stability. In the context of the 2007/2008 crisis, Shin (2012) referred to large international gross exposures of the banking sector as a global banking glut. Our data provide a natural link between credit and gross capital flows: we measure increases in private domestic credit which are financed by the gross exposures of the rest of the world sector. In addition, the data has the advantage that it takes a holistic view on capital inflows, aggregating over all financial instruments that are used to finance a lending boom from abroad.[3]

[2] Jordà et al. (2011) find no relationship between the current account and financial crisis and conclude that "credit growth emerges as the single best predictor of financial instability". Kiley (2021) on the other hand, similar to Liadze et al. (2010), finds a relationship once distinguishing between current account deficits and surpluses.

[3] Studies focusing directly on capital flow measures – instead of the current account – also produced mixed

With these data at hand, we find that funds sourced from the rest of the world and lent out to households are the most important link in the widely documented relationship between credit expansion and crises (Schularick and Taylor, 2012). Our data suggests that it is the intermediation between international capital markets and domestic households through financial sector balance sheets that puts a country's financial stability at risk. Aldasoro et al. (2020) distinguish between a global and a domestic financial cycle, measured as the quantity of capital flows and credit respectively, and they conclude that both cycles come together around crises. Our results show that crises occur when the financial system intermediates between international capital markets and domestic households and, hence, international capital flows and domestic credit measures become two sides of the same coin.

While capital inflows – capital flow bonanzas – have been linked to financial instability (Reinhart and Rogoff, 2009), it has also been argued that crises are followed, and amplified, by large capital outflows – sudden stops (Broner et al., 2013; Forbes and Warnock, 2012; Caballero and Simsek, 2020). We therefore also study the response of credit, decomposed by source sector, to crises. Credit-to-GDP ratios decline quickly after a crisis event, but there is large heterogeneity regarding the sources of this decline. The decline is almost exclusively driven by credit funded with funds from the rest of the world. Looking at other sources of funds, we find that credit financed by the household sector remains stable. Credit ultimately funded by the government increases, but the magnitude is small relative to the decline in funds from the rest of the world. As a result, due to the large outflows of foreign capital, the ratio of credit to GDP contracts.

Taken together, our results suggest that the link between credit on the one hand, and business cycle and crisis dynamics on the other, strongly depends on the ultimate sources of financing. Economic and financial fragility are often preceded by periods when a country's financial sector increasingly intermediates foreign capital to the domestic household sector.

2. Data and unveiling

This section gives an overview of the data and our unveiling procedure. We start with a description of data sources and format and continue with our main unveiling approach. Afterwards, we check the robustness of our estimates using alternative unveiling approaches.

results. Some studies found a relationship between crises and capital flows in specific financial instruments, mostly debt instruments. For a recent overview see Caballero (2016).

2.1. Data

Our main datasource are the OECD financial balance sheets, which are part of the national accounts framework. The data used in this paper comes in three distinct formats. The most recent version are the financial balance sheets from the Systems of National Accounts 2008 (SNA2008). Before the 2008 revision, financial balance sheets came under the preceding 1993 version (SNA93). To further extend the coverage of the series, we link this data with newly digitized data from historical publications of the OECD. This data was published in yearly books by the OECD up until 1998 ('golden books'). A snapshot is shown in Figure A1.2. Since the dataseries are frequently revised and updated, we use the most recent data whenever available. This makes SNA08 our default format, which is extended backwards with the SNA93 dataset, which in turn is extended backwards with the newly digitized data. We use overlapping years to link variables accross datasets and extrapolate recent data with growth rates of historical data going backwards in time. The SNA08 format roughly covers the period between 1995 and 2019, the SNA93 format the period between 1990 and 2013 and the newly digitized data the period from the 1970's to the 1990's. The full table with the available years of data in each dataset for each country can be found in Table A1.1 in the appendix. Due to higher data availability we use the non-consolidated version of the data.

Financial accounts contain information on stocks and flows of financial instruments by economic sector. We focus on stocks which are structured as sectoral balance sheets. For each sector, the data contain the outstanding amounts of assets (claims) and liabilities by financial instrument. Figure A1.1 provides an overview. An important feature for our unveiling approach is that each claim held by an agent must be recorded as a liability in the balance sheet of some other agent in the economy. As a result, the sum of all deposits recorded as assets must be equal to the sum of all deposits recorded as liabilities in the economy.[4] Financial relationships with other countries are recorded in the sector rest of the world. The assets of the rest of the world sector correspond to external liabilities of the respective country and correspond closely to the external positions reported in Lane and Milesi-Ferretti (2018).

All three datasets are structured in the same way, with more recent data expanding on recorded subsectors and instruments. While these balance sheets track the claims and liabilities of each sector, they normally do not contain information on counterparties, i.e. the sector on the other side of the transaction. Some of the newly digitized data, however, does contain this information. This means, that balance sheets not only report outstanding claims

[4]There exist small statistical discrepancies in the data, such that this equality does not always hold.

of a sector, but also identify the sector against which these claims are held. Similar data is available in the US financial accounts used in Mian et al. (2020b) and the 'who-to-whom' matrices provided by the ECB for recent years. While the counterparty data are available only for a subsample of countries and years, it allows us to verify the results of our baseline unveiling approach, which does not rely on counterparty information.

2.2. Unveiling

Where do funds, that households or corporations borrow, come from? While a loan is normally held as an asset by a bank, the bank is not the ultimate source of funds. The bank finances loans on its asset side with equity, bonds, deposits or other instruments on its liability side. The loan is thus ultimately owned by economic agents that hold the bank's liabilities as an asset. 'Unveiling' the role of financial corporations means linking the loan to the ultimate financiers. In line with Mian et al. (2020b), we assume that ultimate owners (u) can be domestic households, the government or the rest of the world ($u \in \{HH, GG, RoTW\}$). Corporate sectors (c) that are not ultimate owners contain non-financial and financial corporations ($c \in \{NF, FI\}$). For example, the domestic household sector may finance a loan on the asset side of bank balance sheets holding bank deposits. The household sector may also finance loans more indirectly, e.g. via claims on pension funds, which again are invested in shares and bonds of the bank. We will use information on sectoral asset and liability composition to link loans to the ultimate providers of capital. The following section describes our baseline unveiling procedure, which we term the *proportional approach*. This approach does not rely on counterparty information, but can be conducted based solely on sectoral balance sheet information on asset and liability composition.

Step 1: The proportional unveiling approach relies on the accounting axiom, that every liability is another agent's asset. Given the previously described data structure, we know the debt composition of any given sector, while observing the asset composition of all other sectors. Remember, that we want to link the financial instruments on the liability side of one sector to the sectors which hold these instruments as an asset. When we do not have counterparty information, we allocate liabilities proportionally. For example, we allocate the deposits used by the financial sector to finance loans to a source sector based on the share this sector has in total deposits in the economy (excluding the financial sector itself). When the household sector holds 70% of all deposits in the economy, we assign 70% of the deposit liabilities of the financial sector to the household sector.

More generally, we want to measure the assets (claims) held by source sector s against recipient sector r through financial instrument i, denoted as $A_{i,s\to r}$, for each sectoral source-

recipient pair. This information is observable in the counterparty data (for some instruments i), but it is not available in our large panel of countries. The key assumption we make is that for a given instrument i, sectors borrow proportionally to the asset holdings from the other sectors. In other words, for a given financial instrument on the liability side, a sector does not have prefererences about the source of its funds, but borrows based on the proportion the other sectors hold of that instrument. Based on this assumption, we can compute an estimate of claims in instrument i held by source sector s against recipient sector r as

$$A_{i,s\to r} = \frac{A_{i,s}}{\sum_{s\neq r}^{S} A_{i,s}} L_{i,r}, \tag{1}$$

where $(r, s) \in \{HH, GG, RoTW, NF, FI\}$ are the recipient sector and the source sector respectively, and i the instrument through which r has raised and s has supplied funds. Instruments (i) can be deposits, bonds, loans, shares, insurances and pensions, gold and SDRs, derivatives and options, or other accounts. We can then sum over all financial instruments to get total holdings for directed sectoral pairs $A_{s\to r} = \sum_{i}^{I} A_{i,s\to r}$. A graphical representation of the allocation based on Equation 1 is given in Figure A1.3.

While in principle allowing all possible source-recipient relationships, we will set $A_{i,RoTW\to HH} = 0$. The reason is that households do not directly access international financial markets to borrow. Whenever we observe counterparty information in the data $A_{i,RoTW\to HH}$ is zero or very small. Allowing this direct link based on proportionality would therefore likely overestimate the importance of the link. While we think this is a reasonable restriction based on observable data, it is also important to note that this approach, if anything, underestimates the role of the rest of the world in funding household debt expansions.

The proportionality assumption will not hold exactly in the data. The approach will work better when instruments are held predominantly by one sector. In our example above: if the household sector is the only owner of deposits in the economy, we will allocate deposits correctly. It is therefore an advantage that asset and liability composition of sectors differ substantially in the data. However, we will also validate the results of our approach using two alternative unveiling approaches. First, we compare the estimates of our baseline approach with results from an unveiling exercise where we observe $A_{i,s\to r}$ or $A_{s\to r}$ directly in the data. This approach is limited by the availability of such counterparty information. In a second exercise, we compare our estimates to results using different assumptions to estimate $A_{i,s\to r}$.

Step 2: Our goal is to determine the ultimate source of household credit, i.e. we want to measure $A_{u\to HH}$ with u being the ultimate source ($u \in \{HH, GG, RoTW\}$).[5] Indirect

[5]Note that the liabilities of the household sector almost exclusively consist of loans, so that $A_{u\to HH}$ is

holdings can take two forms. First, households and u-sectors could be linked via one intermediary, e.g. domestic households supplying deposits to financial intermediaries which then lend to other domestic households. Second, there could be more than one intermediation step: e.g., consumer loans to the household sector on the asset side of non-financial corporate balance sheets may be financed with a loan from financial intermediaries on the liability side. This loan will be recorded as an asset of the financial intermediary and may, again, be financed with funds from households. To correctly assign household debt to ultimate financiers, we estimate the total holdings of ultimate sectors in intermediary sectors that channel funds (corporate c-sectors) as the sum of direct holdings in the intermediary sector and holdings channeled through the other corporate sector. We compute the claims of sector u against sector c channeled through c' as

$$A_{u\to c'\to c} = \frac{A_{u\to c'}}{\sum_u^U A_{u\to c'}} A_{c'\to c}. \tag{2}$$

Adding up the direct holdings and the indirect holdings in Equation 3 gives the total holdings in the two intermediary sectors for our three final suppliers of capital[6]

$$TA_{u\to c} = A_{u\to c} + A_{u\to c'\to c}. \tag{3}$$

Step 3: To determine the final holders of household debt, one additional step is necessary. This step distributes the claims of the two c-sectors on the household sector according to the total holdings in them by the three u-sectors. The total funds supplied by source sector u to the household sector ($TA_{u\to HH}$) are then calculated as the sum of indirect and direct claims on the household sector[7]

$$TA_{u\to HH} = \sum_c^C \frac{TA_{u\to c}}{\sum_u^U TA_{u\to c}} A_{c\to HH} + A_{u\to HH}. \tag{4}$$

2.3. Unveiling with counterparty information

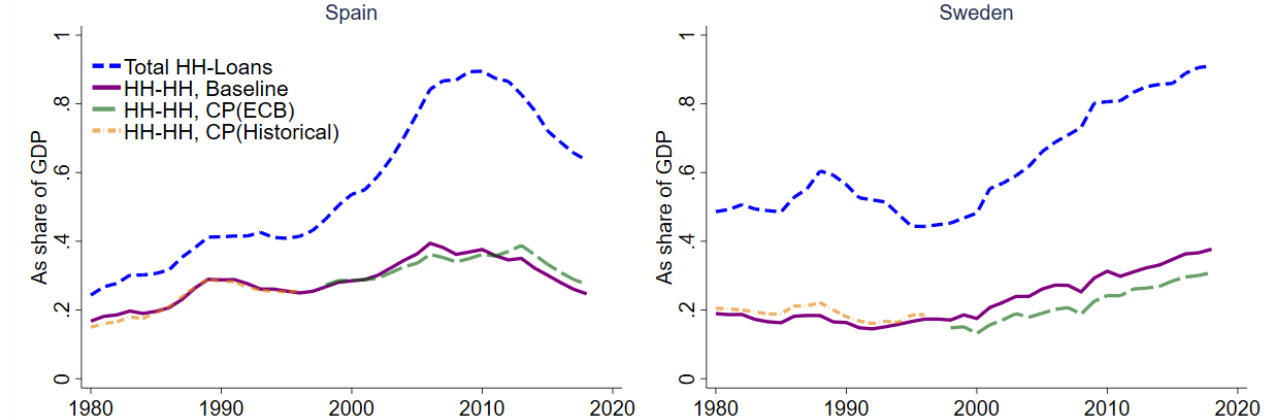
How critical is the proportionality assumption underlying our approach? To answer this question, we resort to datasets where counterparty information is available, making the first

almost identical to $A_{Loans,u\to HH}$.

[6]For loans to the corporate non-financial sector the unveiling ends with this step at the instrument level. Adding up direct loans by the source sectors to the corporate sector and loans by the financial sector to the corporate sector that have been unveiled, yields the total loans to the non-financial corporate sector financed by ultimate sector u

[7]Note that the direct link $A_{u\to HH}$ only plays a role for government claims on the household sector as we have set $A_{i,RoTW\to HH} = 0$. Furthermore, households do not hold loans as assets in the financial accounts, i.e. $A_{Loans,HH\to HH} = 0$. In general direct lending relationships between households are not observed in financial statistics.

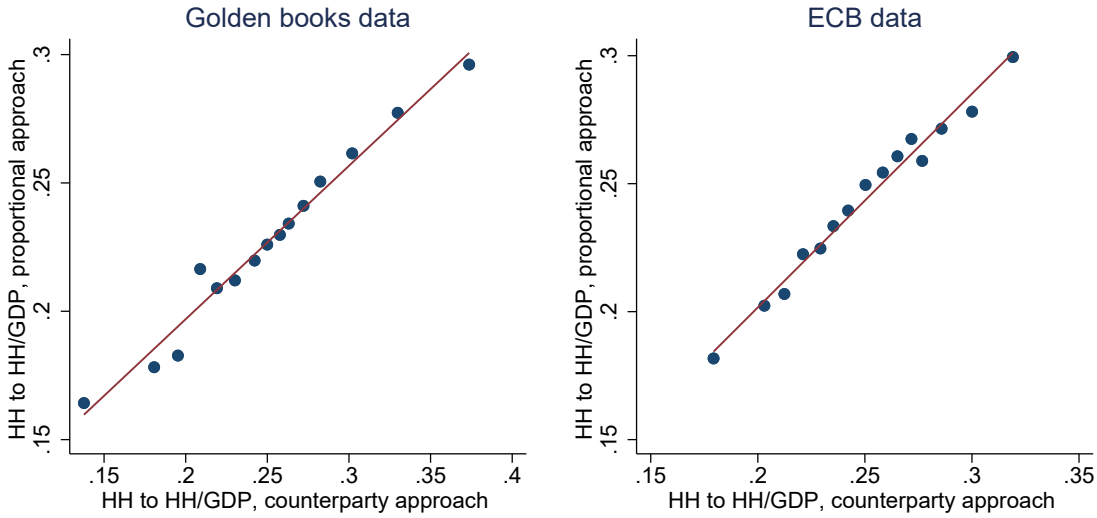
Figure 1: *Household debt financed by the household sector, proportional and counterparty unveiling*



Notes: The figure shows the development of household debt financed by the household sector using different unveiling approaches. The short-dashed (blue) line corresponds to total outstanding household debt as a fraction of GDP for comparison. The solid (purple) line is the household debt ultimately financed by the household sector based on our baseline proportional allocation. The dotted (yellow) line corresponds to the estimate using historical counterparty data to conduct the unveiling. The dashed (green) line employs counterparty data from the ECB financial accounts. See text.

step of proportional allocation in the procedure above obsolete. Counterparty data is available in three different datasets. First, the digitized historical data contain counterparties for some countries, which allows us to perform the unveiling using counterparty information at the beginning of our sample period. Second, for recent years, detailed counterparty information is available from the ECB's 'who-to-whom-matrices'. Third, the US financial accounts contain counterparty information which is exploited in Mian et al. (2020b). We use the information from the historical publications and from ECB statistics for cross-validation in Figure 1. The graph shows in blue total household debt relative to GDP for Spain and Sweden, two countries for which we have counterparty information from both the historical and the ECB data. We then show household debt funded by the household sector (again relative to GDP) using three approaches: the purple line corresponds to the proportional unveiling described above. The yellow line corresponds to the estimate based on counterparty information from the historical data. As can be seen, this data is available from 1980 until the mid-90s for Spain and Sweden. In both countries, the estimate of household debt financed by domestic households is almost identical for the two approaches. The green line shows the results of using recent ECB data containing counterparty information to estimate the sources of household credit. Again, the green and the purple line are close and the dynamics are very similar, with a small level shift in the Swedish data. More generally, Figure 2 shows binscatters for the correlation between counterparty-based estimates and our baseline estimates whenever both series are available. As can be seen, our baseline estimate is close to results using the historical OECD counterparty data as well as recent ECB data.

Figure 2: *Proportional and Counterparty Unveiling of HH to HH lending*



Notes: The figure shows the relationship between estimates of household credit funded by the household sector using different unveiling approaches. The left panel compares the results using the proportional approach to results using counterparty information in historical OECD data. The right panel compares the baseline approach to results using ECB counterparty data. Observations are collapsed into 15 equal sized bins. Each point represents the group specific means of household credit financed by households relative to GDP using the proportional and the respective counterparty approach after controlling for country fixed effects. Fitted regression lines illustrate the correlation.

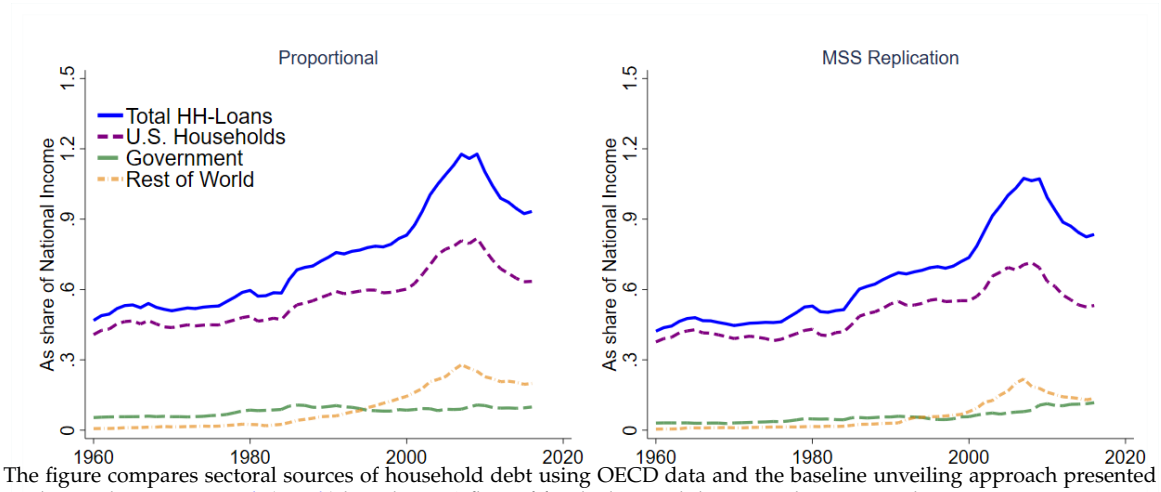
For further verification, we compare the estimates from Mian et al. (2020b) using their replication kit to ours. Figure 3 shows estimates from both approaches, with our baseline outcome left and their result right. Mian et al. (2020b) unveil mortgage and consumer credit while we unveil total household liabilities, as a result there are small level differences in the total household borrowing series. Additionally, in contrast to their approach, our proportional approach does not yield a residual, since all liabilities are distributed. As a result there are small level differences between the different series, but the estimates are almost indistinguishable in levels and dynamics.

2.4. Other unveiling approaches

To check the robustness and plausibility of our estimates, we conduct two additional exercises. In our baseline approach, we treat the financial sector as one, while in the data we can often distinguish between several financial subsectors. We do not exploit this data in our baseline approach as the availability of data for certain subsectors varies across countries. Where it exists, the data allows us to compare our results to two other approaches.

Mian et al. (2020b) use granular information on different financial subsectors and detailed counterparty data for the US to impose a structure on the flow of capital through the economy. The financial sector is decomposed into depository corporations, pensions, insurances, mutual funds, central banks and other financial institutions or pass throughs.

Figure 3: *Comparison with Mian et al. (2020b)*



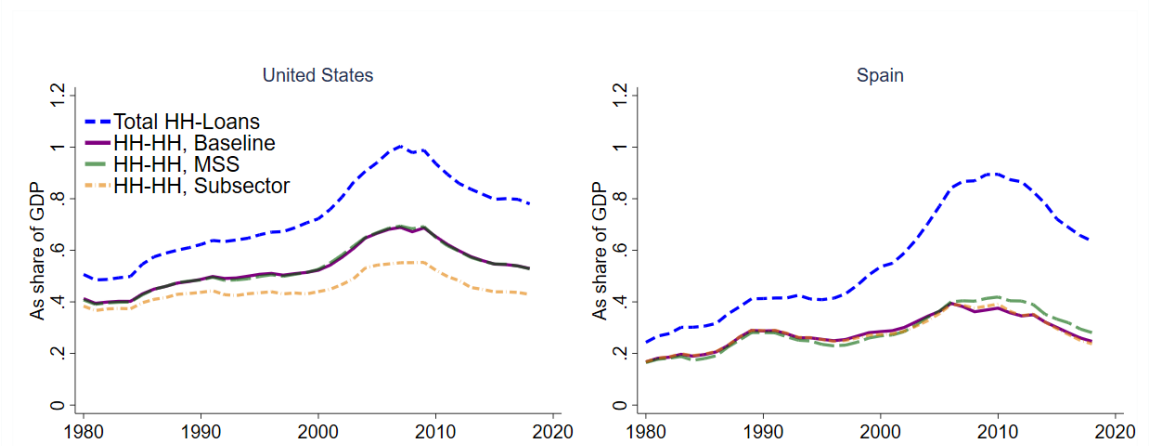
Notes The figure compares sectoral sources of household debt using OECD data and the baseline unveiling approach presented in this paper to the results in Mian et al. (2020b) based on US flow of funds data and their unveiling approach.

Key to the approach is, that at each stage of the unveiling, only a limited number of (sub-)sectors is allowed to hold assets in the sub-sector that is currently being unveiled. In the first robustness exercise, we impose this intermediation structure (the flow chart in Mian et al. (2020b)) on our data. The results are compared to the proportional unveiling in Figure 4. The graph shows in blue total household debt, in green the estimate imposing this intermediation structure on Spain and the United States and again in purple our proportional estimate. As can be seen, the results are again very similar to our baseline.

Finally, we propose an unveiling that uses subsectoral data for the financial sector. In our baseline approach we unveil the financial sector as a whole. Implicitly, this approach assumes that funds within the financial system are channeled from one party to another until all sub-sectoral differences in asset and liability composition do no longer matter. The approach could therefore be interpreted as an upper bound on intermediation within the financial system. For comparison, we use an approach which assumes that all funds enter financial subsectors from ultimate savers and are directly intermediated to ultimate borrowers, without being channelled through other financial subsectors. This approach can be seen as the lower bound of financial intermediation.

In this unveiling approach, we calculate the weighted average financing of every instrument on the asset side of financial subsectors. The liability composition of the subsector that holds the majority of household loans within the financial sector, now matters most. The result of this approach is displayed in Figure 4 in yellow. As can be seen, the result is almost identical to our baseline approach (purple) for Spain. For the US, the approach delivers a lower estimate for household credit ultimately financed by households. These differences can be explained with structural differences between the two financial systems. The Spanish financial sector consists almost exclusively of depository institutions. Hence, there is little

Figure 4: *Alternative unveiling approaches*



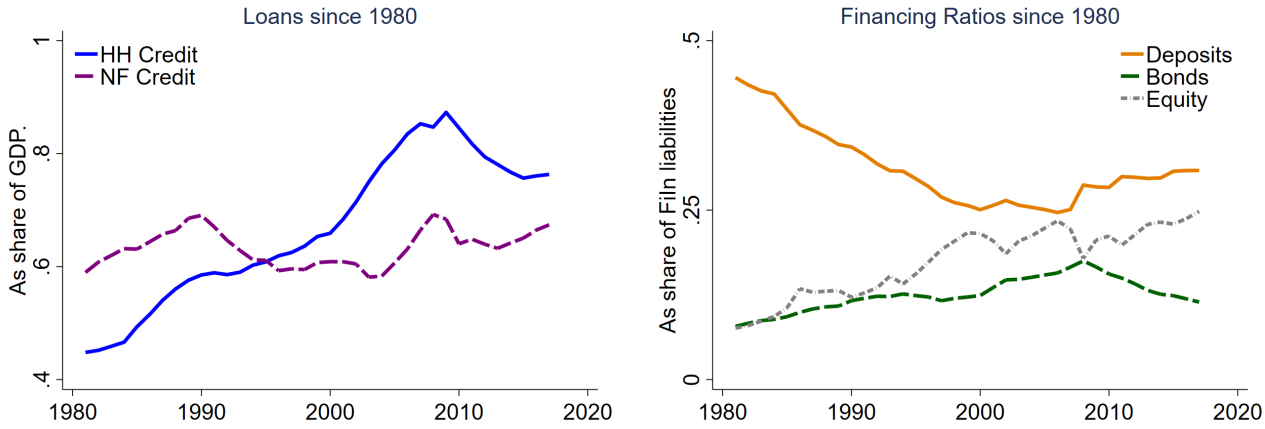
Notes This figure shows total household debt and household debt ultimately financed by the household sector using three unveiling approaches. The dashed blue line is total household debt relative to GDP. The solid purple line is the share of houehold debt ultimately financed by the domestic household sector estimated with our baseline approach. The long-dashed green line presents results using the allowed sectoral allocations from Mian et al. (2020b) for unveiling. The yellow (short-dashed) line corresponds to the estimate using the subsectoral unveiling approach. See text.

difference between the different approaches. In the United States, households hold many claims on non-depository financial institutions, e.g. pension and insurance funds. These institutions often provide funds to depository institutions that hold household loans. Not considering this indirect channel, yields a lower estimate for household credit funded ultimately by households. Figure A1.4 shows the close relationship between estimates for the subsector and structural (Mian et al., 2020b) unveiling approaches respectively, plotting them against our proportional baseline.

3. The Changing Nature of Credit Intermediation

We will now take a closer look at credit intermediation in advanced economies over the last decades. This section will cover the trends, while the following ones will cover credit cycles and macroeconomic outcomes. In the textbook model of banking, banks receive household savings and direct them for investment purposes to non-financial corporates. As Jordà et al. (2016) have shown, this model of finance has been increasingly replaced by one where households are the main borrower of funds from the banking sector. For a stable sample of advanced economies, this can be seen in the left panel of Figure 5, which shows the evolution of household credit and non-financial corporate credit. Household credit soared over the 1980 to 2020 period, while non-financial credit remained rather stable. However, hitherto there is no systematic evidence of structural changes on the supply-side of capital. As the following section will document, it has been capital from abroad that financed the secular increases in household credit.

Figure 5: *Credit and financing ratios, 1980-2018*



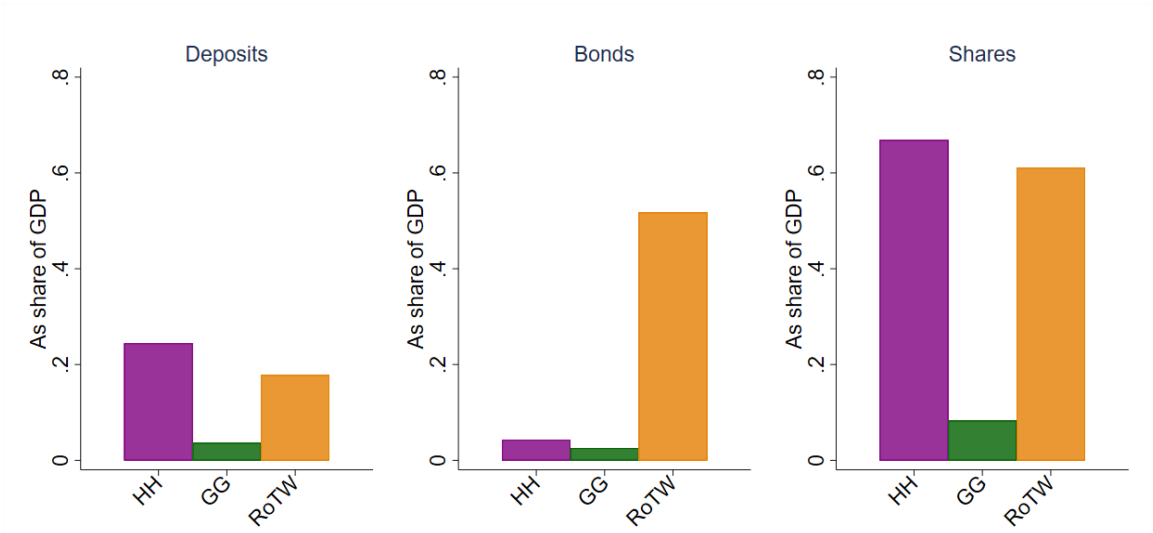
Notes: The left panel shows loans to households (solid blue) and to the non-financial sector (dashed purple) for a stable GDP-weighted sample of countries since 1980 as a ratio to GDP. The right panel shows the sahre of three instruments in total liablities of the financial sector. Deposits are in solid yellow, bonds in dashed green and equity in short-dashed grey.

3.1. Trends in asset and liability composition

Before studying the ultimate sources of funds, we start with a look at the liability composition of the financial sector. We observe a shift away from the textbook financing via deposits and towards financing via bonds and equities. While in 1980 half of the liabilities of the financial sector were deposits, these only accounted for a quarter of financial sector liabilities on the eve of the 2007/2008 crisis (right panel in Figure 5). There are two trends explaining this shift. First, as reported in Jordà et al. (2020) depository institutions have shifted from customer deposits to wholesale funding markets over the second half of the 20th century. Second, the financial sector increasingly consists of institutions other than depository institutions which by definition do not fund themselves with deposits. It is especially these subsectors that fund themselves with shares, leading to an increase in equity financing.

On the other side of financial transactions, households, governments and the rest of the world have been financing these changes. To get a sense of changes in their portfolio composition, Figure 6 shows the growth in asset holdings (relative to GDP) of the three final holding sectors for the three main asset classes. The ratio of deposits held by the household sector relative to GDP increased by more than 20% between 1980 and 2018. Deposit holdings of the rest of the world increased by roughly the same amount. Looking at bond holdings in the middle panel, the picture looks quite different. While holdings of households and the government increased marginally, there has been an increase in the bond holdings of the foreign sector of more than 50% of GDP. Both, households and foreigners, have increased their holdings of shares by more than 60% of GDP between 1980

Figure 6: *Change in holdings of Instruments 1980-2018 in percent of GDP*



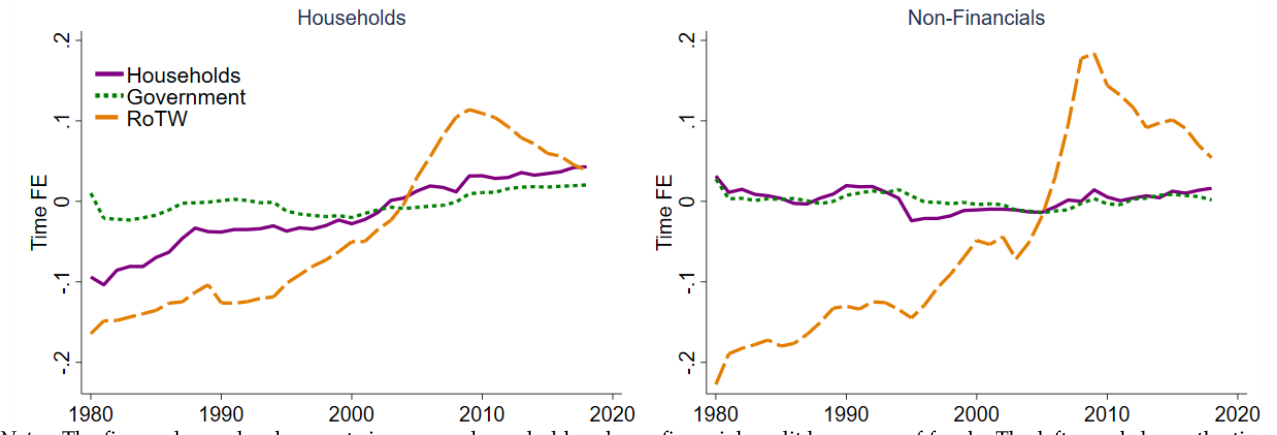
The figure shows changes in asset holdings at the sectoral level between 1980 and 2018. The left panel shows the change in the ratio of deposit assets to GDP for households, governments and the rest of the world. The middle and the right panel show these changes for holdings of bonds and shares respectively.

and 2018. Similar changes can be observed for other financial instruments and the foreign sector has increased asset holdings relative to GDP. As the foreign sector held negligible amounts of assets in 1980, these changes imply a strong reallocation towards the foreign sector as a source of funds.

3.2. The sources of funds for the great leveraging

Based on the unveiled dataseries, we now turn to studying how these three simultaneous developments – the growth in household debt, the change in financial sector financing structure, and changes in the asset composition of final holders of assets – translated into changes in the ultimate sources of household debt. As a measure of global trends, we show in Figure 7 the estimated time effects α_t of a regression of household credit by source x_{it} on country (α_i) and year (α_t) fixed effects, i.e. $x_{it} = \alpha_i + \alpha_t + \epsilon_{it}$, where x_{it} refers to household credit financed by domestic households, household credit financed by the government and household credit financed by the foreign sector respectively. The left panel in Figure 7 plots the three α_t series. Since 1980, there has been a slight increase in household-financed household debt. Governments increased financing of household credit after the financial crisis, but in small magnitude. Household credit financed by the rest of the world increased significantly between 1980 and the GFC, declining afterwards, but remaining elevated compared to the late 20th century. In the right panel, we see similar developments for loans to the corporate sector, where almost all variation between 1980 and today has been driven by the foreign-financed component.

Figure 7: *Time trends in credit by source*

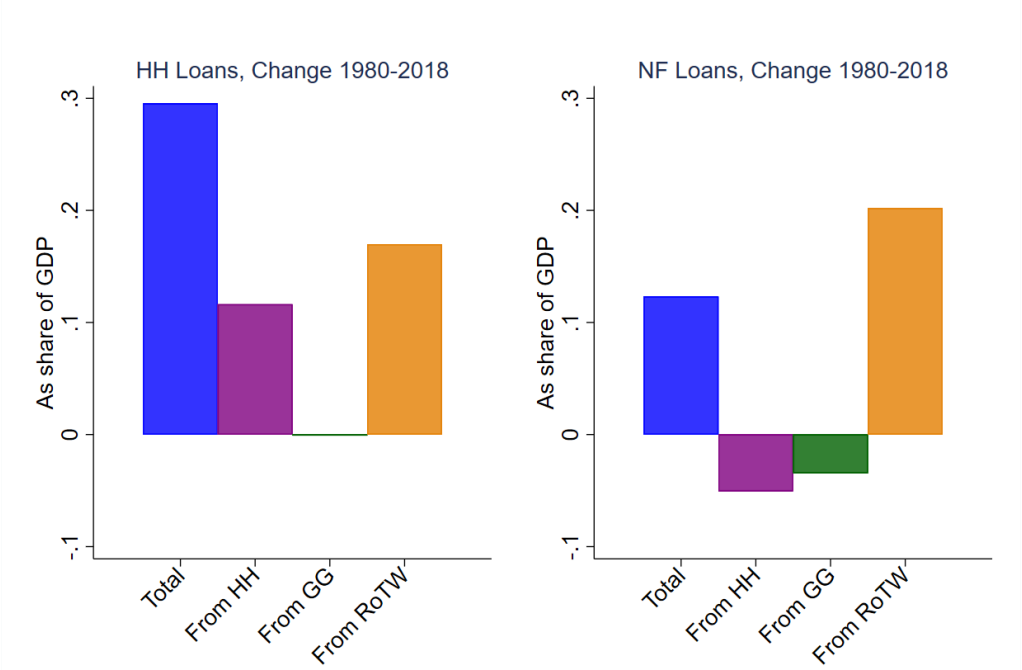


Notes: The figure shows developments in average household and non-financial credit by source of funds. The left panel shows the time fixed effects of a regression of household debt by financing sector on country and time fixed effects. The right panel shows the time fixed effects of a regression of loans to non-financial corporates by financing sector on country and time fixed effects.

For a stable sample of countries, Figure 8 displays the total increase in loans on the liability side for the two borrowing sectors, and the sources of funds for this increase. Household debt increased by 30% of GDP since 1980, with the rest of the world financing the largest share of this increase. The household sector as a source of funds accounted for roughly a third of the increase. This development however is driven mainly by the United States as described in Mian et al. (2020b) and in most other countries there is little change in household credit ultimately financed by domestic households. For corporate credit the picture is even more striking. Loans to the non-financial corporate sector have increased by slightly more than 10% of GDP since 1980, but the amount of loans to corporates ultimately funded by the rest of the world increased by more than 20% of GDP. This was possible, because the respective holdings of corporate debt by households and the government have decreased. The rest of the world has thus not only helped to fund an increase in debt like in the household case, it has substituted domestic sources of funds.

Robustness: The appendix contains additional material on these trends. One concern is that these trends, and the role of foreign capital, are driven by Euro area integration as other European countries are treated as rest of the world in the data. Hence, in Figure A2.6 we exclude the Euro area from the sample. Similarly, we exclude countries with very large RoTW positions (United Kingdom, Switzerland, Netherlands, Ireland, Iceland) in Figure A2.5. In both cases developments look still very similar to the ones reported here.

Figure 8: *Change in credit by source*



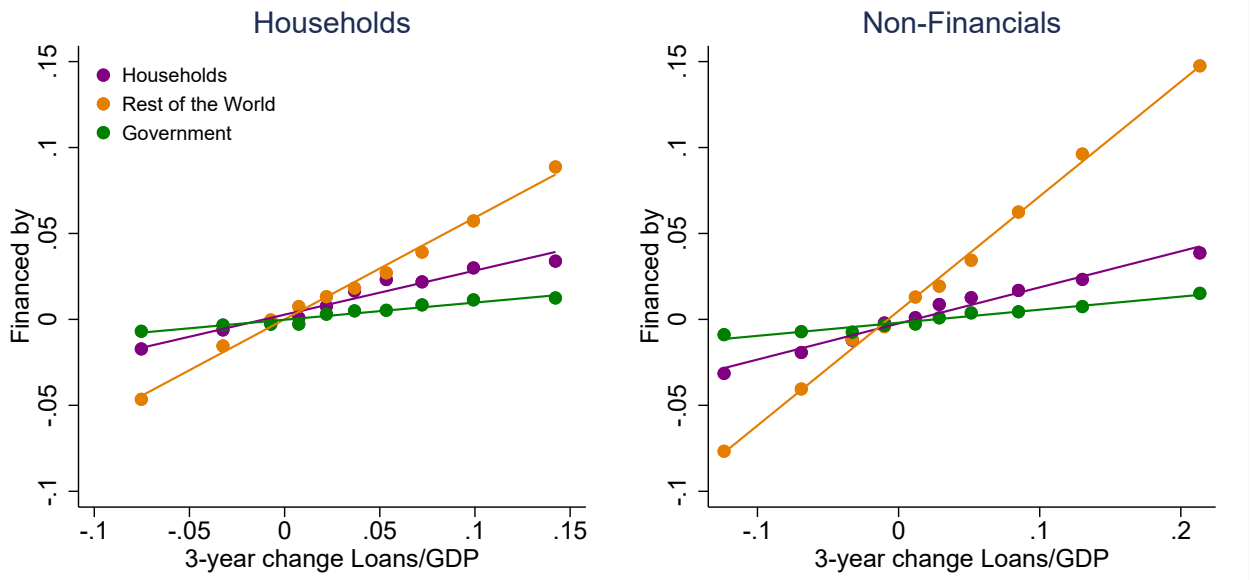
Notes: The figure shows the growth of credit by funding source from 1980 to 2018. The left panel shows the change in household credit to GDP and how much of this change was financed by the household sector, the government or the rest of the world. The right panel shows the change in loans to the corporate sector relative to GDP and how much of this change was financed by the household sector, the government or the rest of the world.

4. Credit and business cycles

How do these changes in the structure of financial intermediation affect the macroeconomy? To answer this question, we will move from long run trends in financial intermediation to cyclical variation, in the following sections. Previous work has shown that household credit expansions predict output and unemployment dynamics in the medium term (Mian et al., 2017), differently affecting tradable and non-tradable sectors (Mian et al., 2020a). Muller and Verner (2021) show that non-financial non-tradable credit predicts GDP once non-financial credit is decomposed into credit to tradable and non-tradable sctors, but the effects are not as strong as for household credit.

These findings are consistent with recent theoretical contributions. In Schmitt-Grohé and Uribe (2016) capital inflows from abroad induce a household demand boom. While tradable goods can be imported, non-tradable goods have to be produced locally, increasing the size of the non-tradable sector relative to the tradable sector. A reversal in foreign credit supply is then associated with an increase in unemployment due to nominal downward rigidity. Mian et al. (2020a) show that the sectoral allocation of output and employment in tradable and non-tradable sectors allows to study whether an identified credit expansion operates throuh this household demand channel. Furthermore, in Benigno and Fornaro

Figure 9: *Sources of 3-year changes in credit/GDP*



Notes: The left (right) panel shows the relationship between changes in total household (non-financial) credit and household (non-financial) credit decomposed by ultimate source of funds. Observations are collapsed into 20 equal sized bins based on three-year changes in the ratio of household (non-financial) credit to GDP. Each point represents the group specific means of three-year changes in total household (non-financial) credit and household (non-financial) credit financed by source sectors relative to GDP, after controlling for country fixed effects. Fitted regression lines illustrate the correlation.

(2014) and Benigno et al. (2020) abundant global capital leads to a misallocation of capital from the tradable to non-tradable sectors with adverse macroeconomic consequences, as economic performance depends on productivity improvements in the tradable sectors.

While these theoretical models rely on exogenous (global) supply of funds that are lent out to households and corporates, empirically this has been difficult to test. Mian et al. (2017) find limited evidence when they analyze cumulated current account deficits as a measure of foreign-financed credit expansion. Our data on credit disaggregated by source sector of funds allows us to directly test the hypothesis that capital inflows lent out to domestic households are associated with adverse macroeconomic consequences. We will first describe the properties of business-cycle variation in credit-to-GDP ratios by financing sector of credit and then study the relationships with macroeconomic outcomes. Credit financed by foreigners has been the main driving force of the long run leveraging in advanced economies, but is it also the driver of credit cycle variation?

The left panel in Figure 9 shows that the rest of the world is indeed the marginal source of financing for credit extended to the household sector at medium-term frequencies. The graph displays mean values of changes in the ratio of household credit financed by each sector, where the data have been sorted into ten bins according to the three-year change in the ratio of household loans to GDP. In the highest decile, the average three-year change

in the ratio of household loans to GDP is close to 15%. Almost two thirds of this increase are financed by the rest of the world: the average three-year change in household credit funded by the rest of the world is close to 10% of GDP for these observations. The right panel reveals a similar pattern for credit to the non-financial sector: three year changes in credit to the non-financial sector are mostly financed with funds flowing in from the rest of the world.

4.1. Output dynamics by sources of credit

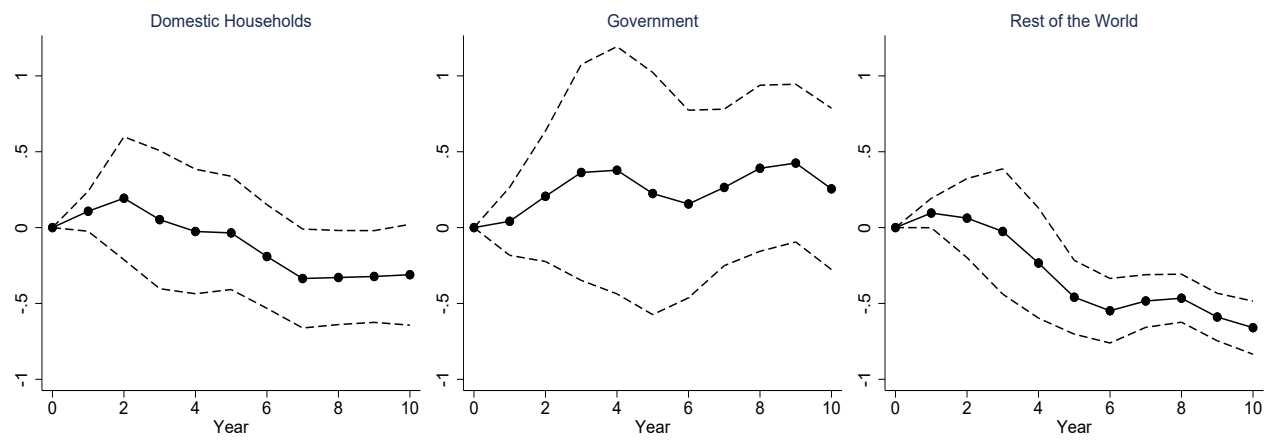
Are there any differences in the link between credit and business cycles depending on the sector ultimately financing credit as suggested by the theories discussed above? We follow Mian et al. (2017) closely to allow for a comparison between their results and the additional information contained in credit measures decomposed by source sector. In the first exercise we estimate local projections (Jordà, 2005)

$$\Delta_h y_{i,t+h} = \alpha_i^h + \sum_{j=0}^{5} \beta_{HH}^{h,j} \Delta C_{i,t-j}^{HH \to P} + \sum_{j=0}^{5} \beta_{GG}^{h,j} \Delta C_{i,t-j}^{GG \to P} + \sum_{j=0}^{5} \beta_{RoTW}^{h,j} \Delta C_{i,t-j}^{RoTW \to P} + \sum_{j=0}^{5} \beta_{y}^{h,j} \Delta y_{i,t-j} + \gamma X_{i,t} + u_{i,t+h}, \quad (5)$$

where $\Delta_h y_{i,t+h}$ is the change in output between time t and $t+h$ for horizons $h = 1, ..., 10$. We first compute private credit by ultimate source of financing, adding up household debt and loans to the corporate non-financial sector. $\Delta C_{i,t}^{HH \to P}$ then denotes the change in the ratio of private domestic credit funded by domestic households, relative to GDP, between years $t-1$ and t. We will be interested in the coefficients $\beta_{HH}^{h,0}$, $\beta_{RoTW}^{h,0}$ and $\beta_{GG}^{h,0}$ for one-year changes in credit sourced from the domestic household, government and rest of the world sector relative to GDP respectively. The specifications control for five lags of GDP growth and the explanatory variables. Recently, Brunnermeier et al. (2019) have argued that the response of output to credit is driven by the endogenous response of monetary policy towards credit shocks. We therefore include the contemporaneous values and five lags of changes in short-term interest rates as additional controls ($X_{i,t}$). Standard errors are dually clustered at the country and year dimension.

The left panel in Figure 10 presents the sequence of $\{\beta_{HH}^{h,0}\}$ coefficients. These are for all estimated horizons close to zero. Credit ultimately financed by the household sector is not significantly associated with the business cycle. The middle panel presents results for $\{\beta_{GG}^{h,0}\}$. Credit ultimately financed by the government predicts slightly positive, but insignificant

Figure 10: *GDP responses to changes in credit, by source of funds*



Notes: This figure shows estimates of impulse responses of real GDP to a change in total loans financed by the household sector, the government and the rest of the world based on Equation 5. Dashed lines represent 95% confidence intervals based on standard errors dually clustered at country and year level.

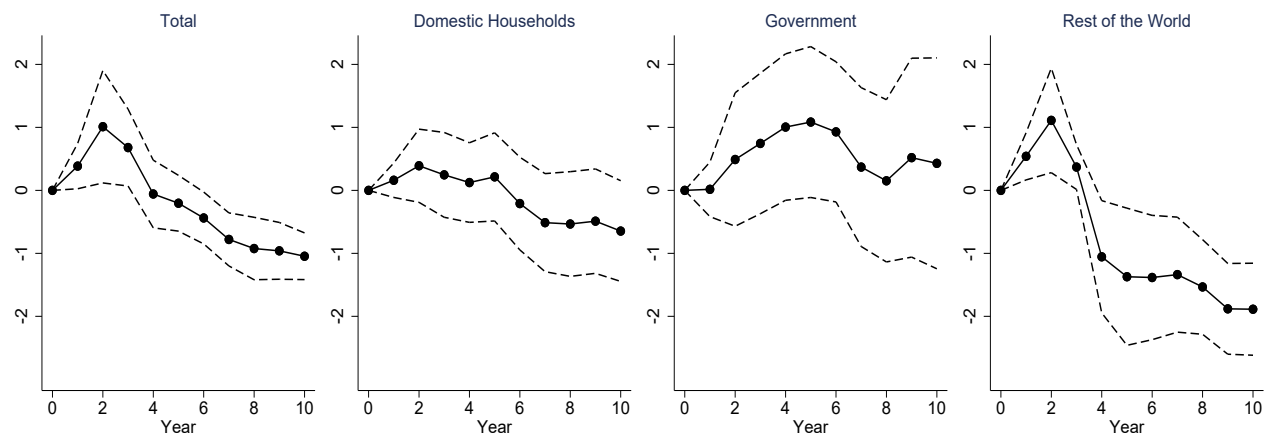
output dynamics. In contrast with these results for domestic sources of financial funds, the right panel reveals a highly significant, negative relationship between changes in credit financed by the rest of the world ($\{\beta^{h,0}_{RoTW}\}$ coefficients) and medium-term output dynamics. This relationship is also economically meaningful, a 1 percentage point increase in the ratio of loans financed by the rest of the world to GDP is associated with a 0.5% lower growth of real GDP over the following five years. Comparing the right panel to the other two, the results suggest that funds ultimately financed by the foreign sector are behind the negative relationship between credit and medium-term business cycle dynamics.

4.2. Output dynamics by source of credit and borrowing sector

Our data not only allows us to decompose total credit to the private domestic sector by sources of funds, but also by borrowing sectors. Here, we distinguish between credit from three source ($HH, GG, RoTW$) and to two borrowing (HH, NF) sectors

$$\Delta_h y_{it+h} = \alpha_i^h + \sum_{j=0}^{5} \beta^{h,j}_{HH,HH} \Delta C^{HH\to HH}_{it-j} + \sum_{j=0}^{5} \beta^{h,j}_{GG,HH} \Delta C^{GG\to HH}_{it-j} + \sum_{j=0}^{5} \beta^{h,j}_{RoTW,HH} \Delta C^{RoTW\to HH}_{it-j}$$
$$+ \sum_{j=0}^{5} \beta^{h,j}_{HH,NF} \Delta C^{HH\to NF}_{it-j} + \sum_{j=0}^{5} \beta^{h,j}_{GG,NF} \Delta C^{GG\to NF}_{it-j} + \sum_{j=0}^{5} \beta^{h,j}_{RoTW,NF} \Delta C^{RoTW\to NF}_{it-j}$$
$$+ \sum_{j=0}^{5} \beta^{h,j}_{y} \Delta y_{it-j} + \gamma X_{i,t} + u_{i,t+h}\,, \quad (6)$$

Figure 11: *GDP responses to changes in household credit by source of funds*

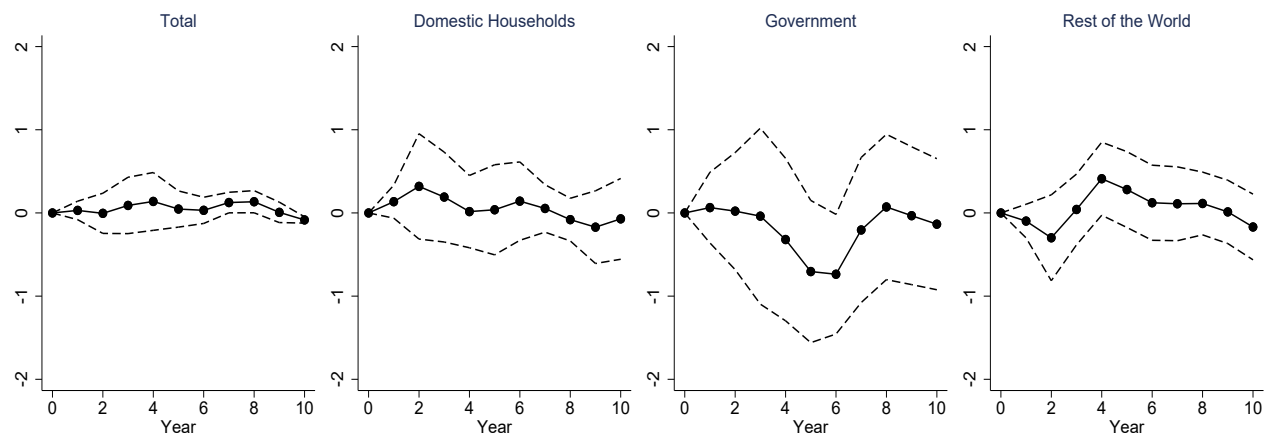


Notes: This figure shows estimates of impulse responses of real GDP to a change of household loans financed by the household, the government and the rest of the world sectors based on Equation 6. Dashed lines represent 95% confidence intervals computed based on standard errors dually clustered on country and year.

for $h = 1, ..., 10$, where $\Delta C_{it}^{HH \to HH}$ is the yearly change in the ratio of household credit financed by the household sector to GDP. We will be interested in the $\beta^{h,0}$-coefficients for each of the six sectoral borrower-saver combinations. Starting with households as borrowers, the $\{\beta_{HH,HH}^{h,0}\}$, $\{\beta_{GG,HH}^{h,0}\}$ and $\{\beta_{RoTW,HH}^{h,0}\}$ coefficients are shown in the three right panels of Figure 11. For comparison, the left panel shows the results for total household credit from a model where the three source sectors in Equation 6 are replaced by one term for changes in the ratio of total household credit to GDP (and non-financial credit respectively).

Starting with the measure of total credit in the left panel, we observe that an increase in household credit is associated with a short-lived boom in economic activity, but the response of cumulative output growth turns negative after year three. Cumulative output growth is then significantly lower six to ten years after the increase in household credit. This relationship has been demonstrated in Mian et al. (2017). The three right panels in Figure 11 decompose this effect by source of funds based on Equation 6. All three panels show an initial increase in output following an increase in household credit to GDP. However, after this initial boom, the responses are significantly different depending on the source of financing. The two middle panels suggest that loans financed with capital sourced from domestic households and from the government are not significantly associated with output dynamics after year three. The coefficient for household-financed household credit is close to zero; the coefficient for government financed household credit remains slightly above zero, but is mostly insignificant. On the other hand, the dynamic response of output to changes in household credit financed by the foreign sector is significantly negative beginning in year four. In line with the theories discussed above, household credit financed by foreigners is strongly associated with the short-lived boom in economic activity, and it

Figure 12: *GDP responses to changes in corporate loans by source of funds*



Notes: This figure shows estimates of impulse responses of real GDP to a change of corporate loans financed by the household, the government and the rest of the world sectors based on Equation 6. Dashed lines represent 95% confidence intervals computed based on standard errors double-clustered by country and year.

also explains the negative relationship between output and household credit beginning in year four.

Figure 12 shows the results for loans extended to the non-financial corporate sector. The left panel confirms the result in Mian et al. (2017) that the relationship between credit to the non-financial sector and macroeconomic outcomes is much less pronounced than for household credit. The coefficient estimate is very close to zero over all horizons. When we decompose non-financial credit by source sector of funds, funds intermediated between domestic households and non-financials similarly show no relationship with macroeconomic outcomes. Credit financed by the government is only a tiny fraction of total corporate borrowing, but if anything there seems to be a slightly negative medium-term relationship with output dynamics. The fourth panel looks at the dynamics of output following an increase in intermediation between corporate borrowers and foreign savers. The pattern suggests a slightly negative short-run effect that reverses after year two. The dynamics are, however, much less pronounced than for household credit and coefficients are insignificant over most horizons. These results add a new dimension to the previous literature, showing that the negative relationship between credit and macroeconomic outcomes is almost entirely explained by household credit financed from abroad.

Robustness: Figure A3.7 in the appendix adds year fixed effects to the specification to ensure that results are not driven by common shocks. This may, however, underestimate the link between foreign-financed household debt and macroeconomic outcomes if increases in foreign-financed household credit are driven by global capital supply. Figure A3.8 repeats the exercise excluding countries with large foreign sector positions (United Kingdom, Switzerland, Netherlands, Ireland, Iceland) from the estimation sample. The responses look

very similar in both cases and household credit funded by the rest of the world emerges as the main driving force behind the association between household credit and business cycle variables.

4.3. Medium-term relationship between credit and business cycles

We will now assess the negative medium-term relationship documented above in more detail. Figure 11 displays a negative association between changes to credit and output dynamics after a short-lived boom in economic activity. We hence start with a specification that relates three-year changes in output or unemployment to credit expansion over the previous three years.[8] Based on the results in the previous section, we focus on household credit decomposed by ultimate source of funds and control for total loans to the non-financial corporate sector, but do not decompose these funds by source in the following exercises.[9] Our baseline specification, hence, includes three-year changes in household credit, decomposed by the source of funds

$$\Delta_3 y_{i,t+3} = \alpha_i + \beta^{HH}\Delta_3 C_{i,t-1}^{HH\to HH} + \beta^{GG}\Delta_3 C_{i,t-1}^{GG\to HH} + \beta^{RoTW}\Delta_3 C_{i,t-1}^{RoTW\to HH} + \beta^{NF}\Delta_3 C_{i,t-1}^{NF} + \sum_{\tau=1}^{3}\gamma_\tau \Delta y_{i,t-\tau} + u_{i,t+3}, \quad (7)$$

where $\Delta_3 y_{i,t+3}$ is the growth of real GDP (or change in unemployment) between time t and time $t+3$, and $\Delta_3 C_{i,t-1}^{s\to HH}$ is the three-year change in credit from sector s to households as a ratio to GDP. $\Delta_3 C_{i,t-1}^{NF}$ is the three-year change in non-financial credit relative to GDP. All specifications control for country fixed effects and distributed lags of the dependent variable. The results are presented in Table 1. In column (1) of Table 1, $\Delta_3 RoTW \to HH_{i,t-1}$ is the coefficient for lagged three-year changes in loans to the household sector financed ultimately by the rest of the world. A one percentage point increase in this variable predicts 0.91% lower output growth over the following three-year window, in line with the dynamic relationship displayed in the right panel of Figure 11. The relationship is highly significant and it is robust to the inclusion of year fixed effects in column (2), assessing only non-overlapping three-year windows (column 3), and excluding crisis periods (column 4). In line with Figure 11, there is no such relationship for other credit variables and a test for the equality of coefficients is rejected.

[8] This horizon is standard in the literature and has been motivated by Mian et al. (2017) in a VAR setting.

[9] The results are, however, robust to the inclusion of non-financial credit decomposed by source sector of funds.

Table 1: *Credit expansion and subsequent outcomes*

	$\Delta_3 ln(Y)_{i,t+3}$				$\Delta_3 Unemployment_{i,t+3}$			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$\Delta_3 RoTW \rightarrow HH_{i,t-1}$	-0.91***	-0.75***	-1.09***	-0.74***	0.23***	0.18***	0.25***	0.19***
	(0.20)	(0.16)	(0.21)	(0.20)	(0.04)	(0.04)	(0.04)	(0.04)
$\Delta_3 HH \rightarrow HH_{i,t-1}$	-0.03	-0.05	-0.04	-0.03	0.14*	0.13*	0.14**	0.10
	(0.16)	(0.15)	(0.19)	(0.15)	(0.08)	(0.07)	(0.07)	(0.07)
$\Delta_3 GG \rightarrow HH_{i,t-1}$	-0.20	0.06	-0.34	-0.18	-0.03	-0.05	-0.05	-0.00
	(0.26)	(0.21)	(0.33)	(0.29)	(0.08)	(0.09)	(0.09)	(0.08)
$\Delta_3 NF_{i,t-1}$	0.02	0.09	0.05	0.06	-0.00	-0.01	-0.01	0.00
	(0.08)	(0.07)	(0.06)	(0.08)	(0.01)	(0.01)	(0.01)	(0.01)
R^2	0.329	0.589	0.405	0.297	0.423	0.579	0.487	0.369
Country fixed effects	✓	✓	✓	✓	✓	✓	✓	✓
LDV	✓	✓	✓	✓	✓	✓	✓	✓
Time fixed effects		✓				✓		
Non-overlapping			✓				✓	
Excluding crises				✓				✓
p-value, $\beta_{RoTW} = \beta_{HH} = \beta_{GG}$	0.00	0.00	0.00	0.00	0.01	0.07	0.00	0.03
Observations	608	591	198	538	609	589	205	545

Notes: This table presents results for Equation 7. The dependent variables are the growth of real GDP and the change in the unemployment rate between year t and $t+3$. Credit is split into flows between two borrowing sectors (HH and NF) and three financing sectors (HH, GG and RoTW). Credit variables are expressed as lagged three year changes in the ratio to GDP. LDV are lags of the dependent variable. Non-overlapping uses only every third observation. Excl. crises excludes a three year window around crisis years. Standard errors in parentheses are dually clustered on country and year. The reported p-value refers to a test for the equality of coefficients. *,**,*** indicates significance at the 0.1, 0.05, 0.01 level, respectively.

The negative relationship between foreign-financed household credit expansion and the business cycle also extends to employment measures as columns (5) to (8) show. A one percentage point higher $\Delta_3 RoTW \rightarrow HH_{it-1}$ is followed by an increase of 0.23% in the unemployment ratio between year t and $t+3$. Here, household credit ultimately financed by domestic households also predicts an increase in unemployment, but the effect is weaker than for external funding. This relationship is again robust to the inclusion of year fixed effects, focusing on non-overlapping observations only, and excluding crisis periods. Table A3.2 in the appendix shows that the results are robust to the exclusion of countries with very large rest of the world positions. The results of all these exercises support the conclusion that household credit funded from the rest of the world is the main driver behind the negative relationship between credit expansion and medium-term macroeconomic developments.

4.4. Global supply and local household credit expansion

For the interpretation of these results it is important whether the link between credit and macroeconomic outcomes is due to the supply of credit or demand for credit. In fact, Table 1 already goes some way in addressing this question, as it shows that the main credit cycle correlations documented in the literature are due to the component of household

credit financed by foreigners. This component depends on changes in the global supply of capital, but it also remains a possibility that higher household demand for credit can only be met by the foreign sector in the short run. We are, hence, interested in isolating the component of foreign-financed household credit expansions that is driven by increased supply of capital and is unrelated to domestic demand side factors.

A simple strategy to isolate this component is to focus on foreign-financed household credit expansion in other countries. While increases in household credit financed by the foreign sector in other countries (excluding country i) depend on the global supply of capital, they are unrelated to domestic credit demand in country i. We denote the change in foreign-financed household credit expansion in other countries as

$$\Delta_3 C_{-i,t}^{RoTW \to HH} = \frac{1}{N-1} \sum_{j \neq i} \Delta_3 C_{j,t}^{RoTW \to HH}. \tag{8}$$

This variable measures the average three-year change in credit from the RoTW to the household sector in all sample countries, excluding country i. Table 2 looks at the relationship between credit expansion and subsequent outcomes, when we instrument credit expansion in country i with the global credit expansion measure, excluding country i. For comparison, we first present the OLS estimates for a regression of three-year changes in GDP on past three-year changes in credit expansion in column (1). Household credit expansions are associated with lower output growth in the medium term. These effects are not present for firm debt expansions. Column (2) shows results when changes in household debt are instrumented with $\Delta_3 C_{-i,t}^{RoTW \to HH}$ as a measure of changes in global capital supply. First, note that the instrumental variable is relevant and $\Delta_3 C_{-i,t}^{RoTW \to HH}$ is strongly correlated with $\Delta_3 C_{i,t}^{HH}$. Turning to the second stage results, the coefficient in the instrumental variable specification is negative and significant, confirming the link between credit expansion and adverse macroeconomic outcomes. The coefficient for instrumented household credit expansion is larger than the OLS estimate. This seems plausible, as the baseline OLS coefficient will be downward biased as it most likely also captures credit demand, i.e. when households borrow against expectations of good future fundamentals.

In columns (3) and (4), we turn to household credit decomposed by source sector of funds. $\Delta_3 C_{-i,t}^{RoTW \to HH}$ naturally lends itself also as an instrument for $\Delta_3 C_{i,t}^{RoTW \to HH}$ as confirmed by the high Kleibergen-Paap statistic. Again, the coefficient is stronger in the instrumental variable specification. Columns (5) to (8) present results for changes in the unemployment rate as the dependent variable. Again, coefficients are larger once we instrument household credit expansion in country i with household credit funded by foreigners in other countries.

Table 2: *Instrumental variable results*

	$\Delta_3 ln(Y)_{i,t+3}$				$\Delta_3 Unemployment_{i,t+3}$			
	OLS (1)	Global IV (2)	OLS (3)	Global IV (4)	OLS (5)	Global IV (6)	OLS (7)	Global IV (8)
$\Delta_3 HH_{i,t-1}$	-0.62***	-1.34***			0.20***	0.28***		
	(0.15)	(0.45)			(0.04)	(0.10)		
$\Delta_3 RoTW \rightarrow HH_{i,t-1}$			-0.91***	-1.72***			0.24***	0.37***
			(0.19)	(0.52)			(0.05)	(0.13)
$\Delta_3 HH \rightarrow HH_{i,t-1}$			-0.04	0.13			0.10	0.07
			(0.16)	(0.21)			(0.06)	(0.08)
$\Delta_3 GG \rightarrow HH_{i,t-1}$			-0.18	0.05			-0.00	-0.04
			(0.26)	(0.28)			(0.09)	(0.10)
$\Delta_3 NF_{i,t-1}$	0.00	0.14	0.02	0.14	0.04*	0.02	0.04	0.02
	(0.07)	(0.09)	(0.08)	(0.10)	(0.02)	(0.02)	(0.02)	(0.03)
Country fixed effects	✓	✓	✓	✓	✓	✓	✓	✓
LDV	✓	✓	✓	✓	✓	✓	✓	✓
Kleibergen-Paap Weak ID		15.96	.	24.24		19.53	.	21.61
p-value, $\beta_{HH} = \beta_{NF}$	0.00	0.00			0.00	0.02		
p-value, $\beta_{RoTW} = \beta_{HH} = \beta_{GG}$			0.00	0.01			0.01	0.11
Observations	591	591	591	591	569	569	569	569

Notes: The dependent variables are the growth of real GDP and the change in the unemployment rate between year t and $t+3$. Credit is split into flows between two borrowing sectors (HH and NF) and three financing sectors (HH, GG and RoTW). Credit variables are expressed as lagged three year changes in the ratio to GDP. LDV are lags of the dependent variable. Global IV specifications instrument $\Delta_3 HH_{i,t-1}$ and $\Delta_3 RoTW \rightarrow HH_{i,t-1}$ with $\Delta_3 RoTW \rightarrow HH_{-i,t-1}$. Standard errors in parentheses are dually clustered on country and year. *,**,*** indicates significance at the 0.1, 0.05, 0.01 level, respectively. See text.

The results are consistent with theories that link exogenous changes in global capital supply and subsequent economic outcomes through credit markets. All specifications have a strong first-stage, meaning that the relevance condition for an instrumental variable is fulfilled. The second assumption, the exclusion restriction, cannot be tested and, as in most macroeconomic settings, it is unlikely to fully hold. For example, it may be the case that demand for credit in country i and in all other countries are correlated due to a global growth component. However, as in the domestic setting, households rationally borrowing against expected future growth would bias the results in the other direction. Global capital supply may also affect an economy through financing channels other than household credit. We cannot rule out these channels, but note that household credit seems to be a particularly important vector linking financial market conditions and macroeconomic outcomes.

4.5. Household demand vs productive capacity channels

Why are credit supply expansions from the RoTW detrimental to output growth? Recent literature distinguishes between several possible effects of credit supply expansions. Lending to households and non-tradables may increase household demand and consumption, while lending to the tradable sector may lead to productivity-enhancing investment. Bahadir and

Table 3: *Credit expansion and sectoral reallocation*

	$\Delta_3 ln(\frac{Y_{NT}}{Y_T})_{i,t}$				$\Delta_3 ln(\frac{Emp_{NT}}{Emp_T})_{i,t}$			
	OLS (1)	Global IV (2)	OLS (3)	Global IV (4)	OLS (5)	Global IV (6)	OLS (7)	Global IV (8)
$\Delta_3 HH_{i,t}$	0.47***	0.56***			0.44***	0.64***		
	(0.12)	(0.21)			(0.06)	(0.12)		
$\Delta_3 RoTW \rightarrow HH_{i,t}$			0.57***	0.62**			0.41***	0.65***
			(0.15)	(0.26)			(0.07)	(0.15)
$\Delta_3 HH \rightarrow HH_{i,t}$			0.15	0.12			0.72***	0.60***
			(0.20)	(0.24)			(0.12)	(0.15)
$\Delta_3 GG \rightarrow HH_{i,t}$			-0.07	-0.08			-0.21	-0.26
			(0.28)	(0.30)			(0.17)	(0.17)
$\Delta_3 NF_{i,t}$	-0.00	-0.02	-0.01	-0.01	-0.00	-0.05	-0.00	-0.04
	(0.11)	(0.10)	(0.11)	(0.10)	(0.03)	(0.04)	(0.03)	(0.04)
R^2	0.130	0.126	0.125	0.124	0.313	0.257	0.349	0.300
Country fixed effects	✓	✓	✓	✓	✓	✓	✓	✓
Kleibergen-Paap Weak ID		13.59		17.13		16.74		17.39
p-value, $\beta_{HH} = \beta_{NF}$	0.03	0.04			0.00	0.00		
p-value, $\beta_{RoTW} = \beta_{HH} = \beta_{GG}$			0.07	0.35			0.00	0.00
Observations	589	589	589	589	548	548	548	548

Notes: The dependent variables are three-year changes in the log ratio of output (employment) in the non-tradable to tradable sectors between t and $t-3$. Credit variables are expressed as contemporaneous three year changes in the ratio of credit relative to GDP. Global IV specifications instrument $\Delta_3 HH_{i,t}$ and $\Delta_3 RoTW \rightarrow HH_{i,t}$ with $\Delta_3 RoTW \rightarrow HH_{-i,t}$. Standard errors in parentheses are dually clustered on country and year. *,**,*** indicates significance at the 0.1, 0.05, 0.01 level, respectively. See text.

Gumus (2016) and Mian et al. (2020a) argue that credit supply driven household demand entails a reallocation from the tradable to the non-tradable sector that would not be observed for credit supply expansions that are used to finance productivity enhancing investment. Benigno and Fornaro (2014) and Benigno et al. (2020) argue that the reallocation from the tradable to the non-tradable sector is detrimental to growth because the productivity improvements necessary for growth are concentrated in the tradable sector.

We test the prediction that credit expansion financed by capital inflows triggers such reallocation. Similar to Mian et al. (2020a), we regress the log ratio of employment and output in tradable vs. non-tradable industries on contemporaneous credit expansion

$$\Delta_3 ln\left(\frac{Emp_{NT}}{Emp_T}\right)_{i,t} = \alpha_i + \beta_{HH}\Delta_3 C^{HH}_{i,t} + \beta_{NF}\Delta_3 C^{NF}_{i,t} + u_{i,t}, \tag{9}$$

replacing $\Delta_3 C^{HH}_{i,t}$ with credit expansion decomposed by source of funds in subsequent specifications. The baseline OLS results presented in column (1) of Table 3 confirm the finding in Mian et al. (2020a) for our sample. Household credit expansions are associated with an increase in the ratio of non-tradable to tradable output. Column (2) shows results instrumenting household credit expansion. Column (3) includes household credit expansions decomposed by source of funds. Household credit financed by the RoTW increases, in line with theory, the ratio of output in the non-tradable relative to the tradable

Table 4: *Credit expansion and growth forecast errors*

	(1) $e_{t+1\|t}$	(2) $e_{t+2\|t}$	(3) $e_{t+3\|t}$	(4) $e_{t+1\|t}$	(5) $e_{t+2\|t}$	(6) $e_{t+3\|t}$
$\Delta_3 HH_{i,t-1}$	-12.58**	-18.14***	-18.18***			
	(5.56)	(6.97)	(6.01)			
$\Delta_3 RoTW \rightarrow HH_{i,t-1}$				-17.96**	-25.39***	-24.92***
				(7.47)	(8.56)	(7.28)
$\Delta_3 HH \rightarrow HH_{i,t-1}$				-4.01	-6.08	-7.56
				(2.58)	(4.72)	(4.89)
$\Delta_3 GG \rightarrow HH_{i,t-1}$				0.94	5.50	4.07
				(6.75)	(5.69)	(5.01)
$\Delta_3 NF_{i,t-1}$	0.03	-0.09	0.40	1.05	1.33	1.71
	(0.41)	(0.53)	(0.91)	(0.69)	(0.89)	(1.08)
R^2	0.101	0.159	0.152	0.116	0.175	0.167
Country fixed effects	✓	✓	✓	✓	✓	✓
p-value, $\beta_{HH} = \beta_{NF}$	0.03	0.01	0.01			
p-value, $\beta_{RoTW} = \beta_{HH} = \beta_{GG}$				0.08	0.01	0.00
Observations	570	570	570	570	570	570

Notes: This table reports regression estimates of GDP growth forecast errors over the years t to $t+3$ on the change in credit measures from $t-4$ to $t-1$. The forecasts are from the fall issues of the IMF World Economic Outlook and the OECD Economic Outlook. $e_{t+1|t}$ is the realized change in log GDP from t to $t+1$ minus the time t forecast of the change in log GDP from t to $t+1$. Standard errors in parentheses are dually clustered on country and year. *,**,*** indicates significance at the 0.1, 0.05, 0.01 level, respectively.

sector. When we instrument foreign-financed credit expansion in column (4), results are similar. In columns (5) to (8), the dependent variable is the ratio of employment in the non-tradable to the tradable sector. Again, increases in household credit financed from abroad are associated with a reallocation from tradable sectors to non-tradable sectors. Here, increases in household credit financed by domestic households are also associated with such reallocation.

4.6. Growth expectations

What is the role of non-rational expectations in these relationships? After all, Kindleberger (1978) explicitly stressed the role of non-rational behavior by investors. Household credit expansions are associated with lower subsequent output growth, but this relationship has not been reflected in macroeconomic forecasts of IMF or OECD staff economists (Mian et al., 2017). As a result, forecast errors are predictable during household credit expansions. But who are the lenders, who supply the funds fueling credit expansions associated with predictable underperformance?

To answer this question, we regress the forecast error for time $t+h$ on lagged household credit expansion decomposed by source of funds. The forecast error is computed as realized growth between t and $t+h$ minus the time t forecast of growth between t and $t+h$. The results are presented in Table 4 for horizons h between 1 and 3 years. Columns (1) to

(3) confirm the relationship reported in Mian et al. (2017) for our sample. Household credit expansion predicts negative forecast errors, i.e. economic forecasters do not adjust their forecast to the negative relationship between credit expansion and output. Columns (4) to (6) show that this relationship is explained by the component of household credit financed by foreigners. In other words, household credit supplied by the rest of the world is associated with low output growth, but economic forecasters do not account for this relationship. Domestically financed household credit or credit to the corporate non-financial sector are not associated with these forecast errors.

4.7. Returns on bank equity and housing

Foreign investors, supplying capital for credit expansions, do not necessarily share the same beliefs as IMF forecasters, so it is difficult to assess their forecasts at the time of financing household sector borrowing. We can, however, assess whether periods of household borrowing financed by foreigners are associated with high sentiment, and hence low subsequent returns to providers of capital? To answer this question, we follow Baron and Xiong (2017) and focus on bank index returns. If banks suffer losses following household credit expansions, these losses will first be borne by bank shareholders. Returns on the bank index therefore provide a good measure of returns for suppliers of capital during a credit expansion. Hence, we regress future returns for bank shareholders on measures of credit expansion. More specifically, we run the following specifications

$$R^{Bank}_{i,t\to t+3} = \alpha_i + \beta_{HH}\Delta_3 C^{HH}_{i,t-1} + \beta_{NF}\Delta_3 C^{NF}_{i,t-1} + \gamma log(D/P)_{i,t-1} + \epsilon_{i,t}\,, \tag{10}$$

where $R^{Bank}_{t\to t+3}$ is the cumulative real total return on the bank index from t to $t+3$. We first include in specification (1) in Table 5 the 3-year changes in loans to the household and to the nonfinancial sector, controlling for bank dividend yield ($log(D/P)_{i,t-1}$). As in Baron and Xiong (2017) we find that credit expansion, here especially household credit, has predictive power beyond the information contained in dividend yield, and credit expansions are associated with low subsequent returns on the bank index. In column (2), we decompose household credit expansion by source and find that foreign capital is the main driving force behind this negative relationship. These results suggest that bank shareholders do not ask for higher returns during periods of large capital inflows being intermediated to finance the household credit, although these periods are associated with predictably worse macroeconomic outcomes, as shown above. Since loans to the household sector mostly consist of mortgages, we then ask whether foreign-financed household credit also predicts developments in housing markets, regressing three-year changes in the real house price

Table 5: *Sources of credit expansion and subsequent returns*

	Cumulative bank stock returns (t to t+3)		Growth in real house prices (t to t+3)	
	(1)	(2)	(3)	(4)
$\Delta_3 HH_{i,t-1}$	-3.08***		-1.14***	
	(1.07)		(0.16)	
$\Delta_3 RoTW \rightarrow HH_{i,t-1}$		-4.66**		-1.25***
		(1.65)		(0.21)
$\Delta_3 HH \rightarrow HH_{i,t-1}$		-0.26		-0.49
		(1.97)		(0.40)
$\Delta_3 GG \rightarrow HH_{i,t-1}$		0.52		-0.67
		(2.07)		(0.58)
$\Delta_3 NF_{i,t-1}$	0.46	0.44	-0.06***	-0.02
	(0.50)	(0.53)	(0.02)	(0.04)
R^2	0.345	0.338	0.363	0.327
Country fixed effects	✓	✓	✓	✓
Log(Bank D/P)	✓	✓		
p-value, $\beta_{HH} = \beta_{NF}$	0.02		0.00	
p-value, $\beta_{RoTW} = \beta_{HH} = \beta_{GG}$		0.13		0.07
Observations	402	402	584	584

Notes: This table reports estimates for a regression of cumulative returns to bank shareholders and growth in real house price indices on the change in credit measures from $t-4$ to $t-1$. Columns (1) and (2) control for log dividen yield of the bank index. Bank stock return and dividend yield data is from Baron and Xiong (2017) and the real house price index is taken from the OECD. Standard errors in parentheses are dually clustered on country and year. *,**,*** indicates significance at the 0.1, 0.05, 0.01 level, respectively.

index ($HP^{Real}_{t\rightarrow t+3}$) on measures of past credit expansion

$$HP^{Real}_{i,t\rightarrow t+3} = \alpha_i + \beta_{HH}\Delta_3 C^{HH}_{i,t-1} + \beta_{NF}\Delta_3 C^{NF}_{i,t-1} + \epsilon_{i,t}. \tag{11}$$

Column (3) in Table 5 shows that credit expansions are associated with a predictable negative effect on the house price index over the following years. Column (4) shows that this effect can, again, be mainly attributed to household credit financed by the rest of the world. Household credit expansion financed from abroad is associated with significantly lower house price growth, while household credit financed from other sources is not significantly related to future house price developments.

Taken together, the results in this section allow us to further characterize the nature of credit expansions. The new decomposition of credit shows that household credit expansions financed with capital inflows are associated with lower growth and higher unemployment, as well as sectoral reallocation from the tradable to the non-tradable sector. At the same time, professional forecasters and investors do not seem to be aware of these relationships, in particular not adjusting their forecasts to the foreign capital component. This result, that it is mainly international capital which is driving the relationship between credit expansion and forecast errors, matches with the arguments made in Kindleberger (1978). They also align with the notion of capital inflows that are unrelated to a country's economic state, but pushed into the country based on excess supply of capital in global financial markets.

5. Crises

Credit expansions have been shown to predict financial crises (Schularick and Taylor, 2012). In this section, we want to study the association between sectoral origins of funding for a credit expansion, and financial fragility. Rapid inflows of capital from abroad and their intermediation by the financial sector may amplify moral hazard and adverse selection problems. In addition to amplifying these problems, foreign inflows also create maturity and currency mismatches and expose domestic financial conditions to fluctuations in global sentiment (Rey, 2013). As a result, inflows of capital could be associated with a higher likelihood of experiencing costly financial crises (e.g. Reinhart and Rogoff (2009)).

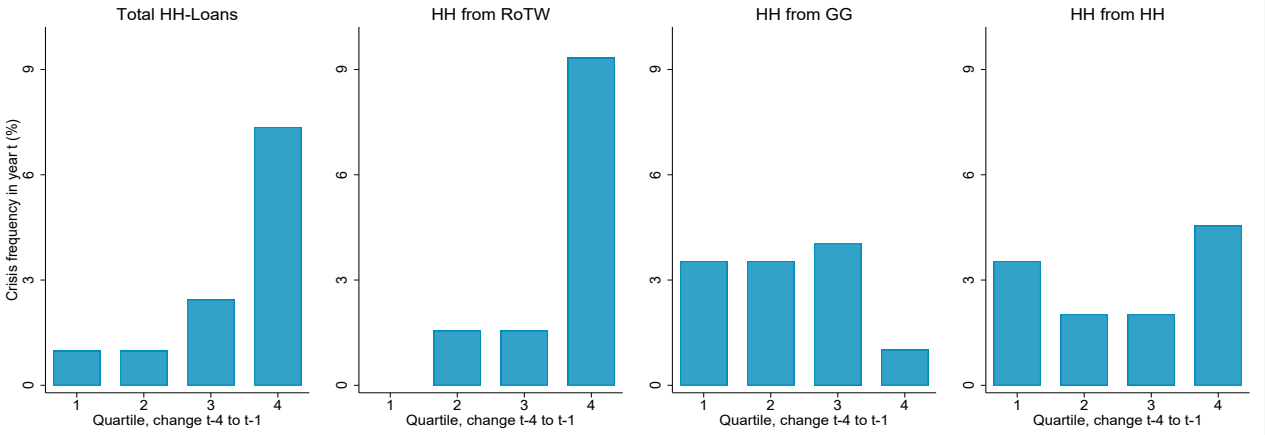
Despite this intuitive link, empirical studies have had mixed success in linking international supply of capital to banking crisis events. One way to study this link is to focus on the current account balance, as it most likely reflects capital inflows. Using this approach, Kiley (2021) finds a significant effect of current account deficits on banking crisis risk, but Jordà et al. (2011) find no relationship once they control for credit growth in a long run sample. Another part of the literature focuses more directly on capital flows. Broner et al. (2013) show that capital flows are large during expansions, while they collapse during crises. However, it has proven difficult to establish a clear link between banking crisis and capital flows, and the findings often depend on the assessed financial instruments. Caballero (2016) detects a link between capital inflow bonanzas, lending booms, and banking crises.

One reason may be, that most measures used in the literature are rather indirect measures of the funds intermediated by the banking sector between foreign providers of capital and domestic borrowers. Our data allows us to study this link directly, as we can explicitly link domestic debt to foreign financing, accounting for all possible financial instruments used. In this section, we will study the link between foreign-financed household debt and banking crises, looking first at the incidence and then at the aftermath of these crisis periods.

5.1. Predicting crises

As a simple way of analysing the link between credit expansion and crisis Figure 13 shows the financial crisis frequency for equal-sized bins of previous household credit expansions – in total and by source of funds. Consistent with previous findings in the literature, the left panel shows that the crisis frequency is increasing with the rate of three-year household credit expansion: in the highest quartile of household credit expansion the crisis frequency is more than six percentage point higher than in the lowest quartile. This pattern is even stronger for household credit expansion financed from the rest of the world (middle left

Figure 13: *Crisis probability in t by quartile of change in credit-to-GDP ratios from t-4 to t-1*



Notes: This figure shows the relationship between changes in household credit to GDP (by source of funds) between $t-4$ and $t-1$ and financial crisis frequencies for the year t. Observations are sorted into four equal-sized bins according to the change in household credit to GDP (by source sector of funds) between $t-4$ and $t-1$. Vertical bars indicate the frequency of financial crises in year t for each of these bins.

panel). On the other hand, the patterns are not so clear for household credit expansions financed domestically by either the government or the domestic household sector.

To formally study the pre-crisis dynamics of disaggregated credit relationships, we turn to crisis prediction exercises as it is standard in the literature. As a measure of financial distress we focus on systemic crisis events based on the Valencia and Laeven (2012) chronology which covers our sample countries and period. According to this definition, a systemic banking crisis is dated in country i for year t if there are significant signs of financial distress in the banking system (as indicated by significant bank runs, losses in the banking system, and/or bank liquidations) and significant banking policy intervention measures are taken in response.

We first ask whether information on the sources of credit extended in a credit expansion contains information about crisis risk that goes beyond the information contained in aggregate credit. Specifically, we estimate a probit model for a systemic financial crisis starting in country i in year t, denoted by the indicator variable $B_{i,t}$ conditional on lagged observables $X_{i,t-1}$.

$$Pr[B_{i,t} = 1|X_{i,t-1}] = \Phi(\beta X_{i,t-1}). \tag{12}$$

Here, $X_{i,t-1}$ includes the three-year changes in measures of credit relative to GDP. β denotes the vector of coefficients of interest for the various specifications. Column (1) in Table 6 first reports marginal effects for the relationship between changes in the ratio of household credit to GDP between $t-4$ and $t-1$ and crisis likelihood in year t. An increase in the ratio of household credit to GDP by one standard deviation (7.5 percentage points) is

associated with a 1.7 percentage point higher crisis likelihood. Given a sample frequency of about 3.5%, this implies that crisis risk increases by 50% when the three-year change in household credit to GDP is elevated by one standard deviation. Three-year changes in credit to non-financial corporates are also associated with significantly elevated financial crisis risk (as recently argued in Greenwood et al. (2020) and Muller and Verner (2021)). As a measure of capital inflows we also include the three-year changes in the current account. The coefficient is negative, as expected, but insignificant when credit expansion measures are included. We report the AUC-statistic (*area under the curve*), which is a benchmark-summary of predictive accuracy which allows to evaluate predictive performance of a model across specifications. The AUC is 0.5 for a model that does not add any predictive accuracy (a coin toss), and it approaches 1 for models that are perfectly able to sort the data into crisis and non-crisis bins. The baseline model in (1) including three-year changes in household and firm credit as well as three-year changes in the current account has an AUC of 0.74, a significant improvement relative to the 0.5 baseline AUC. We use this model as our baseline model and will compare all results to this model. Column (2) additionally includes country fixed effects. As a result, the number of observations is decreasing since some countries did not experience any financial crisis during the sample period. Furthermore, the AUC is slightly higher, as fixed effects help to sort the data into the crisis and no-crisis bins. The findings are, however, unchanged. Household credit expansion, and to a lesser extent credit to the non-financial sector predict crises.

Based on the findings above, we then decompose household credit by source of funds in column (3). The results suggest that the baseline relationship between expansions in household credit and crisis is driven by the component of household credit financed by foreigners. A one standard deviation higher increase in the ratio of household credit funded by the RoTW to GDP is associated with a 2.3 percentage points higher likelihood of crisis. Three-year changes in the ratio of household credit funded by the government relative to GDP are associated with a slightly lower likelihood of crisis, while changes in corporate credit are insignificant once we decompose household credit. In terms of predictive accuracy this model performs significantly better than the model in (1) as indicated by the AUC of 0.80. The results in (4), including fixed effects, are very similar, also improving predictive accuracy relative to the model in (2).

Where are these improvements coming from? In column (5), we include only a single variable, the three-year change in household credit financed by foreigners. The coefficient estimate remains stable relative to column (3), and more importantly, predictive accuracy is almost the same. A single-factor model, including only household credit expansion financed by the rest of the world, contains almost the same amount of information on crisis likelihood

Table 6: *Predicting financial crises*

	Baseline		By source of HH		Only RoTW to HH		All others	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$\Delta_3 HH_{i,t-1}$	0.23***	0.31***						
	(0.06)	(0.09)						
$\Delta_3 RoTW \rightarrow HH_{i,t-1}$			0.37***	0.45***	0.39***	0.58***		
			(0.07)	(0.14)	(0.06)	(0.06)		
$\Delta_3 GG \rightarrow HH_{i,t-1}$			-0.36*	-0.22			-0.37**	-0.38***
			(0.21)	(0.15)			(0.18)	(0.14)
$\Delta_3 HH \rightarrow HH_{i,t-1}$			0.02	-0.02			0.11	0.10
			(0.19)	(0.16)			(0.25)	(0.28)
$\Delta_3 NF_{i,t-1}$	0.03**	0.09**	-0.01	0.03			0.05**	0.15***
	(0.01)	(0.04)	(0.02)	(0.04)			(0.02)	(0.05)
$\Delta_3 CA/GDP_{i,t-1}$	-0.15	-0.17	-0.14	-0.10			-0.31**	-0.42*
	(0.14)	(0.21)	(0.14)	(0.13)			(0.16)	(0.22)
AUC	0.74	0.77	0.80	0.84	0.79	0.83	0.72	0.74
s.e.	0.05	0.05	0.05	0.04	0.05	0.04	0.05	0.05
Country fixed effects		✓		✓		✓		✓
Observations	674	525	674	525	674	525	674	525

Notes: The table shows probit classification models where the dependent variable is a financial crisis dummy. Coefficients are marginal effects. AUC is the area under the ROC-curve and below is its standard error. Clustered (by country) standard errors in parentheses. $^{*}p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

as a model additionally including changes in household credit from other sources, non-financial credit and the current account. To further illustrate this point, column (7) shows results from a model excluding only three-year changes in household credit funded by the RoTW from the model in column (3) and the AUC drops to 0.72. We conclude that RoTW-financed household credit expansion contains information on crisis likelihood not contained in other credit measures. Furthermore, the coefficient estimate of the current account in (7) is significantly negative, meaning that a deteriorating current account is associated with higher crisis likelihood. This was not the case in models containing information on foreign-financed household credit. The current account ratio, hence, seems to capture some of the information on foreign funded household credit, albeit very imperfectly (as indicated by the low AUC). These findings are robust to the inclusion of fixed effects in columns (6) and (8).

The appendix contains a battery of robustness checks to ensure that results are not driven by the choice of specification or variable definitions. In Table A4.4 we estimate linear probability model with country fixed effects instead of a probit model. In Table A4.3, variables are expressed in five-year changes instead of three-year changes. Finally, we employ the the Baron et al. (2021) crisis chronology in Table A4.5. In all these specifications, household credit funded by the rest of the world is highly significant and it is the most important link between credit and crisis, as measured by the AUC across models.

Why does household credit financed by foreigners perform so well as a crisis predictor,

while the previous literature found only mixed evidence for a link between capital flows and financial crises? First, our measure has the advantage of capturing gross capital flows. It can therefore account for both, the global banking glut and the global saving glut hypotheses. Second, the unveiling approach has the advantage that it captures funding provided by capital flows through any financial instrument. Country experiences around financial crises have been quite heterogeneous in terms of financial instruments used. Even the global financial cycle prior to the 2007/2008 crisis was characterised by the use of many different, country-specific, financing arrangements. Finally, the unveiling approach allows us to focus on the underlying financial relationship between ultimate borrowers and savers, while previous literature did not have a direct measure of these two linkages.

The downside of this approach is that our dataset only covers a set of advanced economies over the last decades. Since financial crises are rare events, this implies that the results are based on a limited number of crises events. However, recent long-run evidence on bank liability structure around financial crises events is consistent with the patterns described here. Jordà et al. (2020) decompose bank liabilities into capital, deposits and non-core liabilities. In line with the findings here, they argue that crises are often preceded by a shift towards non-deposit liabilities in the banking sector. Likewise, increases in the domestic loans-to-deposits ratio, i.e. loans financed increasingly with other financing sources than deposits of domestic residents, are associated with higher crisis likelihood, just as we find here.

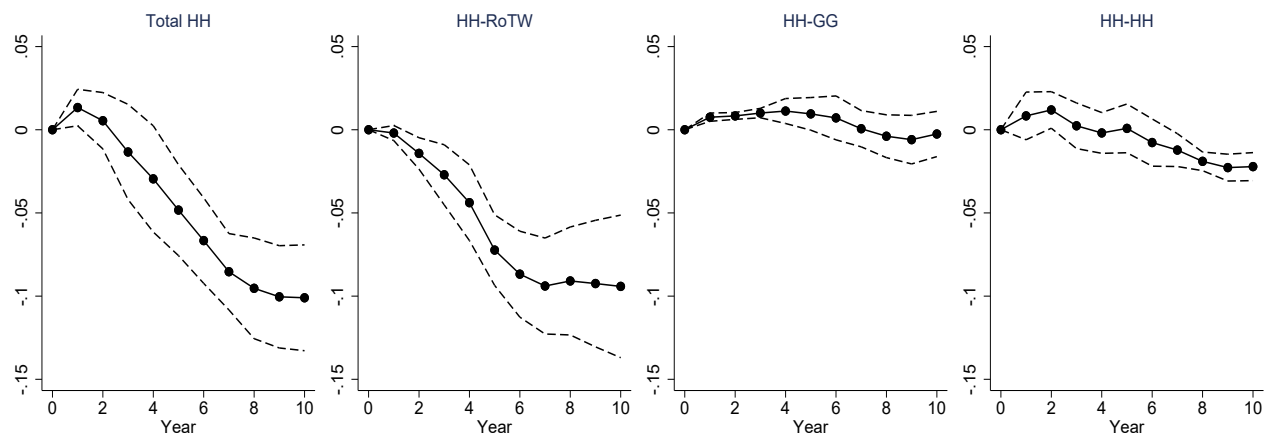
5.2. Credit after crises

Crises are preceded by the financial sector intermediating increasing quantities of capital between international markets and the private domestic, in particular household, sector. What happens once the crisis occurs? In a second step, we now ask whether financial crises are followed by disintermediation. And if yes, which borrower-saver relationship is subject to this disintermediation? Financial crisis are often characterised by increases in the price of credit (Krishnamurthy and Muir, 2017; Romer and Romer, 2017) and later by decreasing quantities of loans intermediated by the financial sector (Jordà et al., 2013).

Using our decomposition of credit by source of financing, we ask which sectoral source of credit is driving the decline in credit volumes after financial crises events. We again employ local projections and run specifications of the form

$$\Delta_h C^s_{i,t+h} = \alpha^h_i + \sum_{j=0}^{5} \beta^{h,j}_{BC} Crisis_{i,t-j} + \sum_{j=0}^{5} \beta^{h,j}_{Credit} \Delta C^s_{i,t-j} + \sum_{j=0}^{5} \beta^h_y \Delta Y_{i,t-j} + u_{i,t+h}, \qquad (13)$$

Figure 14: *Change in household credit after crises by source of financing*

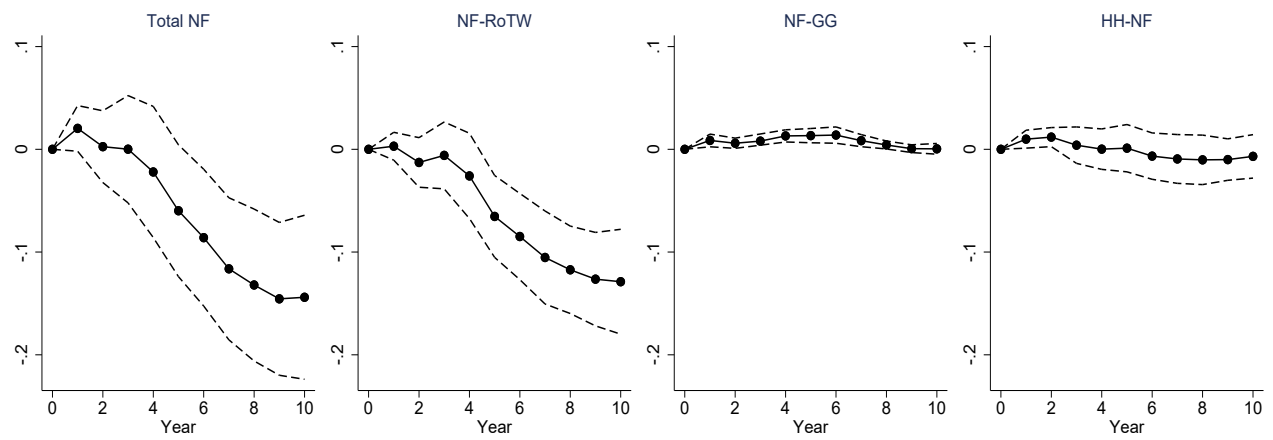


Notes: This figure shows estimates of responses of credit aggregates to a financial crisis based on Equation 13. Dashed lines represent 95% confidence intervals computed based on standard errors double-clustered by country and year.

where dependent variables $\Delta_h C_{i,t+h}$ are different measures of changes in the ratio of credit-to-GDP in country i between time t and time $t+h$. $\beta_{BC}^{h,0}$ measures the response of this credit measure towards a crisis event over varying horizons h. Clearly, given the link between crisis incidence and credit intermediated from the rest of the world towards the domestic household sector, the results of this exercise cannot be interpreted causally. Nevertheless, the results in Figure 14 provide an interesting account of financial intermediation after a banking crisis.

The left panel shows that following a financial crisis, loans to the household sector relative to GDP increase in the first year, before they start declining and the change in this ratio is significantly lower a few years after a crisis. Ten years after a crisis, the ratio of household credit is on average ten percentage points lower. In the three right-hand panels we repeat this exercise for household credit decomposed by the source of financing. To allow for a comparison, and in particular to explain the decline in total hosuehold credit, we plot all graphs on the same scale. The middle-left panel reveals which financing sector is behind the decline in household credit. The ten percentage point difference in the left panel is almost entirely explained by the decline in household credit financed with funds from abroad, which also declines by roughly ten percentage points. At the same time, household credit financed by domestic sectors does not decline significantly in the aftermath of financial crises. In fact, the ratio of government financed household credit to GDP is increasing in the first years after financial crises. Funds supplied by domestic households also increase directly after the crisis, befor they start declining several years after a crisis. Both effects are difficult to observe in the graph, as the effects are an order of magnitude smaller than for the foreign sector.

Figure 15: *Change in non-financial credit after crises by source of financing*



Notes: This figure shows estimates of responses of credit aggregates to a financial crisis based on Equation 13. Dashed lines represent 95% confidence intervals computed based on standard errors double-clustered by country and year.

Figure 15 shows that these effects are very similar for loans to the non-financial corporate sector. These decrease significantly after financial crises events with the bulk of this reduction coming from the rest of the world sector. Taken together, the results suggest that financial crises are preceded by increasing quantities of credit intermediated between the RoTW and domestic markets, especially households. Shortly after the crisis has started, the rest of the world is withdrawing these funds, consistent with the view that foreign funding is flighty in periods of distress. This affects both, credit to households and to the non-financial corporate sector.

6. Conclusions

The financial crisis in 2007/2008 painfully demonstrated the long-lasting negative macroeconomic consequences of a shock to the financial sector. More importantly, the transmission of an initially small shock to US mortgage portfolios through the global financial system laid bare the dangers of an interconnected global financial system. As we show in this paper, the flow of financial capital across borders does not only amplify and transmit shocks, it is often also the source of fluctuations.

Schularick and Taylor (2012) have noted the divergence of credit and money since the mid-20th century. This divergence can be explained by the role of international financial markets financing domestic credit in recent decades. Credit to the domestic household sector ultimately financed with capital inflows from abroad is associated with lower output growth, higher unemployment, and a reallocation from tradable to non-tradable sectors, potentially hampering productivity enhancements. Economic agents seem largely unaware

of the impending risks during such credit expansions. As witnessed in 2007/2008, the risks often manifest themselves in a costly crisis a few years into the boom. These relationships were previously documented separately for credit expansions and (partly) for capital flows, but they only occur when the two measures both reflect the same underlying transactions.

The changing nature of financial intermediation documented in this paper has important implications for macroeconomic modelling and policy. Developments in domestic credit markets cannot be disentangled from global capital markets. The financial system is not only intermediating from domestic households to non-financial corporates, but more and more between foreign entities and domestic households. Policymakers eager to avoid the adverse effects of rapid credit expansions will have to account for the role of international capital in local credit cycles. For optimal policy, this may require to jointly assess the role of monetary and macroprudential policies as well as capital controls to insulate economies from these fluctuations.

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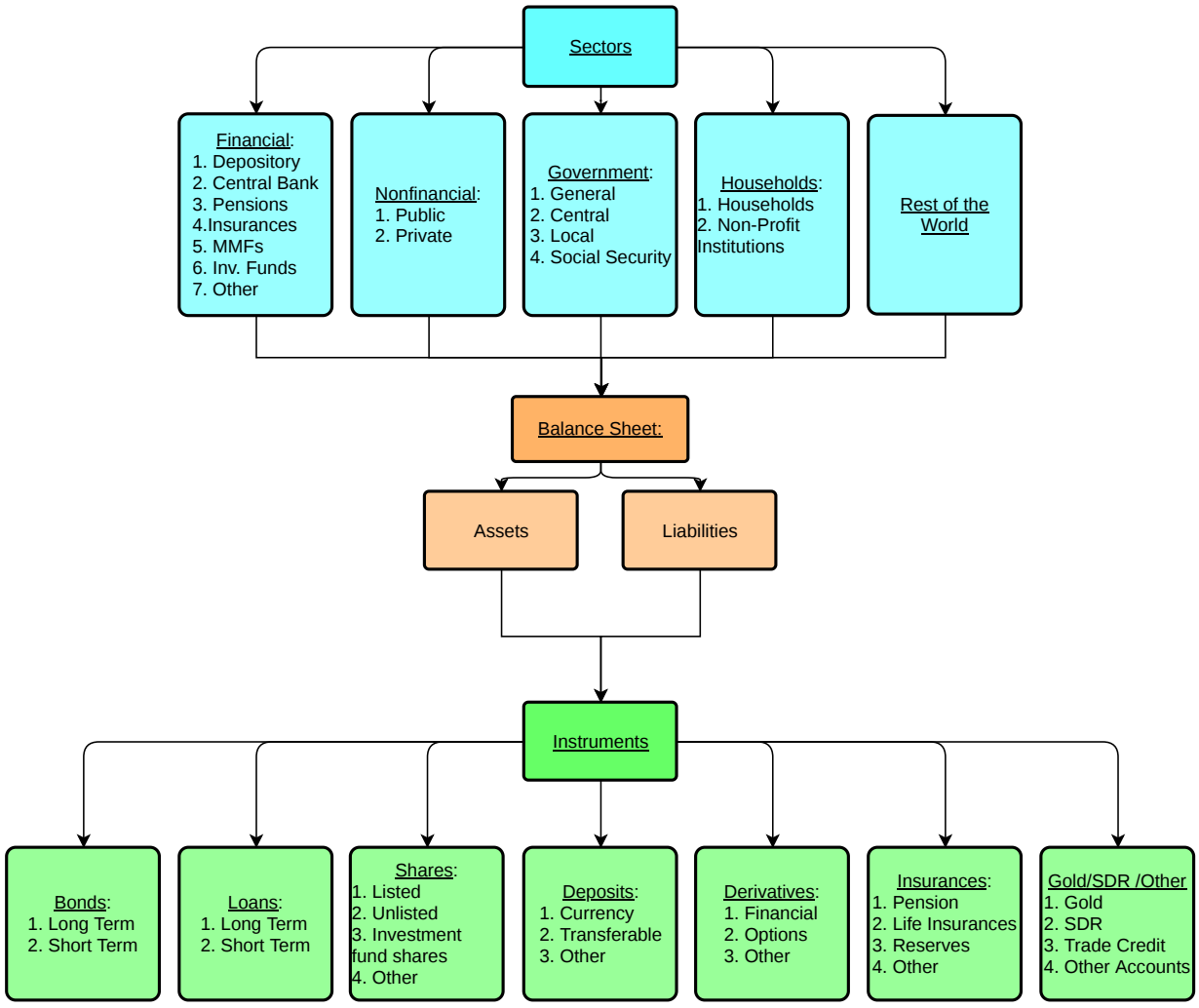
Appendix

When Two Become One: Foreign Capital and Household Credit Expansion

A. Appendix

A1. Data and Unveiling

Figure A1.1: *Overview of Financial Accounts Balance Sheets*



This figure gives an overview over the structural composition of our data. It shows, from top to bottom: 1: The division into the five main sectors, with its respective subsectors, 2: The split of every sectoral account into its respective asset and liability positions and 3: Through which financial instrument these positions are recorded.

Table A1.1: *Range by Sample*

Country	SNA08	SNA93	Golden Books
Austria	1995-2018	1995-2012	
Belgium	1995-2018	1994-2013	1973-1996
Brazil	2009-2015	2004-2009	
Canada	1990-2019	1970-2014	1974-1996
Chile	2003-2018	2002-2015	
Colombia	2015-2018	1996-2015	
Czech Republic	1995-2018	1994-2012	
Denmark	1994-2018	1994-2013	
Estonia	1995-2018	1995-2012	
Finland	1995-2018	1995-2012	1980-1995
France	1995-2018	1995-2012	1977-1997
Germany	1995-2018	1991-2012	1973-1997
Greece	1995-2018	1995-2013	
Hungary	1990-2018	1989-2013	
Iceland	2003-2018	2003-2012	
India	2011-2017		
Ireland	2001-2018	2001-2012	
Israel	2010-2017	2010-2012	
Italy	1995-2018	1995-2012	1979-1997
Japan	1994-2018	1980-2014	1973-1996
Korea	2008-2018	2002-2012	
Latvia	1995-2018		
Lithuania	1995-2018		
Luxembourg	1999-2018	2006-2012	
Mexico	2003-2018	1997-2009	
Netherlands	1995-2018	1990-2012	1987-1996
New Zealand	2007-2017		
Norway	1995-2019	1995-2013	1981-1993
Poland	1995-2018	1995-2012	
Portugal	1995-2018	1995-2013	
Russia	2011-2018		
Slovak Republic	1995-2018	1995-2012	
Slovenia	1995-2018	2001-2013	
Spain	1995-2018	1980-2012	1973-1996
Sweden	1995-2018	1995-2013	1980-1996
Switzerland	1999-2018	1999-2011	
Turkey	2010-2018	2010-2015	
United Kingdom	1995-2018	1987-2013	
United States	1960-2019	1960-2013	1955-1996

Figure A1.2: *Instrument holdings by Sector: Spain*

SPAIN TABLE 31B/06 *(cont'd)*

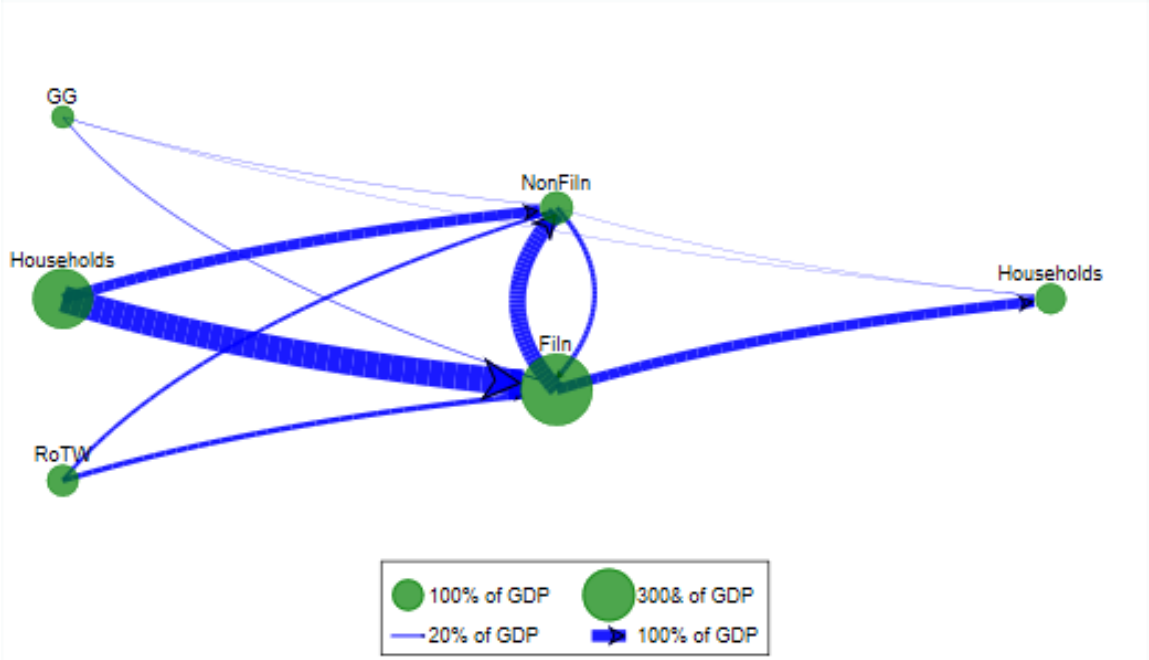
OUTSTANDING FINANCIAL ASSETS AND LIABILITIES OF FINANCIAL INSTITUTIONS

Monetary unit: billion pesetas

	1981	1982	1983	1984	1985	1986	1987	1988
LIABILITIES OF FINANCIAL INSTITUTIONS, to:	***26 895.6***	***32 763.5***	***39 246.4***	***46 446.7***	***51 446.0***	***57 266.6***	***66 446.5***	***76 083.8***
a) Institutions of the group	***2 065.2***	***2 850.5***	***3 163.3***	***4 031.4***	***5 060.6***	***5 163.8***	***5 193.8***	***6 129.6***
b) Other financial institutions	***3 033.4***	***4 334.6***	***6 365.3***	***7 363.6***	***7 842.3***	***9 057.1***	***11 372.3***	***13 544.0***
c) General Government	***1 697.9***	***2 240.9***	***2 676.3***	***3 157.7***	***3 432.8***	***3 553.1***	***3 692.9***	***2 629.9***
d) Other domestic sectors	***16 183.7***	***18 831.6***	***21 601.7***	***25 019.5***	***28 287.8***	***32 470.1***	***37 998.2***	***44 566.2***
e) Rest of the world	***2 893.5***	***3 054.7***	***3 482.8***	***4 138.1***	***3 679.1***	***3 897.1***	***4 254.9***	***5 072.8***
• Not allocated	***1 021.9***	***1 451.2***	***1 957.0***	***2 736.4***	***3 143.4***	***3 125.4***	***3 934.4***	***4 141.3***
1. Counterpart of net allocations of SDRs and use of IMF credit, ECUs	41.5	27.1	35.3	42.9	46.8	47.5	45.8	45.6
– Counterpart of net allocations of SDRs	*41.5*	*27.1*	*35.3*	*42.9*	*46.8*	*47.5*	*45.8*	*45.6*
2. Cash and other transferable deposits, *assets of:*	5 577.4	6 393.9	7 308.1	9 974.8	11 088.3	12 473.2	14 218.4	16 423.0
b) Other financial institutions	*822.0*	*1 025.3*	*1 340.1*	*3 441.0*	*3 733.8*	*4 089.3*	*4 598.1*	*4 676.8*
c) General Government	*196.3*	*363.7*	*472.9*	*616.0*	*715.3*	*759.2*	*849.7*	*1 078.2*
d) Other domestic sectors	*4 558.1*	*5 003.0*	*5 401.3*	*5 802.2*	*6 511.9*	*7 306.4*	*8 432.7*	*10 130.3*
e) Rest of the world	*1.0*	*1.9*	*93.8*	*115.6*	*127.3*	*318.3*	*337.9*	*537.7*
3. Other deposits, *by:*	15 114.4	18 105.9	20 958.8	24 979.7	27 433.2	29 607.5	34 740.6	39 927.6
a) Institutions of the group	*1 766.1*	*2 455.4*	*2 744.9*	*3 540.1*	*4 555.8*	*4 640.0*	*4 670.9*	*5 385.6*
b) Other financial institutions	*617.4*	*869.8*	*1 206.6*	*1 360.0*	*1 465.6*	*1 835.5*	*3 596.6*	*4 980.9*
c) General Government	*42.6*	*149.2*	*181.7*	*242.2*	*231.1*	*206.8*	*196.5*	*280.4*
d) Other domestic sectors	*10 039.7*	*11 889.2*	*13 829.9*	*16 167.2*	*17 980.9*	*19 802.4*	*22 933.1*	*25 510.5*
e) Rest of the world	*2 648.6*	*2 742.3*	*2 995.7*	*3 670.2*	*3 199.8*	*3 122.8*	*3 343.5*	*3 770.2*
4. Short-term securities, *held by:*	566.3	978.4	1 854.4	–	–	–	–	–
b) Other financial institutions	*566.3*	*978.4*	*1 854.4*	–	–	–	–	–
7. Bonds, *held by:*	479.9	683.6	936.0	1 328.9	1 716.2	2 228.8	2 054.5	2 114.3
a) Institutions of the group	*110.0*	*113.8*	*84.7*	*77.0*	*53.6*	*66.3*	*45.6*	*52.2*
b) Other financial institutions	*83.7*	*111.2*	*121.9*	*173.7*	*237.5*	*298.7*	*347.9*	*467.6*
c) General Government	*0.1*	*0.6*	*0.6*	*0.7*	*0.7*	*0.8*	*0.8*	*0.9*
d) Other domestic sectors	*285.5*	*457.7*	*728.7*	*1 076.8*	*1 424.4*	*1 863.0*	*1 647.6*	*1 579.4*
e) Rest of the world	*0.6*	*0.3*	*0.1*	*0.7*	–	–	*12.6*	*14.2*
8. Shares, *held by:*	1 070.0	1 162.3	1 241.2	1 493.7	1 764.4	2 566.6	3 569.9	5 295.2
a) Institutions of the group	*87.8*	*124.9*	*136.0*	*146.5*	*171.8*	*173.8*	*221.2*	*454.5*
b) Other financial institutions	*66.1*	*66.1*	*68.2*	*72.7*	*89.6*	*163.1*	*219.9*	*371.0*
c) General Government	*30.8*	*33.6*	*44.4*	*44.4*	*48.9*	*48.9*	*48.9*	*160.2*
d) Other domestic sectors	*834.6*	*879.5*	*917.2*	*1 142.3*	*1 332.9*	*1 925.1*	*2 727.1*	*3 833.6*
e) Rest of the world	*50.7*	*58.2*	*75.4*	*87.8*	*121.2*	*255.7*	*352.8*	*475.9*
5+9. Loans, *from:*	2 542.6	3 349.2	4 236.0	5 060.9	5 220.9	5 676.9	5 751.4	4 860.3
a) Institutions of the group	*73.1*	*125.1*	*166.3*	*227.6*	*229.8*	*212.0*	*192.8*	*170.3*
b) Other financial institutions	*877.9*	*1 283.8*	*1 774.1*	*2 316.2*	*2 315.8*	*2 670.5*	*2 609.8*	*3 047.7*
c) General Government	*1 428.1*	*1 693.8*	*1 976.7*	*2 254.4*	*2 436.8*	*2 537.4*	*2 597.0*	*1 110.2*
d) Other domestic sectors	*12.4*	*21.6*	*36.4*	*41.8*	*54.5*	*104.2*	*189.5*	*302.9*
e) Rest of the world	*151.1*	*224.9*	*282.5*	*220.9*	*184.0*	*152.8*	*162.3*	*229.2*
10. Net equity of household on life insurance reserves and pension funds, *assets of:*	453.4	580.6	688.2	789.2	983.2	844.6	1 309.5	2 326.8
d) Other domestic sectors	*453.4*	*580.6*	*688.2*	*789.2*	*983.2*	*844.6*	*1 309.5*	*2 326.8*
11. Others, *to:*	1 050.1	1 482.5	1 988.4	2 776.6	3 193.0	3 821.5	4 756.4	5 091.0
a) Institutions of the group	*28.2*	*31.3*	*31.4*	*40.2*	*49.6*	*71.7*	*63.3*	*67.0*
d) Other domestic sectors	–	–	–	–	–	*624.4*	*758.7*	*882.7*
• Not allocated	*1 021.9*	*1 451.2*	*1 957.0*	*2 736.4*	*3 143.4*	*3 125.4*	*3 934.4*	*4 141.3*

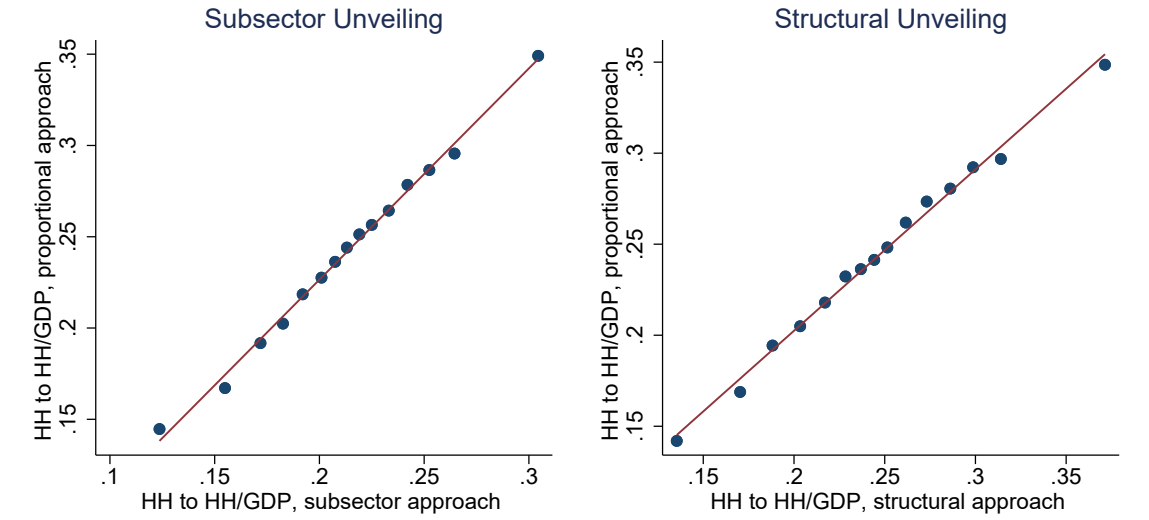
This figure shows a typical snapshot of the data from 'Golden Books' newly digitized for this paper. In addition to reporting sectoral accounts by instrument, the Golden Books often report counterparty information, that is the sector on the other side of an asset or liability position, as can be seen here for the example of Spain between 1981 and 1987.

Figure A1.3: *Graphic representation of Equation 1, United States 2007*



The figure shows the allowed direct links to and from the household sector. The nodesize, safe for the right hand side household sector, is determined by the size of the respective sector's assets, scaled by GDP. For the household sector on the right (the receiving sector) the nodesize represents not assets but liabilities. The edgesize ist determined by the solution to Equation 1, likewise scaled by GDP. Showing the United States in 2007, the figure is recreateable for all Country-Year combinations

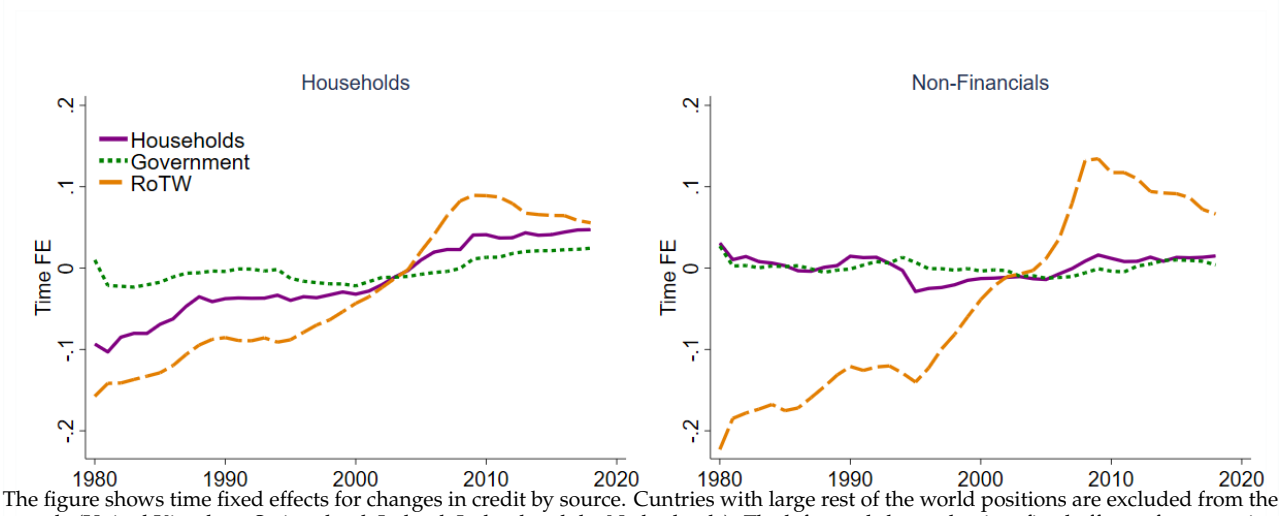
Figure A1.4: *Proportional compared to subsector and structural unveiling*



The figure shows the relationship between estimates of household credit funded by the household sector using different unveilings. The left panel compares the results of the proportional approach to results using detailed subsector information. The right panel compares our baseline to results using the structural approach derived from Mian et al. (2020b). Bins are constructed as in Figure 2.

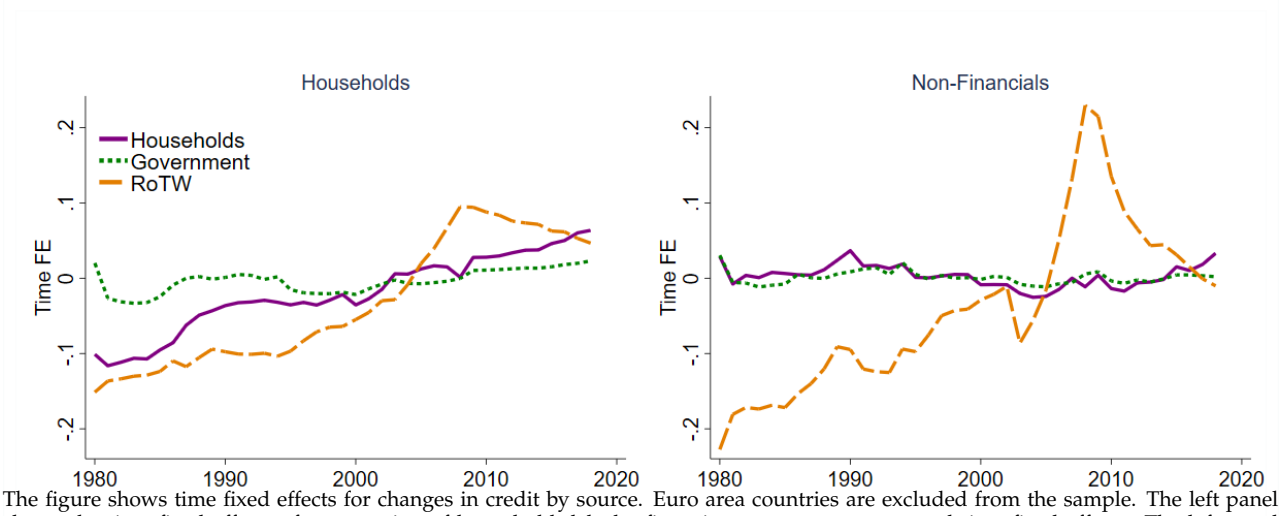
A2. The Changing Nature of Credit Intermediation

Figure A2.5: *Time trends in credit by source, excluding countries with large rest of the world sectors*



The figure shows time fixed effects for changes in credit by source. Cuntries with large rest of the world positions are excluded from the sample (United Kingdom, Switzerland, Ireland, Iceland and the Netherlands). The left panel shows the time fixed effects of a regression of household debt by financing sector on country and time fixed effects. The left panel shows the time fixed effects of a regression of loans to non-financial corporates by financing sector on country and time fixed effects.

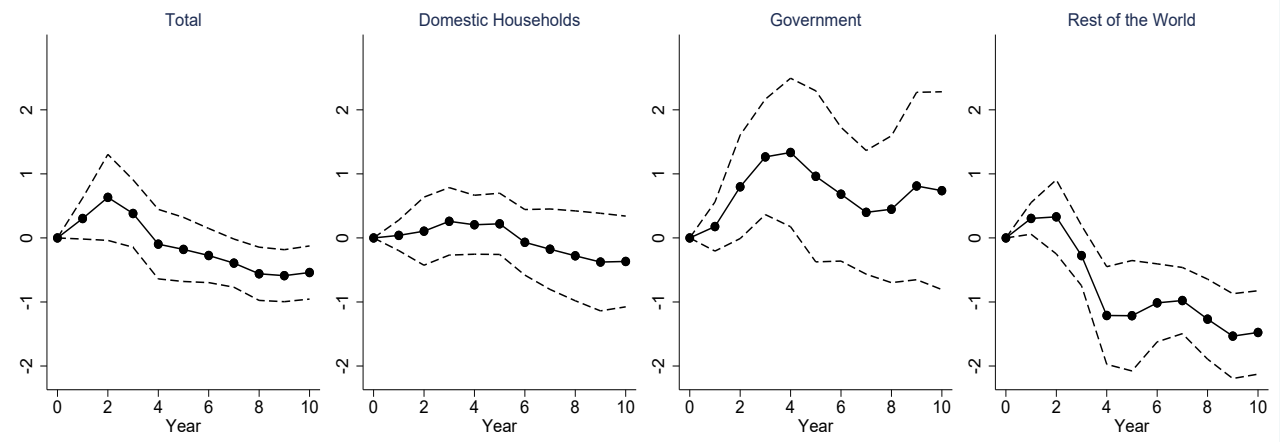
Figure A2.6: *Time trends in credit by source, excluding Euro area countries*



The figure shows time fixed effects for changes in credit by source. Euro area countries are excluded from the sample. The left panel shows the time fixed effects of a regression of household debt by financing sector on country and time fixed effects. The left panel shows the time fixed effects of a regression of loans to non-financial corporates by financing sector on country and time fixed effects.

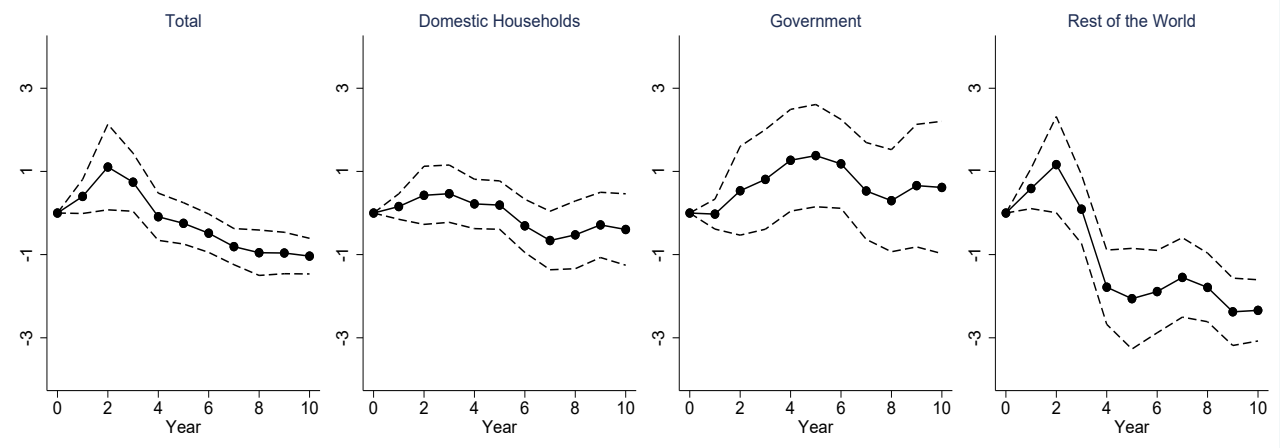
A3. Credit and Business Cycles

Figure A3.7: *GDP responses to increases in household credit, including year fixed effects*



Notes: This figure shows estimates of impulse responses of real GDP to an innovation of household loans financed by the household, the government and the rest of the world sectors based on Equation 6 including year fixed effects as controls. Dashed lines represent 95% confidence intervals computed based on standard errors dually clustered on country and year.

Figure A3.8: *GDP responses to increases in household credit, excluding countries with large rest of the world sectors*



Notes: This figure shows estimates of impulse responses of real GDP to an innovation of household loans financed by the household, the government and the rest of the world sectors based on Equation 6 excluding financial center countries from the sample. Dashed lines represent 95% confidence intervals computed based on standard errors dually clustered on country and year.

Table A3.2: *GDP responses to increases in household credit, excluding countries with large rest of the world sectors*

	$\Delta_3 ln(Y)_{i,t+3}$				$\Delta_3 Unemployment_{i,t+3}$			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$\Delta_3 RoTW \rightarrow HH_{i,t-1}$	-1.03***	-0.82***	-1.26***	-0.80***	0.30***	0.26***	0.32***	0.27***
	(0.27)	(0.18)	(0.27)	(0.25)	(0.07)	(0.07)	(0.07)	(0.06)
$\Delta_3 HH \rightarrow HH_{i,t-1}$	-0.17	-0.03	-0.10	-0.15	0.10	0.09	0.11*	0.07
	(0.15)	(0.16)	(0.18)	(0.16)	(0.07)	(0.07)	(0.06)	(0.07)
$\Delta_3 GG \rightarrow HH_{i,t-1}$	-0.04	0.07	-0.18	-0.06	-0.07	-0.07	-0.05	-0.02
	(0.24)	(0.20)	(0.32)	(0.27)	(0.07)	(0.09)	(0.09)	(0.08)
$\Delta_3 NF_{i,t-1}$	0.06	0.09	0.06	0.09	0.03	0.01	0.01	0.01
	(0.09)	(0.09)	(0.07)	(0.10)	(0.02)	(0.03)	(0.02)	(0.02)
R^2	0.314	0.578	0.388	0.283	0.429	0.578	0.491	0.376
Country fixed effects	✓	✓	✓	✓	✓	✓	✓	✓
LDV	✓	✓	✓	✓	✓	✓	✓	✓
Time fixed effects		✓				✓		
Non-overlapping			✓				✓	
Excluding crises				✓				✓
p-value, $\beta_{RoTW} = \beta_{HH} = \beta_{GG}$	0.00	0.00	0.00	0.01	0.00	0.04	0.01	0.00
Observations	542	525	176	484	535	515	181	483

Notes: This table presents results for Equation 7. The dependent variables are the growth of real GDP and the change in the unemployment rate between year t and $t+3$. Credit is split into flows between two borrowing sectors (HH and NF) and three financing sectors (HH, GG and RoTW). Credit variables are expressed as lagged three year changes in the ratio to GDP. LDV are lags of the dependent variable. Non-overlapping uses only every third observation. Excl. crises excludes a three year window around crisis years. Standard errors in parentheses are dually clustered on country and year. United Kingdom, Switzerland, Ireland, Iceland and the Netherlands are excluded from the sample. The reported p-value refers to a test for the equality of coefficients. *,**,*** indicates significance at the 0.1, 0.05, 0.01 level, respectively.

A4. Crisis

Table A4.3: *Predicting financial crises: 5-year changes*

	Baseline		By source of HH		Only RoTW to HH		All others	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$\Delta_5 HH_{i,t-1}$	0.20***	0.33***						
	(0.03)	(0.03)						
$\Delta_5 RoTW \rightarrow HH_{i,t-1}$			0.25***	0.40***	0.26***	0.53***		
			(0.05)	(0.11)	(0.05)	(0.01)		
$\Delta_5 GG \rightarrow HH_{i,t-1}$			-0.51**	-0.40**			-0.49**	-0.54**
			(0.24)	(0.17)			(0.24)	(0.25)
$\Delta_5 HH \rightarrow HH_{i,t-1}$			0.17	0.13			0.26*	0.38**
			(0.11)	(0.11)			(0.14)	(0.19)
$\Delta_5 NF_{i,t-1}$	-0.02	-0.04	-0.04***	-0.05			0.00	0.02
	(0.01)	(0.05)	(0.01)	(0.04)			(0.02)	(0.06)
$\Delta_5 CA/GDP_{i,t-1}$	-0.22***	-0.25**	-0.26***	-0.24***			-0.39***	-0.64***
	(0.08)	(0.11)	(0.08)	(0.08)			(0.10)	(0.13)
AUC	0.75	0.80	0.79	0.83	0.76	0.80	0.69	0.72
s.e.	0.05	0.04	0.05	0.04	0.05	0.04	0.06	0.05
Country fixed effects		✓		✓		✓		✓
Observations	612	473	612	473	612	473	612	473

Notes: The table shows probit classification models where the dependent variable is a financial crisis dummy. Coefficients are marginal effects. AUC is the area under the ROC-curve and below is its standard error. Clustered (by country) standard errors in parentheses. $^{*}p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table A4.4: *Predicting financial crises: linear probability models*

	Baseline		By source of HH		Only RoTW to HH		All others	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$\Delta_3 HH_{i,t-1}$	0.29***	0.34***						
	(0.08)	(0.09)						
$\Delta_3 RoTW \rightarrow HH_{i,t-1}$			0.58***	0.58***	0.62***	0.62***		
			(0.10)	(0.12)	(0.09)	(0.10)		
$\Delta_3 GG \rightarrow HH_{i,t-1}$			-0.43**	-0.39*			-0.36**	-0.29
			(0.19)	(0.22)			(0.17)	(0.20)
$\Delta_3 HH \rightarrow HH_{i,t-1}$			-0.14	-0.06			0.06	0.15
			(0.35)	(0.41)			(0.34)	(0.39)
$\Delta_3 NF_{i,t-1}$	0.06***	0.05***	0.01	0.00			0.08***	0.08***
	(0.02)	(0.02)	(0.02)	(0.02)			(0.03)	(0.02)
$\Delta_3 CA/GDP_{i,t-1}$	-0.21	-0.23	-0.16	-0.19			-0.32**	-0.35**
	(0.15)	(0.16)	(0.13)	(0.14)			(0.15)	(0.16)
AUC	0.74	0.80	0.80	0.84	0.79	0.83	0.74	0.77
s.e.	0.05	0.05	0.05	0.04	0.05	0.04	0.05	0.05
Country fixed effects		✓		✓		✓		✓
Observations	674	674	674	674	674	674	674	674

Notes: The table shows linear classification models where the dependent variable is a financial crisis dummy. AUC is the area under the ROC-curve and below is its standard error. Clustered (by country) standard errors in parentheses. $^{*}p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table A4.5: *Predicting financial crises: (Baron et al., 2021) crisis chronology*

	Baseline		By source of HH		Only RoTW to HH		All others	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$\Delta_3 HH_{i,t-1}$	0.28***	0.29*						
	(0.10)	(0.15)						
$\Delta_3 RoTW \rightarrow HH_{i,t-1}$			0.45***	0.49***	0.51***	0.77***		
			(0.07)	(0.17)	(0.07)	(0.17)		
$\Delta_3 GG \rightarrow HH_{i,t-1}$			0.59**	0.78**			0.63**	0.83***
			(0.30)	(0.35)			(0.28)	(0.31)
$\Delta_3 HH \rightarrow HH_{i,t-1}$			-0.28	-0.35			-0.17	-0.30
			(0.26)	(0.36)			(0.28)	(0.35)
$\Delta_3 NF_{i,t-1}$	0.05**	0.19***	-0.00	0.14**			0.07**	0.21***
	(0.02)	(0.06)	(0.03)	(0.06)			(0.03)	(0.06)
$\Delta_3 CA/GDP_{i,t-1}$	-0.21	-0.40	-0.24	-0.42			-0.39**	-0.66**
	(0.20)	(0.33)	(0.18)	(0.28)			(0.17)	(0.26)
AUC	0.69	0.74	0.72	0.77	0.69	0.72	0.67	0.74
s.e.	0.04	0.04	0.04	0.03	0.05	0.04	0.04	0.04
Country fixed effects		✓		✓		✓		✓
Observations	674	489	674	489	674	489	674	489

Notes: The table shows probit classification models where the dependent variable is a financial crisis dummy. Coefficients are marginal effects. AUC is the area under the ROC-curve and below is its standard error. Clustered (by country) standard errors in parentheses. $^{*}p < 0.10$, ** $p < 0.05$, *** $p < 0.01$