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When Two Become One: Foreign Capital and Household Credit Expansion

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

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Abstract

Rapid household credit expansions predict lower output growth and banking crises, but does it matter who is financing them? We employ data from financial accounts for a panel of 33 countries to trace the flow of financial funds through the economy, and to identify the ultimate counterparties financing credit expansions. Removing the veil of financial intermediation shows that credit is increasingly financed by foreigners, reflecting large gross capital flows. We find that these gross capital flows are the key driver of the cyclical relationship between credit and real activity. Household credit expansions financed from abroad predict lower future growth and higher risk of crises, but domestically financed credit expansions do not. We link these dynamics to foreign capital supply, exploiting an instrumental variable based on decomposed cross-border banking flows. Finally, we study potential channels and find the macroeconomic risks of foreign-financed household credit to be closely associated with reversals in capital supply and with the flow of debt service payments to foreigners.

Keywords: Business cycles, capital flows, debt service, financial crises, global financial cycle, household debt.

JEL classification codes: E32, E44, F34, G01, G15, G51

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1. Introduction

Rapid credit expansions are often associated with financial crises and predictably worse macroeconomic outcomes (Schularick and Taylor, 2012; López-Salido et al., 2017). To understand these dynamics, recent research has focused on the type of borrower and the financial constraints they are facing (Mian et al., 2017; Müller and Verner, 2021; Jordà et al., 2022). On the other hand, relatively little is known about the ultimate counterparties financing these credit expansions (Mian and Sufi, 2018). But who provides the financing is likely to matter for refinancing risks, the direction of future repayment flows, and the transmission of credit expansions to the real economy. Based on historical financial crises, Kindleberger (1978), e.g., emphasized the role of one particular counterparty – foreigners – in financing the credit booms that often precede crises.[1]

Empirically, it has been difficult to quantify this link. One reason is that credit statistics do not include a breakdown by ultimate financing counterparty. Hence, researchers often rely on measures of net capital flows, such as the current account. Net measures, however, neither capture the accumulation of gross foreign liabilities, nor the maturity mismatches in financial intermediary balance sheets associated with the transformation of fickle foreign capital into long-term domestic credit (Borio, 2016). Even without such aggregate mismatches, large gross flows may be associated with mismatches at the level of individual intermediaries, putting financial stability at risk (Obstfeld, 2012). Similarly, differences in financial constraints or marginal propensities to consume out of income between ultimate borrowers and lenders may matter for macroeconomic dynamics, but are not reflected in net capital flow measures (Mian et al., 2021, 2020b).

In this paper, we rely on financial accounts to map two or more financial relationships into one, linking the ultimate borrowing and financing sectors by unveiling balance sheets of intermediate sectors (as in Mian et al. (2020b) for the US). As a result, we obtain a new dataset on household and firm borrowing by ultimate counterparty. We then study who has financed the secular increase in credit, and which counterparty has the most pronounced influence on the business cycle. Our approach reveals that household credit ultimately financed from the foreign sector is key: it is a 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 externally financed household credit are followed by a short-lived boom and subsequent bust in GDP, and are associated with significantly elevated crisis risk.

We link the origin of these foreign-financed credit expansions to the supply of capital as

[1] Kindleberger (1978) documents a strong international dimension: *"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).

argued in (Rey, 2013). Instrumenting foreign-financed household credit expansion with supply shocks in the international banking network, we find a strong link between the supply of funds and macroeconomic outcomes. Finally, we decompose GDP to understand the transmission channels from credit expansion to real activity in more detail, and find that a large share of the GDP response is driven by consumption, with debt service payments to the foreign sector weighing on domestic demand.

Key to our analysis is an unveiling exercise linking borrowers to ultimate counterparties financing this borrowing, similar to the procedure applied in Mian et al. (2020b) to flow of funds data from 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 counterparties that finance intermediary sector liabilities, lifting the veil of intermediary balance sheets. We show that this unveiling approach – decomposing credit by ultimate financing counterparty – can be performed in a broad panel of countries. We distinguish between three ultimate counterparties: domestic households, the government, and the rest of the world, where the latter includes all financial relationships of domestic agents with foreigners. The exercise is based on financial accounts, which we newly digitized for the years before 1995 using historical OECD publications.[2] The resulting dataset contains information on private credit decomposed by ultimate counterparty sector for an unbalanced panel of 33 countries starting in the 1970s.[3]

Based on this new slice of data, we explore the evolution of financial intermediation over the last 50 years. The textbook model of financial intermediation ties household savings to bank deposits, and these deposits in turn to loans to non-financial corporations. Our 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, domestic households play an increasingly important role as borrowers 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 and towards the foreign sector as a counterparty financing credit growth.

The growing reliance on cross-border financing has implications for business cycle dynamics. On the one hand, foreign financing of household debt may allow for better risk sharing and stabilization of the macroeconomy, on the other hand it may increase the macro-financial vulnerabilities associated with credit. We first study the role of different

[2]Financial accounts are compiled by statistical agencies as part of the system of national accounts (SNA 2008 and its predecessors) and contain stocks and flows of financial instruments by economic sector: domestic households, the government, non-financial corporations, financial corporations, and the rest of the world (RotW).

[3]We cross-validate results from the baseline approach used in the broad panel against approaches making use of the more granular data from the US, and recent as well as historical cross-country data containing additional information.

financing counterparties for the relationship between credit expansions and business cycle outcomes documented in, among others, Mian et al. (2017). We find that those household credit expansions financed by foreign counterparties are the main driving force behind the negative association of household credit expansion and subsequent output. The results show that increases in household credit financed by foreigners are associated with a short-lived boom in economic activity that is followed by significantly lower economic growth over horizons of more than three years. These results hold across a battery of robustness checks. 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.

We then study whether intermediation between international capital markets and domestic households through financial sector balance sheets puts a country's financial stability at risk (Calvo, 2011; Reinhart and Rogoff, 2009). We find that funds sourced from abroad and lent out to domestic households are the most important link in the widely documented relationship between credit and crises. Furthermore, in line with the idea that foreigners are more likely to run and withdraw funds in a crisis, the contraction in credit following financial crises is almost exclusively driven by a reduction in credit financed ultimately by foreigners.

Why do foreigners supply capital in the first place, if it is so predictably associated with negative macroeconomic dynamics? A potential explanation is that capital flow dynamics are driven by supply-side factors and the relationship with subsequent macroeconomic and financial developments is not well understood by economic agents and financial markets. To test this proposition, we exploit bilateral data on international banking flows and apply the Amiti and Weinstein (2018) methodology — as in Amiti et al. (2019) — to compute a supply measure of banking flows that reflects the global financial cycle and country-specific supply shocks, while orthogonal to country-specific demand. We employ this measure as a supply-based instrumental variable for foreign-financed household credit expansion. The instrumental variable results strengthen our main results discussed above, confirming a strong link from the supply of foreign capital financing household borrowing to subsequent macroeconomic dynamics.

Building on previous approaches in the literature (Mian et al., 2017; Baron and Xiong, 2017), we then ask whether these dynamics are understood by forecasters and market participants? When we look at growth forecast errors, we find that IMF staff forecasts are unaffected by household lending booms financed with foreign capital. Hence, given the previously discussed results, forecasts turn out to be overoptimistic. Similarly, bank shareholders do not seem to ask for higher compensation during foreign-financed credit

booms. In sum, instead of being linked to domestic investment opportunities, foreign financing reflects capital supply dynamics from the global financial cycle in line with Rey (2013), without expectations adjusting to the consequences of these credit expansions.

What are the channels that link the supply of foreign capital to macroeconomic dynamics? In the last part of the paper, we decompose GDP into its components and study their relationship with foreign-financed household credit expansion. We find that the short-lived boom in economic activity is associated with increasing investment and consumption, as well as a decline in net exports. More importantly, the negative medium-term response of GDP is mostly driven by depressed consumption. This can be explained by reversals in foreign capital supply, and by debt service payments to foreigners, resulting from today's borrowing, weighing on future domestic demand. Central banks that enjoy monetary autonomy could offset this channel using monetary policy as in, e.g., Schmitt-Grohé and Uribe (2016). And indeed, we find that the link from foreign-financed household credit to economic outcomes is offset in floating exchange rate countries, where monetary policy autonomy is not limited through the trilemma of international finance.

Taken together, the paper shows that the link between credit on the one hand, and business cycle- and crisis dynamics on the other, depends crucially on the financing intermediation chain through the economy. Economic and financial fragility is the result of an intricate interplay between borrowers, intermediaries and ultimate counterparties financing credit. Banking sectors intermediating foreign capital to the domestic household sector expose economies to macro-financial vulnerabilities that need to be accounted for in the design of macroprudential, monetary, and capital account policies.

Contribution to the literature. The paper contributes to several strands of literature. First, there is a large literature that links domestic credit market conditions to business-cycle dynamics and banking crises. Several papers have linked output dynamics and crisis incidence to rapid credit expansions (Borio and Lowe, 2002; Schularick and Taylor, 2012; Mian et al., 2017, 2020a), especially during periods of high asset price growth (Jordà et al., 2015; Greenwood et al., 2022). Müller and Verner (2021) and Jordà et al. (2022) show that the composition of borrowers during credit expansions matters. On the other side of the financial sector balance sheet, Jordà et al. (2021) and Hahm et al. (2013) highlight the role of liability composition of the banking sector for crisis dynamics. Our paper shows that the identity of the counterparty financing these liabilities is key to understanding the macroeconomic dynamics around credit booms, assigning an important role to foreign counterparties. Studying the transmission channel in more detail, Drehmann et al. (2017) highlight the role of debt service payments of borrowers. Here we add that aggregate outcomes depend strongly on the counterparty ultimately receiving these debt service

payments. This result is in line with a large body of theoretical literature emphasizing heterogeneity in financial constraints as potential channels for debt to affect aggregate outcomes (Farhi and Werning, 2016; Korinek and Simsek, 2016; Schmitt-Grohé and Uribe, 2016; Mian et al., 2021). Debt service payments flowing to foreigners can be seen as an extreme form of such heterogeneity, as foreign creditors are unlikely to spend the income they receive from debt service payments in the country of the borrower.

Second, the paper contributes to a long tradition of linking international capital flow dynamics to banking crises. In fact, concerns about imbalances and a global savings glut (Bernanke, 2005) preceded the global financial crisis. But the focus was on the current account as a measure of capital flows, as in most of the literature studying this question, which has resulted in mixed findings (Jordà et al., 2011; Kiley, 2021; Mian et al., 2017; Davis et al., 2016; Caballero, 2016). Gourinchas and Obstfeld (2012) conclude that the empirical evidence for capital flows being associated with crises is much more mixed than for domestic private credit. However, credit extended by the domestic banking sector may still be funded externally. Our paper shows that it is exactly this transformation of more flighty foreign capital into mostly long-term household lending that puts financial sectors at risk (Diamond and Dybvig, 1983; Calvo, 2011; Bolton et al., 2020). Importantly, this transformation reflects large gross capital flows and is not necessarily captured by net measures (Borio, 2016). Unlike the current account, our measures of credit by financing counterparty capture the potential of run-like dynamics of foreign capital in periods of financial turmoil (Broner et al., 2013; Forbes and Warnock, 2012; Caballero and Simsek, 2020). The paper, hence, complements recent micro-level evidence on run-risk associated with funding through different counterparties during episodes of financial instability (Blickle et al., 2022; Iyer and Puri, 2012; Iyer et al., 2016).

Third, a recent literature has highlighted the important role of a global financial cycle (Rey, 2013; Miranda-Agrippino and Rey, 2020). Bruno and Shin (2015) argue that this cycle is transmitted through the balance sheets of globally operating banks and di Giovanni et al. (2021) show evidence for such transmission at the micro-level for Turkey. Our unveiling approach provides the mapping from the global financial cycle to domestic credit for a panel of advanced economies since 1970. Aldasoro et al. (2020) argue that domestic and global financial cycles come together around crises. We show that this synchronization results from interlocking balance sheets of the domestic household sector, banks, and the foreign sector and how this exposes countries to macroeconomic risk.

More generally, our paper also contributes to the understanding of the structure of the financial system. Several studies have documented the growth of the financial sector in advanced economies (Philippon and Reshef, 2013; Greenwood and Scharfstein, 2013). As

argued by Jordà et al. (2016), household borrowing has been one of the main contributors to increasing debt levels over the past decades. At the same time, bank lending across borders surged (McCauley et al., 2021). The unveiling exercise conducted in this paper shows that these trends are two sides of the same coin: household borrowing is increasingly financed across borders, with important implications for financial stability and the macroeconomy.

The paper proceeds as follows. We first describe the data, the unveiling approach, and trends in raw and unveiled data in section 2. Section 3 focuses on business cycle- and section 4 on crisis dynamics associated with credit expansions financed through different counterparties. Section 5 links the results to the supply of funding in international credit markets, and section 6 takes a closer look at potential channels facilitating the previously described dynamics. Section 7 concludes.

2. Data, unveiling methodology, and trends

This section gives an overview of the data, the unveiling procedure, and important trends in raw and unveiled data.

2.1. Data

Our main datasource for credit aggregates and their decomposition are sectoral financial balance sheets, which are compiled by statistical agencies as part of the national accounts framework. As a result, the data are fully consistent with other variables used to study macroeconomic effects and transmission channels. The data come in three distinct formats. The most recent version are the financial balance sheets based on the System of National Accounts 2008 (SNA2008). Before the 2008 revision, financial balance sheets are based on the 1993 version (SNA93). The data based on these standards are published online by the OECD and generally cover the post-1995 period. To extend the coverage of the series, we link this data to newly digitized data from historical publications of the OECD. This data was published in yearly "golden books" by the OECD up until 1998 (OECD, 1970-1998). A snapshot is shown in Figure A1.1. Since the dataseries are frequently revised and updated, we use the most recent data whenever available, and use overlapping years to link variables accross datasets and extrapolate recent data backwards with growth rates in historical data. Table A1.1 in the appendix contains an overview of the available years of data in each dataset for each country. We use the non-consolidated version of the data whenever available.[4]

[4]We use consolidated data for Australia which does not publish data in the unconsolidated format. In robustness checks, we also confirm that results hold using consolidated data for all countries instead.

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.[5] For each sector, the data contain the outstanding amounts of assets (claims) and liabilities by financial instrument.[6] Figure A1.2 provides an overview of sectors and financial instruments available in the baseline data. An important feature of the data is that each claim held by one agent must be recorded as a liability in the balance sheet of some other agent in the economy. As a result, the sum over all sectors of, e.g., deposits recorded as assets must be equal to the sum of all deposits liabilities in the economy.Financial relationships of domestic agents with foreign counterparties 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 reported in the Lane and Milesi-Ferretti (2018) data. All three datasets are structured in the same way, with more recent data expanding on recorded subsectors and financial instruments. Whenever available, we complement this data with additional counterparty information, i.e. the identity of the sector holding a claim on another sector's liabilities. Such counterparty data makes the allocation of credit to ultimate counterparties much easier. Due to limited availability, our baseline unveiling approach does not depend on counterparty data, but we validate our unveiling results for the subset of observations where granular counterparty data is available.

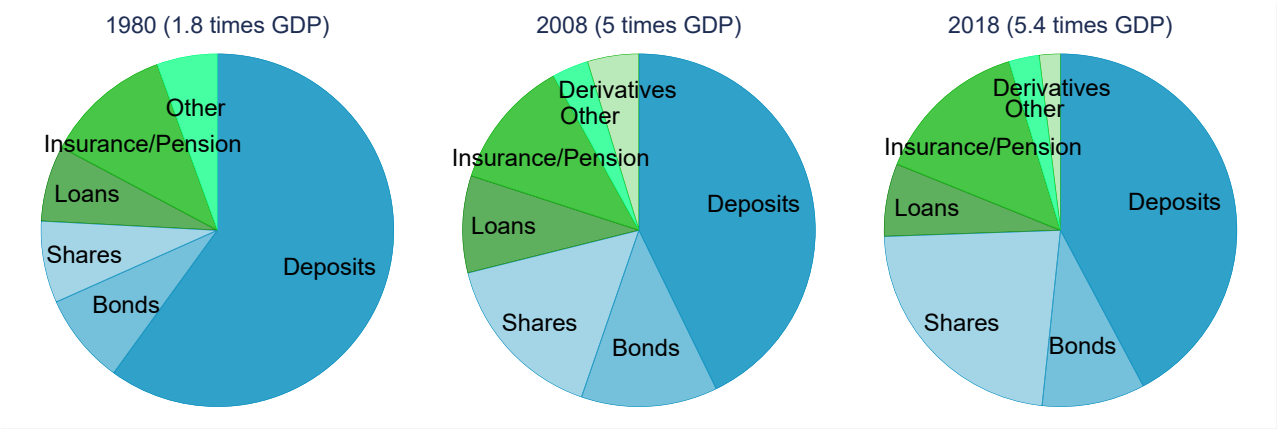
2.2. Trends in the raw data

Eventually, we want to link the borrowings of one sector to the asset holdings of other sectors, who ultimately supply these funds and study trends and cycles in these ultimate borrower-creditor relationships. Changes in borrowing sectors, with households surpassing corporations as the main borrower of funds over the last decades have been widely documented (Jordà et al., 2016; Müller and Verner, 2021). At the same time, to fund loans to borrowers, the banking sector increasingly relies on non-core liabilities – non-deposit debt liabilities – as shown in Jordà et al. (2021). In our data, this trend can be seen in Figure 1, showing which financial instruments are used by financial intermediaries to finance their assets, and thereby the loans to households and non-financials. The data display a shift away from deposits and towards financing via bonds and equities. While in 1980 almost two thirds of financial sector liabilities were deposits, these only accounted for slightly

[5]The baseline set of sectors comprises of domestic households and NPISH, government, financial corporations, non-financial corporations and foreigners (rest of the world). In many cases, the data contains more granular sectoral information. We exploit this data in our robustness exercises for the unveiling.

[6]Financial instruments reported include bonds, loans, shares, deposits, derivatives, insurances, gold/SDR, and other instruments.

Figure 1: *Liability composition of the financial sector*



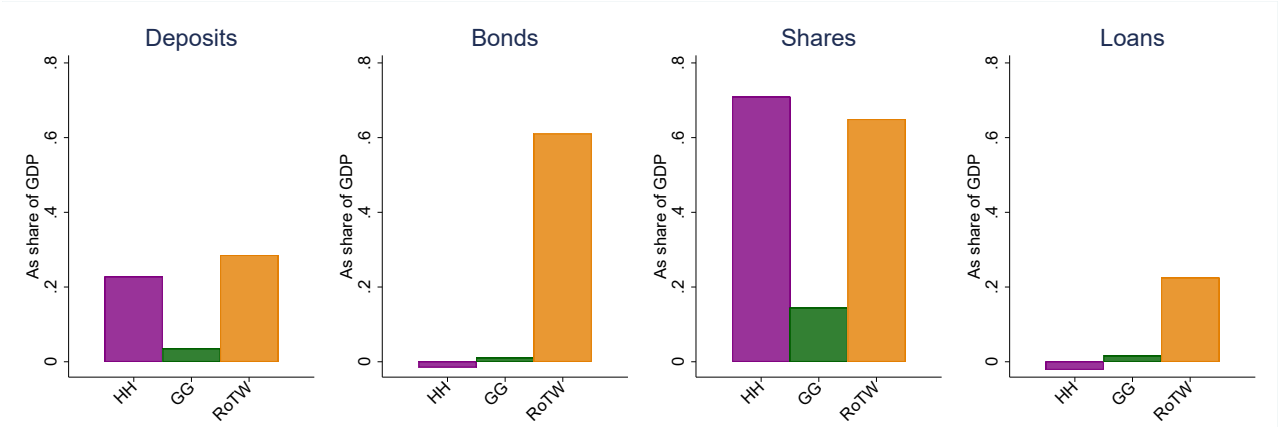
Notes: This graph shows the average composition of total liabilities of the financial sector by financial instrument for a stable sample at different points in time. The header contains information on the size of financial sector liabilities relative to GDP.

more than 40% of financial sector liabilities on the eve of the 2007/2008 crisis.[7] At the same time, the size of financial intermediary balance sheets relative to the economy increased from a factor of two to more than five.

Accounting dictates that the growth in financial sector liabilities, particularly non-core liabilities, needs to be mirrored in the asset holdings of other sectors. To get a sense of changes in sectoral asset holdings and composition since 1980, Figure 2 shows the change in asset holdings (relative to GDP) of the three ultimate holding sectors for the most important financial instruments. The ratio of deposits held by the household sector relative to GDP increased on average by more than 20 percentage points between 1980 and 2018. Deposit holdings of the foreign sector increased by a similar amount over the same time period. Looking at bond holdings in the middle left panel, the picture looks quite different. While holdings of households and the government saw little change, there has been an increase in the bond holdings of the foreign sector of about 60% of GDP. Both, households and foreigners, have increased their holdings of shares by more than 60% of GDP between 1980 and 2018. The right panel shows the change in holdings of loans. The foreign sector has increased its holdings of loans relative to GDP by 20%. As the foreign sector held only small amounts of all these financial instruments in 1980, all these changes imply a strong reallocation towards the foreign sector as a counterparty for domestic agents.

[7]There are two trends explaining this shift. First, as reported in Jordà et al. (2021) depository institutions have shifted from customer deposits to other sources of funds, especially wholesale funding markets, here reflected by bonds and derivatives. Second, the financial sector increasingly comprises of institutions other than depository institutions which, by definition, do not fund themselves with deposits. It is especially these sub-sectors funding themselves with shares (e.g. different types of mutual funds), leading to an increase in equity financing, while depository institutions operate with comparatively low levels of equity capital throughout our sample period.

Figure 2: *Change in holdings of Instruments 1980-2018 in percent of GDP*



Notes: The figure shows the average changes in asset holdings at the sectoral level for a stable sample between 1980 and 2018. The left panel shows the change in the ratio of deposit holdings to GDP for households, governments, and the rest of the world. The other panels show these changes for holdings of bonds, shares, and loans respectively.

Taken together, these trends suggest that credit is increasingly financed from abroad. The following unveiling describes our approach to study this reallocation in a more systematic manner.

2.3. Unveiling

The goal of the unveiling is to allocate credit to households and firms to the counterparty ultimately financing this loan, as done for the US in Mian et al. (2020b), for the largest possible sample of countries.[8] While a loan is normally held as an asset by a bank, the bank is not the ultimate counterparty providing financing. Banks finance loans on the asset side with equity, bonds, deposits or other financial instruments on the liability side of the balance sheet. A loan is thus ultimately financed by the agents that hold the bank's liabilities as an asset. 'Unveiling' the role of financial corporations implies linking the loan to the ultimate financiers. In line with Mian et al. (2020b), we assume that ultimate financing sectors (u) can be domestic households, the government, or the rest of the world ($u \in \{HH, GG, RoTW\}$). Corporate sectors (c) that cannot be ultimate counterparties and are unveiled are non-financial and financial corporations ($c \in \{NF, FI\}$). The following section introduces our baseline unveiling procedure, which we label *proportional unveiling*, and its assumptions.

To allocate credit on the asset side of intermediary balance sheets to ultimate counterparties, we need to know counterparties financing liabilities. This information is, however, only available in a subset of data. We therefore rely on the accounting axiom that every liability is another agent's asset. Given the previously described data structure, we know the

[8] Unlike Mian et al. (2020b), we do not study the distribution within the household sector.

liability composition of any given sector, while observing the asset composition of all other sectors. In our baseline, we allocate liabilities proportionally to the sectoral distribution in holdings of this instrument as an asset. For example, we allocate the deposits, used by the financial sector to finance loans, to a counterparty 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 (excluding deposits held as assets by financial intermediaries), we assign 70% of the deposit liabilities of the financial sector to the household sector.

The key assumption we make here is that for a given financial instrument the mix of financing sectors can be computed based on the proportional asset holdings of all other sectors in that instrument.[9] Applying this assumption to data on all available financial instruments (deposits, bonds, loans, shares, insurances and pensions, gold and SDRs, derivatives and options, other accounts) we estimate the total pairwise holding from a sector s supplying financing to a receiving sector r. While in principle allowing all possible $s \rightarrow r$ relationships ($(r,s) \in \{HH, GG, RoTW, NF, FI\}$), we set the direct link from $RoTW$ to HH to zero. The reason is that households normally do not directly access international financial markets to borrow.[10] While we think this is a reasonable restriction based on observable data, it is important to note that this approach, if anything, underestimates the rest of the world as a funding source for household debt expansions.

To determine the ultimate counterparty financing household and non-financial corporate credit $C^{u \rightarrow b}$, with u being the ultimate supplying sector ($u \in \{HH, GG, RoTW\}$) and b the borrowing sector ($b \in \{HH, NF\}$) of credit C, we need to account for both direct and indirect links from u to b. While we calculated the direct link above, we still need to account for indirect links, which can be very important as credit is usually intermediated. These indirect links can take two forms. First, borrowers and u-sectors could be linked via one intermediary, e.g. domestic households holding deposits of financial intermediaries which then lend to other households. Second, there could be more than one intermediation step: e.g., consumer loans made by non-financial corporates to households could be financed with loans from financial intermediaries. To correctly assign credit to the ultimate counterparty, we first estimate the total holdings of u sectors in intermediary corporate c-sectors ($c \in \{NF, FI\}$) and then allocate the claims c-sectors might have on borrowing sectors b proportionally to the u sectors' share in financing intermediaries.

[9] The same assumption is, e.g., used in Vom Lehn and Winberry (2022) and by the BEA in the context of constructing bilateral sectoral capital-flows tables.

[10] Whenever we observe counterparty information in the data, this number is close to zero. Allowing this direct link based on proportionality would therefore likely overestimate the importance of foreign financing for household credit.

Finally adding up direct and indirect links from $u \rightarrow b$, yields the credit of borrowing sector b, financed by ultimate sector u. Note, that the liabilities of the household sector almost exclusively consist of loans. Corporates, on the other hand, also borrow using other financial instruments. Here, we want to focus on loans to be able to allow comparisons with other datasets and results in the literature. Consequently, we denote our credit variable as $C^{u \rightarrow HH}$ for households and $C^{u \rightarrow NF}$ for non-financial corporations. A detailed explanation of our approach can be found in appendix section A2-1.

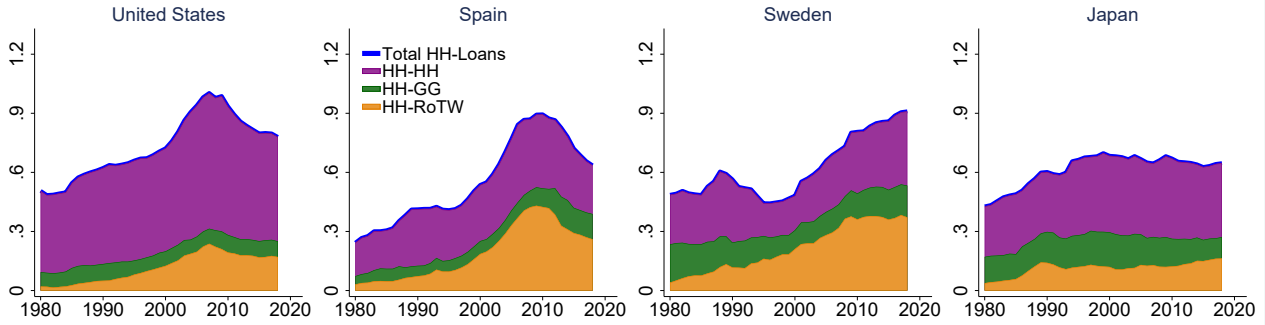
Our baseline unveiling is based on the broadest available sectoral breakdown of sectors. To validate our results we compare them to results using (i) additional counterparty information, (ii) the Mian et al. (2020b) replication files, and (iii) additional subsector information (see A2 for details).

(i) Counterparty unveiling. We first resort to data where counterparty information is available, making the proportionality assumption in our procedure obsolete. Counterparty data is available from three sources. First, the newly digitized historical data from OECD golden books contain counterparty information for some countries, allowing for counterparty-based unveiling at the beginning of our sample period. Second, for recent years, detailed counterparty information is available from the ECB's 'who-to-whom-matrices' for Eurosystem countries. Third, the US financial accounts (flow of funds) contain counterparty information which is also exploited in Mian et al. (2020b). The left two panels of Figure A2.3 use information from the historical publications and from ECB statistics for cross-validation for Spain and Sweden, two countries for which we have counterparty information from both historical and more recent sources. In both countries, our baseline estimate of household debt financed from abroad is almost identical to estimates using either historical or recent counterparty information. More generally, the right two panels of Figure A2.3 show binscatters for the correlation between counterparty-based and our baseline estimates whenever both series are available. As can be seen, our baseline estimate corresponds closely to results using historical OECD counterparty as well as recent ECB data.

(ii) Comparison with Mian et al. (2020b). For further verification, we compare the estimates from Mian et al. (2020b), using their replication kit, to ours. There are some small level differences in the total household credit series, as they unveil mortgage and consumer credit only, but Figure A2.4 shows that the resulting series mirror each other in levels and dynamics.

(iii) Additional sectors. In all these approaches, we treat the financial sector as one, but depending on availability we can also distinguish between several financial subsectors. In subsection A2, we describe in detail robustness approaches where we use a more

Figure 3: *Household credit by ultimate counterparty for the U.S., Spain, Sweden and Japan*



Notes: The figure shows the development of household debt financed by the three final sectors based on our baseline unveiling approach for the United States, Spain, Sweden and Japan. All series are relative to domestic GDP. Total household debt is shown in solid blue, while household credit financed from domestic households, the government and the rest of the world (RoTW) are shown in purple, green and orange respectively.

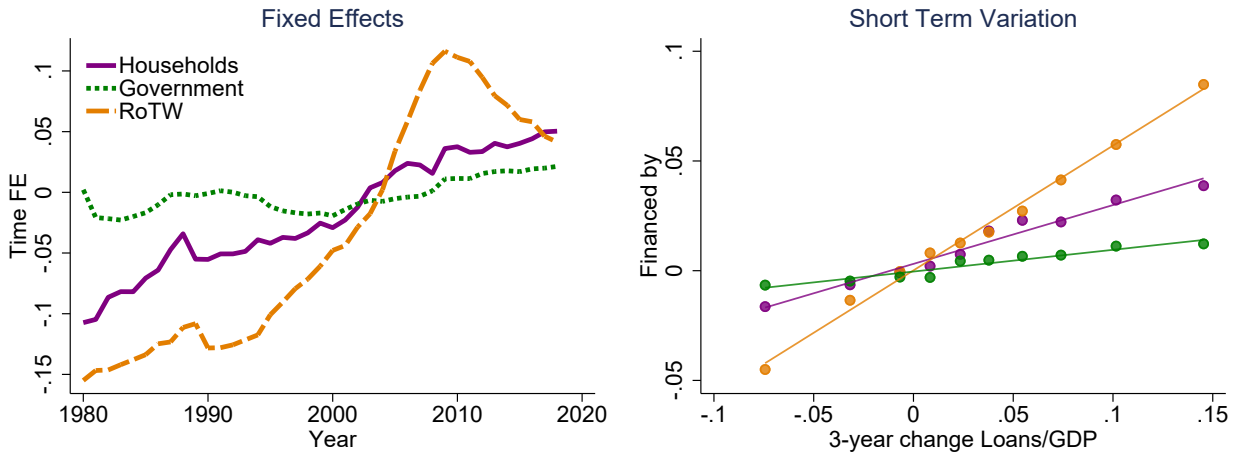
granular sectoral breakdown available for subsets of data and additional exercises where we only allow for certain links between sectors, i.e. restrict some of the sectoral financial relationships to be 0. In addition, we perform a similar exercise in consolidated financial accounts data. The main takeaway from all these exercises is that the deviations from our baseline approach are rather small and all main results hold using these alternative procedures.

2.4. Trends in the unveiled data

Figure 3 shows the results of the unveiling procedure for four countries with data going back to 1980 – the United States, Spain, Sweden and Japan. The graph shows the development of household credit by counterparty, relative to GDP, since 1980. In 1980, household credit was financed almost entirely by domestic counterparties in all four countries, while foreign counterparties rarely financed household credit. After 1980, all four countries experienced increases in household credit to GDP, although cycles differ. As documented in Mian et al. (2020b), the increase in borrowing of US households between 1980 and 2007 was financed to a similar degree by domestic households and foreigners, with both declining after 2007. Total household credit in Spain displays similar dynamics, but the boom was financed entirely from abroad. In both countries, foreign-financed household credit was the exception at the beginning of the sample period. In Sweden and Japan foreign financing of household credit increased already before their respective financial crises in the early 1990s. Afterwards, foreign-financed and total household credit remained stable in Japan, while both increased continuously in Sweden.[11]

[11]For a stable sample of countries Figure A3.9 displays the total increase in loans on the liability side of household and the non-financial sector balance sheets relative to GDP and the sources of funds for this increase. Household debt increased by 30% of GDP since 1980, with foreigners financing the largest share of

Figure 4: *Household credit by ultimate counterparty sector: trends and cycles*



Notes: The left panel plots time fixed effects α_t of a regression of household credit by ultimate sector relative to GDP ($C_{i,t}^{u \to HH}$) on country (α_i) and year (α_t) fixed effects, i.e. $C_{i,t}^{u \to HH} = \alpha_i + \alpha_t + \epsilon_{it}$, where u refers to domestic households, government, and the foreign sector respectively. The right panel shows the relationship between changes in total household credit and household credit decomposed by ultimate source of funds. Observations are collapsed into 10 equal sized bins based on three-year changes in the ratio of household credit to GDP. Each point represents the group specific means of three-year changes in total household credit and household credit financed by ultimate counterparty sectors relative to GDP, after controlling for country fixed effects. Fitted regression lines illustrate the correlation.

Moving to the full sample, the left panel in Figure 4 shows the estimated time effects α_t of a regression of household credit by ultimate counterparty u relative to GDP on country (α_i) and year (α_t) fixed effects, i.e. $C_{i,t}^{u \to HH} = \alpha_i + \alpha_t + \epsilon_{it}$, where u refers to domestic households, government and the foreign sector respectively. Since 1980, there has been a slight increase in household-financed household debt, while government-financed household credit is almost stable. On the other hand, household credit financed by foreign counterparties increased significantly between 1980 and the 2007/2008 crisis, declining afterwards, but remaining elevated. The appendix contains additional robustness checks on these trends. One concern is that these trends, and the role of foreign capital, could be entirely driven by Euro area financial integration. Hence, in Figure A3.10 we again calculate and plot yearly fixed effects, excluding the Euro area from the sample. Similarly, we exclude financial centers with very large RoTW positions (United Kingdom, Switzerland, Netherlands, Ireland, Iceland) in Figure A3.11. In both cases developments look very similar to the ones reported here.

When we study credit cycle variation, the right panel in Figure 4 shows that the rest of the world is also the marginal counterparty financing credit extended to the household sector at medium-term frequencies. The graph displays mean values of 3-year changes in the ratio of household credit (x-axis) and household credit by counterparty (y-axis) where the data have been sorted into ten bins. In the highest decile, the average three-year

this increase.

change in the ratio of household credit 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 for this decile is close to 10% of GDP. Most of the remaining increase is financed by domestic households, while the government does not play an important role as a source of funds. Figure A3.12 replicates Figure 4 for the non-financial corporate sector, showing that credit to the non-financial sector is likewise mostly financed with funds flowing in from the rest of the world.

3. Credit and business cycles

How do these changes in the structure of financial intermediation affect the macroeconomy? Does increasing reliance on foreign financing alter the links between credit and business cycle dynamics? Recent models that link (household) credit expansion with macroeconomic dynamics usually rely on foreign-financed demand booms (Schmitt-Grohé and Uribe, 2016; Mian et al., 2020a). Empirically however, this has been difficult to test. Mian et al. (2017) find limited evidence when they analyze accumulated current account deficits as a measure of foreign-financed household credit expansions. Our data on credit, disaggregated by the financing sector of funds, allows us to directly test the hypothesis that capital inflows intermediated to domestic households have consequences for macroeconomic dynamics.

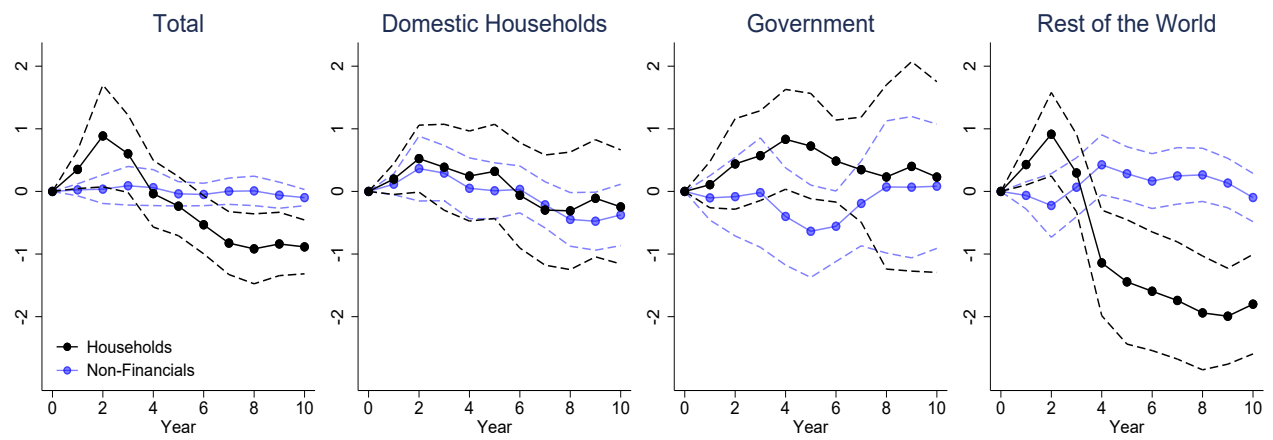
3.1. Credit sources and macroeconomic dynamics: Main results

To understand the business cycle dynamics associated with credit expansions financed from different sources, we decompose household and non-financial credit by counterparty sector. We first estimate local projections (Jordà, 2005), including six credit variables (two borrowing sectors $b \times$ three ultimate counterparty sectors u) to characterize the dynamics of output following an increase in the respective credit measure

$$\Delta_h y_{i,t+h} = \alpha_{i,h} + \sum_{b \in B} \sum_{u \in U} \sum_{j=0}^{5} \beta_{h,j}^{u,b} \, \Delta C_{i,t-j}^{u \to b} + \sum_{j=0}^{5} \beta_{h,j}^{y} \, \Delta y_{i,t-j} + \gamma X_{i,t} + \epsilon_{i,t+h} \,, \tag{1}$$

where $\Delta_h y_{i,t+h} = y_{i,t+h} - y_{i,t}$ is the growth of log real GDP for $h = 1, ..., 10$. B contains households and non-financial corporates as borrowing sectors and U contains households, governments, and the rest of the world as ultimate counterparty sectors. $\Delta C_{i,t}^{RoTW \to HH}$, e.g., denotes the yearly change in the ratio of household credit financed by the RoTW sector relative to GDP. We will be interested in the $\beta_{h,0}$-coefficients for each of the six sectoral borrower-creditor combinations. The specifications control for contemporaneous GDP growth as well as five lags of GDP growth and of the credit variables. Recently,

Figure 5: *GDP responses to changes in credit by borrowing sector and source of funds*



Notes: This figure shows estimates of impulse responses of real GDP (in %) to increases in the ratio of household (black) and non-financial (blue) credit to GDP (left panel). The left panel shows responses to total household and non-financial credit for comparison. The three right panels show responses to increases in the ratio of household and non-financial credit decomposed by ultimate counterparty sector based on Equation 1. All six responses are estimated jointly but shown in three panels for better visibility. Dashed lines represent 95% confidence intervals around estimates computed based on standard errors dually clustered on country and year.

Brunnermeier et al. (2021) have argued that the response of output to credit is driven by the endogenous response of monetary policy to credit shocks. We therefore include the contemporaneous values and five lags of changes in short-term interest rates as additional controls $X_{i,t}$.

The results are presented in Figure 5, where we show the response of output to household and non-financial credit financed by domestic households, governments and foreigners respectively. For comparison, the left panel shows results for a specification that includes total household and non-financial borrowing instead of decomposing these variables by counterparty. The results for this specification in our sample are very close to those in Mian et al. (2017). An increase in household credit (black) 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 initial increase in household credit. The blue line shows that the relationship between credit to the non-financial sector and macroeconomic outcomes is much less pronounced than for household credit.

The right three panels in Figure 5 show the results from estimating Equation 1. All six responses are jointly estimated, but for ease of visibility presented separately by financing counterparty. The second panel shows the sequence of $\{\beta_{h,0}^{HH,HH}\}$ (black) and $\{\beta_{h,0}^{HH,NF}\}$ (blue) coefficients. The two responses are almost identical and an increase in credit financed by domestic households is associated with a small but insignificant increase in output first, and a response close to zero at longer horizons. The middle right panel shows the sequence of $\{\beta_{h,0}^{GG,HH}\}$ and $\{\beta_{h,0}^{GG,NF}\}$ coefficients. Increases in government-financed household credit

are associated with a mostly insignificant increase in output until year 4, which reverses in the following years. The coefficients for government-financed increases in non-financial credit are close to zero and insignificant throughout. The dynamics for foreign-financed household credit presented in the far right panel are strikingly different. Initially, an increase in household credit financed from abroad is associated with higher output. This is reversed quickly, and starting in year 4 the cumulative response of output to an increase in household credit financed from abroad turns negative. The estimates for horizons larger than 4 years are all significantly negative. Non-financial credit financed by foreigners (blue) is not associated with such dynamics. In sum, household credit financed by foreigners is strongly associated with a short-lived boom in economic activity followed by a bust, and it emerges as the main driving force behind the association between household credit and business cycles displayed in the left panel.

In Table 1 we present corresponding results from a single-equation model commonly used in the literature (Mian et al., 2017; Müller and Verner, 2021). In particular, we estimate the relationship between three-year changes in household and non-financial credit, decomposed by ultimate financing source of funds, and subsequent real GDP growth (changes in unemployment)

$$\Delta_3 y_{i,t+3} = \alpha_i + \sum_{b \in B} \sum_{u \in U} \beta^{u,b} \Delta_3 C_{i,t-1}^{u \to b} + \sum_{j=1}^{3} \beta_j^y \Delta y_{i,t-j} + \gamma X_{i,t} + u_{i,t+3}\,, \tag{2}$$

where $\Delta_3 y_{i,t+3}$ is the growth of real GDP (unemployment) between time t and $t+3$, and $\Delta_3 C_{i,t-1}^{u \to b}$ is the three-year change in credit financed by sector u to borrowing sector b as a ratio to GDP. All specifications control for country fixed effects, lagged dependent variables and non-financial credit, decomposed by ultimate counterparty. 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 0.9 percentage points lower output growth over the following three-year window, in line with the dynamic relationship displayed in the right panel of Figure 5. The relationship is highly significant and it is robust to the inclusion of year fixed effects in column (2). Like in Figure 5, there is no such relationship for other credit variables and a test for the equality of coefficients $\beta^{HH,HH}$, $\beta^{GG,HH}$, and $\beta^{RoTW,HH}$ is soundly rejected.

$\Delta_3 RoTW \to HH_{i,t-1}$ is a measure of gross positions of foreigners that are intermediated through the financial system to domestic households. As discussed earlier, the role of gross capital flows and asset/liability positions has been emphasized after the global financial crisis, while earlier literature focused on net flows measured as current account dynamics.

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)
$\Delta_3 RoTW \rightarrow HH_{i,t-1}$	-0.90***	-0.74***	-0.71***	-0.68***	0.30***	0.25***	0.22***	0.20***
	(0.20)	(0.17)	(0.17)	(0.19)	(0.05)	(0.04)	(0.04)	(0.04)
$\Delta_3 HH \rightarrow HH_{i,t-1}$	0.23	0.23	0.23	0.14	0.04	0.04	0.04	0.05
	(0.18)	(0.14)	(0.15)	(0.15)	(0.06)	(0.06)	(0.06)	(0.06)
$\Delta_3 GG \rightarrow HH_{i,t-1}$	-0.42	-0.22	-0.16	0.15	-0.10	-0.12	-0.14	-0.24**
	(0.31)	(0.30)	(0.29)	(0.32)	(0.10)	(0.10)	(0.10)	(0.11)
$\Delta_3 CA_{i,t-1}$			0.20*	0.15			-0.16***	-0.16***
			(0.11)	(0.10)			(0.04)	(0.04)
R^2	0.346	0.583	0.589	0.615	0.451	0.601	0.625	0.666
Country fixed effects	✓	✓	✓	✓	✓	✓	✓	✓
LDV	✓	✓	✓	✓	✓	✓	✓	✓
NF Credit	✓	✓	✓	✓	✓	✓	✓	✓
Year fixed effects		✓	✓	✓		✓	✓	✓
Additional Controls				✓				✓
p-value HH, $\beta_{RoTW} = \beta_{HH} = \beta_{GG}$	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00
Observations	678	664	663	596	634	621	620	566

Notes: This table presents results from estimating Equation 2. The dependent variables are the growth of real GDP and the change in the unemployment rate between year t and $t+3$. Household credit is decomposed by ultimate counterparty sector. Credit variables are expressed as lagged three-year changes in the ratio to GDP. LDV are distributed lags of the dependent variable. NF Credit includes non-financial credit decomposed by ultimate counterparty sector and additional controls include changes in household sector net worth, short-term interest rates and foreign capital not financing household credit. Standard errors in parentheses are dually clustered on country and year. The reported p-value refers to a test for the equality of credit coefficients by counterparty sector. *,**,*** indicates significance at the 0.1, 0.05, 0.01 levels, respectively.

In column (3) we include changes in the current account to control for net flows. In column (4), we additionally include changes in financial net worth of the household sector, foreign capital not financing household credit and short-term interest rates. The coefficients for $\Delta_3 RoTW \rightarrow HH_{i,t-1}$ in columns (3) and (4) are almost unaffected by the inclusion of these variables, suggesting that foreign capital intermediated to domestic households plays an important role that is different from the role of net capital flows, total assets held by foreigners or household sector financial net worth.

The negative relationship between foreign-financed household credit expansion and the business cycle also extends to unemployment, as columns (5) to (8) show. A one percentage point increase in foreign-financed household credit to GDP is followed by an increase of 0.30 percentage points in unemployment between year t and $t+3$. This relationship is robust to the inclusion of year fixed effects and including the set of controls described above.

3.2. Robustness

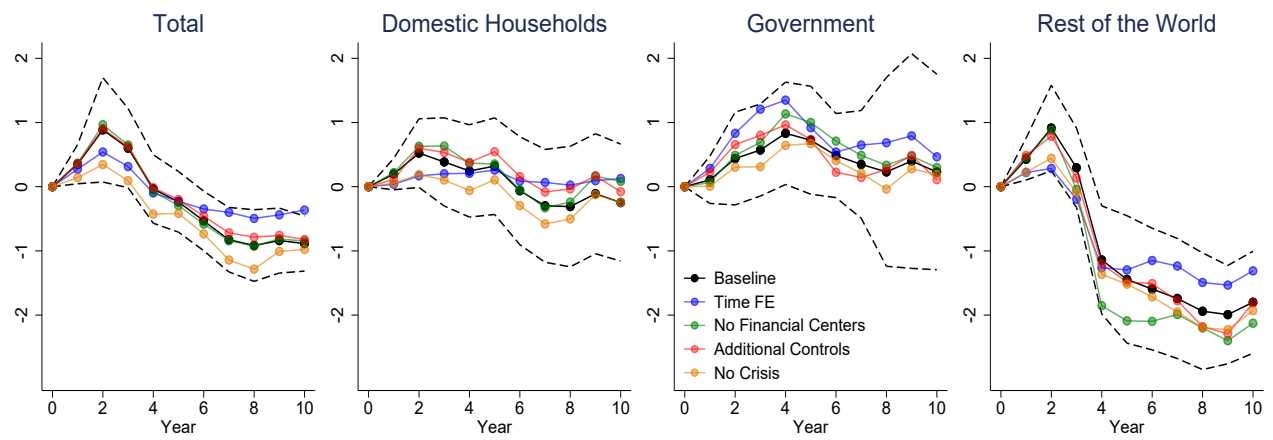
We conduct a battery of robustness checks for these findings. Figure 6 shows that the relationships between household credit by source of financing and GDP growth are a robust

feature of the data. The panels show the baseline estimates for the relationship between foreign-financed household credit expansion and GDP growth from Figure 5 in black. We then add coefficients of several robustness specifications to the graphs. Red coefficients correspond to specifications that include additional controls: the current account-to-GDP ratio, household sector net financial positions, and foreign capital not financing household credit as in Table 1. The graphs show that adding these controls has very little effect on the main results. Figure A4.13 in the appendix shows the responses of GDP to these variables. When included jointly with household credit financed from abroad, the response of GDP to these variables is insignificant. On the other hand, when estimated separately for each variable, including only lags of the variable itself, lagged GDP and interest rate controls (Figure A4.14), the GDP response to the current account displays a similar pattern as to foreign-financed household credit, while financial net worth of the household sector is robustly associated with subsequent GDP growth. Hence, these variables partly capture the relationship between foreign-financed household credit and subsequent macroeconomic dynamics when it is impossible to account for decomposed credit.

The blue line shows that responses are very similar to the baseline estimates, with slightly dampened responses, when adding year fixed effects to the specification. 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, as we will discuss later. We also exclude countries with large foreign sector positions (Iceland, Ireland, the Netherlands, Switzerland, United Kingdom) from the estimation sample (green). Another specification (yellow) excludes a three year window around financial crises from the sample. Both lines show, if anything, a strengthening in the relationship between household credit and subsequent economic outcomes, being close to our baseline estimates. Figure A4.15 in the appendix shows the estimated responses relying on a SVAR-model instead of local projections. The responses look similar to our baseline estimates using this alternative empirical approach. All these tests confirm our main result: household credit funded from the RoTW is associated with an initial increase in output followed by a reversal that underlies the negative medium-term association between household credit expansion and output reported in Mian et al. (2017).

For the single-equation model, Table A4.3 in the appendix shows that these results are robust to the exclusion of countries with very large rest of the world positions. Table A4.4 shows that foreign-financed household credit expansion in a single factor model achieves a R^2 similar to a regression including all other variables. Table A4.5 shows that the results are robust when we use data from robustness unveiling procedures. Figure A4.16 displays regression coefficients from time series regressions in country level data and shows that the

Figure 6: *GDP responses to changes in household credit by source of funds, robustness*



Notes: This figure shows different estimates of impulse responses of real GDP (in %) to increases in the ratio of total household credit to GDP (left panel). The three right panels show responses to increases in the ratio of household credit decomposed by ultimate counterparty sector based on Equation 1. The black line corresponds to the baseline estimates reported in Figure 5. Dashed lines represent 95% confidence intervals around this estimate, based on standard errors dually clustered on country and year. Additional specifications include year fixed effects (blue), additional controls such as current account, household net position, foreign inflows not financing household credit (red), excluding financial center countries (green) and excluding financial crisis years (yellow).

relationship documented here holds in the overwhelming majority of countries.

4. Credit and financial fragility

Credit expansions have been shown to predict financial crises (Schularick and Taylor, 2012). In this section, we study the association between the counterparty providing financing for a credit expansion, and financial fragility. Rapid inflows of capital from abroad and their intermediation to domestic households may amplify moral hazard and adverse selection problems in the financial sector and create maturity and currency mismatches that 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. Calvo (2011); Reinhart and Rogoff (2009)). Despite this intuitive link, empirical studies have had mixed success in linking foreign financing to banking crisis events. The following section studies whether credit decomposed by financing sector helps predicting banking crises.

4.1. Predicting crises

To formally study the pre-crisis dynamics of disaggregated credit relationships, we turn to the standard crisis prediction framework, and ask whether the financing counterparty of credit contains information about crisis risk that goes beyond the information contained in aggregate credit variables. 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 $X_{i,t-1}$

$$Pr[B_{i,t} = 1|X_{i,t-1}] = \Phi(\beta X_{i,t-1}), \tag{3}$$

where $X_{i,t-1}$ includes the three-year changes in credit relative to GDP, with credit disaggregated by borrowing sector and financing source. β denotes the vector of coefficients of interest for the various specifications.

For comparison with counterparty estimates, column (1) in Table 2 reports mean marginal effects for the relationship between changes in the ratio of total 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 is associated with significantly higher crisis likelihood. 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. (2022) and Müller and Verner (2021)). As a measure of net capital inflows commonly used in the literature, we include the three-year change in the current account. The coefficient is negative, but insignificant as found in previous studies. For all specifications, 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-statistic 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 benchmark 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 random AUC. Column (2) additionally includes country fixed effects. The number of observations is decreasing since some countries did not experience a financial crisis in the sample period. Furthermore, the AUC is slightly higher, as fixed effects add some ability to sort the data into the crisis and no-crisis bins.

We then decompose credit by ultimate counterparty sector 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 (6.2 percentage points) increase in the ratio of household credit funded by foreigners is associated with a 3 ($= 6.2 \times 0.47$) percentage points higher likelihood of crisis. Given a sample frequency of about 3.5%, crisis risk almost doubles. Three-year changes in all other credit variables, as well as the current account are insignificant. 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).

Table 2: *Predicting financial crises*

	Benchmark		By counterparty		Only RoTW to HH		All others	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$\Delta_3 HH_{i,t-1}$	0.24***	0.46***						
	(0.07)	(0.18)						
$\Delta_3 NF_{i,t-1}$	0.04**	0.14*						
	(0.01)	(0.08)						
$\Delta_3 RoTW \rightarrow HH_{i,t-1}$			0.47***	1.14***	0.44***	1.20***		
			(0.11)	(0.28)	(0.08)	(0.25)		
$\Delta_3 GG \rightarrow HH_{i,t-1}$			-0.42	-0.48			-0.16	-0.11
			(0.37)	(0.56)			(0.35)	(0.52)
$\Delta_3 HH \rightarrow HH_{i,t-1}$			-0.06	-0.12			0.04	0.05
			(0.23)	(0.40)			(0.26)	(0.39)
$\Delta_3 RoTW \rightarrow NF_{i,t-1}$			-0.04	0.05			0.06*	0.31**
			(0.04)	(0.10)			(0.03)	(0.13)
$\Delta_3 GG \rightarrow NF_{i,t-1}$			0.18	0.03			-0.18	-0.74
			(0.39)	(0.71)			(0.36)	(0.68)
$\Delta_3 HH \rightarrow NF_{i,t-1}$			0.07	0.21			0.05	0.13
			(0.13)	(0.20)			(0.16)	(0.28)
$\Delta_3 CA_{i,t-1}$	-0.16	-0.26	-0.16	-0.22			-0.30*	-0.61*
	(0.16)	(0.34)	(0.17)	(0.35)			(0.18)	(0.32)
AUC	0.74	0.77	0.80	0.84	0.79	0.83	0.75	0.78
s.e.	0.05	0.05	0.05	0.04	0.05	0.04	0.05	0.05
Country fixed effects		✓		✓		✓		✓
Observations	739	534	739	534	739	534	739	534

Notes: The table shows probit classification models where the dependent variable is a financial crisis dummy. Coefficients shown are mean marginal effects. AUC is the area under the ROC-curve and below is its standard error. Columns (1) and (2) show results including three-year changes in total household and non-financial credit as a benchmark. In columns (3) and (4) credit variables are decomposed by ultimate counterparty Columns (5) and (6) only include RoTW-financed household credit and (7) and (8) all other variables (excluding RoTW-financed household credit). Clustered (by country) standard errors in parentheses. *,**,*** indicates significance at the 0.1, 0.05, 0.01 levels, respectively.

Where are these improvements in predictive accuracy coming from? In column (5), we include only a single variable, the three-year change in household credit financed by foreigners. The coefficient remains similar 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 as a model additionally including changes in household credit financed from other sectors, non-financial credit decomposed by source, 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 specification in (3) and the AUC drops to 0.75. We conclude that RoTW-financed household credit expansion contains information on crisis likelihood not contained in other credit measures. The coefficient estimates of the current account and non-financial credit financed externally are slightly significant in (7). Hence, they seem 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).

Robustness. The appendix contains several robustness checks to ensure that results are not driven by the choice of specification or variable definitions. In Table A5.6 we estimate a linear probability model with country fixed effects instead of a probit model. We employ the Baron et al. (2021) crisis chronology in Table A5.7. In all these specifications, household credit funded by the rest of the world is highly significant and the most important link between credit and crisis, as indicated by the AUC across models. Figure A5.17 additionally shows that crisis frequency in the highest quartile of household credit expansion financed from abroad is almost 9%, while it is zero in the lowest bin. On the other hand, crisis frequencies are similar across different quartiles of household credit expansions financed domestically by either the government or the domestic household sector.

4.2. Sources of deleveraging after crises

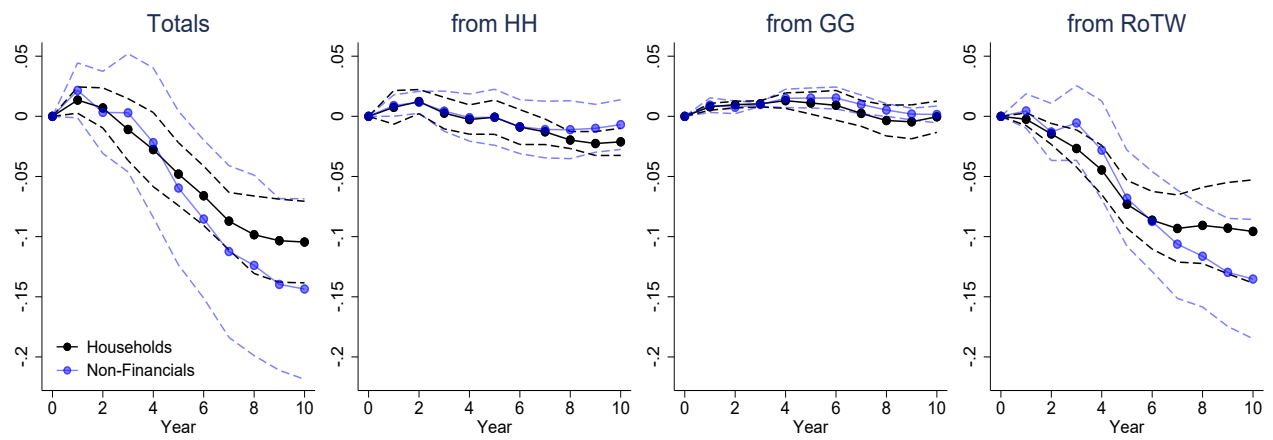
What happens once the crisis occurs? Are foreign counterparties indeed more prone to withdrawing funds during and shortly after financial turmoil? Financial crises are often characterised by increases in the price of credit (Krishnamurthy and Muir, 2017; Romer and Romer, 2017) and disintermediation (Jordà et al., 2013). At the same time, gross capital flows are known to dry up during periods of financial turmoil (Broner et al., 2013). Here, we ask, whether this disintermediation is specific to foreign-financed credit. Using our decomposition of credit by source of financing, we employ local projections and run specifications of the form

$$\Delta_h C^u_{i,t+h} = \alpha_{i,h} + \sum_{j=0}^{5} \beta^{BC}_{h,j} Crisis_{i,t-j} + \sum_{j=0}^{5} \beta^{u}_{h,j} \Delta C^u_{i,t-j} + \sum_{j=0}^{5} \beta^{y}_{h,j} \Delta Y_{i,t-j} + \epsilon_{i,t+h}, \qquad (4)$$

where dependent variables $\Delta_h C^u_{i,t+h}$ are changes in the ratio of different measures of credit relative to GDP in country i between time t and time $t+h$. $\beta^{BC}_{h,0}$-coefficients measure the response of the respective credit measure towards a crisis event over varying horizons h. The results are plotted in Figure 7 and provide an account of financial intermediation after a banking crisis.

The left panel shows the response of total credit to households and to the non-financial sector to a financial crisis. Following a financial crisis, loans to the household sector, relative to GDP, increase in the first year, before they start declining in the following years. Ten years after a crisis, household credit-to-GDP has, on average, decreased by ten percentage points, non-financial credit even more. In the three right-hand panels we repeat this exercise decomposing credit by counterparty sector. To allow comparisons, we plot all graphs on the

Figure 7: *Change in credit after crises by borrowing and ultimate counterparty sectors*



Notes: This figure shows estimates of responses of household credit (black) and non-financial credit (blue) to a financial crisis based on Equation 4. The left panel shows total credit for comparison, the three right panels divide credit by ultimate counterparty sector. Dashed lines represent 95% confidence intervals computed based on standard errors dually clustered by country and year.

same scale. The right panel reveals which financing sector is behind the decline in credit. The ten percentage point difference for household credit in the left panel is almost entirely explained by the decline in credit financed with funds from abroad. Credit financed by domestic sectors does not decline significantly. In fact, the ratio of government-financed credit to GDP is increasing in the first years after financial crises. These effects are, however, difficult to observe in the graph, as they are an order of magnitude smaller than the decline in credit financed by the foreign sector.

Taken together, foreign-financed household credit expansion emerges as a strong predictor of financial crises, driving the relationship between aggregate credit and crises. It is also this foreign funding that is most flighty in periods of distress. Hence, crises after credit expansions financed by foreigners are associated with stronger deleveraging. This deleveraging again feeds back with potentially adverse effects on the real economy (Chodorow-Reich, 2014; Huber, 2018).

5. Foreign credit supply vs. domestic credit demand

The previous sections have shown that the macroeconomic dynamics associated with household credit expansion differ based on the source of capital financing them, and that in particular foreign financing is key to understanding the relationship between credit and business cycles. But why do foreigners finance domestic household credit? Rey (2013) argues that, empirically, it seems like capital flows are often unrelated to a country's macroeconomic conditions and instead driven by supply, often linked to a global financial cycle (see Miranda-Agrippino and Rey (2022) for a review). To study whether these supply-

based explanations are associated with the dynamics we have presented here, we first need to disentangle the role of supply and demand for foreign-financed household credit. To make progress on this issue, in this section we rely on the Amiti and Weinstein (2018) procedure to decompose bilateral banking flows into country-specific demand for foreign capital and components driven by country-specific and common supply shocks. We then study the relation between the supply of foreign financing and macroeconomic dynamics.

In particular, we apply the Amiti and Weinstein (2018) procedure to data from the Locational Banking Statistics (LBS) provided by the Bank for International Settlements (BIS) similar to Amiti et al. (2019).[12] The LBS report the amount of bilateral outstanding claims of creditor banking system c on borrower country b, $L_{c,b,t}$. Using the Amiti et al. (2019)-approach we decompose the growth rate in these claims $\frac{L_{c,b,t}-L_{c,b,t-1}}{L_{c,b,t-1}}$ into country-specific time-varying demand ($\alpha_{b,t}$) and supply effects ($\beta_{c,t}$) using the following equation

$$\frac{L_{c,b,t} - L_{c,b,t-1}}{L_{c,b,t-1}} = \alpha_{b,t} + \beta_{c,t} + \epsilon_{c,b,t}. \tag{5}$$

Amiti and Weinstein (2018) show that estimating this equation using weighted least squares (WLS), with the lagged claim level as weights, allows to compute supply, demand and common shocks that add up exactly to the growth rate of pre-existing relationships. We implement their procedure in our data and decompose the growth rate in claims on borrower country b into idiosyncratic demand shocks $\hat{\alpha}_{b,t}$, a common shock $\hat{c}_t$, and the idiosyncratic supply shock, a weighted average (weighted by their share as a creditor of borrowing country b) of supply shocks of creditor banking systems $\sum_c (\frac{L_{c,b,t-1}}{\sum_c L_{c,b,t-1}} \hat{\beta}_{c,t})$.

?? shows the estimated growth decomposition for some of our sample countries, where we choose the set of countries such that the estimated shocks can be compared to the results presented in Figure 10 and 11 of Amiti et al. (2019). We then add up the common and country-specific supply shocks to obtain a measure of banking inflow shocks that excludes country-specific demand factors. We transform the growth rates into volume of funds and add up these volumes over the same three-year window that we use in our baseline regressions and likewise scale them by GDP. Figure A6.19 shows that there is a strong positive relationship between this foreign supply of funds and our measure of foreign-financed household credit expansion.

We then study the role of these supply shocks for the relationships documented in the previous sections. We fix the sample to observations where the supply variable is available and report in column (1) the OLS relationship between household credit financed

[12] Amiti et al. (2019) apply the procedure using the Consolidated Banking Statistics (CBS). However, the OECD non-consolidated financial accounts are based on the residency principle, as applied in the LBS and hence this data maps conceptually directly into our measure of foreign-financed credit.

Table 3: *Foreign-financed household credit and business cycle dynamics - foreign supply of funds*

	$\Delta_3 ln(Y)_{i,t+3}$			$\Delta_3 Unemployment_{i,t+3}$		
	Baseline (1)	*Reduced* (2)	*IV* (3)	*Baseline* (4)	*Reduced* (5)	*IV* (6)
$\Delta_3 RoTW \rightarrow HH_{i,t-1}$	-0.82***		-1.89***	0.22***		0.28***
	(0.17)		(0.57)	(0.04)		(0.07)
$\Delta_3 Supply_{i,t-1}$		-0.25***			0.05***	
		(0.05)			(0.02)	
Country fixed effects	✓	✓	✓	✓	✓	✓
LDV	✓	✓	✓	✓	✓	✓
Credit Controls	✓	✓	✓	✓	✓	✓
Current Account	✓	✓	✓	✓	✓	✓
Kleibergen-Paap Weak ID	.	.	22.30	.	.	11.80
Observations	653	653	653	609	609	609

Notes: The dependent variable is GDP growth from t to $t+3$ in (1)-(3) and changes in the unemployment rate between t and $t+3$ in (4)-(6). All specifications control for country fixed effects and distributed lags of the dependent variable (LDV). Credit controls include household credit financed by domestic sectors and non-financial credit. Columns (1) and (4) are based on Equation 2. Columns (2) and (5) replace $\Delta_3 RoTW \rightarrow HH_{i,t-1}$ with the supply shock measure. Columns (3) and (6) use the supply shock measure as an instrumental variable for $\Delta_3 RoTW \rightarrow HH_{i,t-1}$. Standard errors in parentheses are dually clustered on country and year. *,**,*** indicates significance at the 0.1, 0.05, 0.01 level, respectively.

from abroad and the business cycle. Column (2) shows the reduced-form relationship between the GDP-scaled supply shocks and subsequent output dynamics. The coefficient is negative and highly significant, suggesting that supply of foreign financing is associated with lower subsequent GDP growth. Column (3) employs the measure of foreign capital supply as an instrumental variable for foreign-financed household credit expansion. The coefficient is highly significant and larger than the baseline coefficient reported in column (1), suggesting that the baseline OLS estimates are biased towards zero. Such a bias seems plausible, as households may sometimes borrow from abroad against (expected) good future fundamentals. We report the Kleibergen-Paap statistic (22.30) which confirms the visual impression of a strong first-stage relationship from Figure A6.19. Columns (4) to (6) repeat the procedure with unemployment as the dependent variable. As for GDP growth, the results remain highly significant, with stronger coefficients than in the baseline OLS specifications. These results show that supply-driven inflows of capital from international markets are associated with adverse macroeconomic dynamics.

As in most macroeconomic applications, there are potential concerns that we have to consider when interpreting the instrumental variable results. Supply shocks in foreign financing, e.g., may affect the macroeconomy through other channels than foreign-financed household credit expansion. The most obvious candidate channel is foreign-financed credit to the non-financial sector expanding due to global capital supply. Empirically, however, Figure A6.19 shows that there is no clear relationship between international banking supply shocks and lending to non-financial corporates, and standard relevance criteria for instrumental variables based on a first stage regression are not met. Another

Table 4: *Predicting financial crises - foreign supply of funds*

	Baseline (1)	*Reduced* (2)	*IV* (3)	*Baseline* (4)	*Reduced* (5)	*IV* (6)
$\Delta_3 RoTW \rightarrow HH_{i,t-1}$	0.43***		0.92***	1.10***		2.85***
	(0.09)		(0.29)	(0.24)		(0.51)
$\Delta_3 Supply_{i,t-1}$		0.18***			0.61***	
		(0.06)			(0.11)	
Credit Controls	✓	✓	✓	✓	✓	✓
Current Account	✓	✓	✓	✓	✓	✓
Country fixed effects				✓	✓	✓
Kleibergen-Paap Weak ID			25.57			15.00
Observations	725	725	725	523	523	523

Notes: The table shows probit classification models where the dependent variable is a financial crisis dummy. Coefficients shown are mean marginal effects. Baseline models are probit specification as in Equation 3. Reduced-form specifications replace $\Delta_3 RoTW \rightarrow HH_{i,t-1}$ with the supply shock measure. IV specifications use the supply shock measure as an instrumental variable for $\Delta_3 RoTW \rightarrow HH_{i,t-1}$. Credit controls contain three-year changes in household credit financed by domestic sectors and non-financial credit, all relative to GDP. Clustered (by country) standard errors in parentheses. *,**,*** indicates significance at the 0.1, 0.05, 0.01 level, respectively.

potential concern is that the common component entering the capital supply variable may be endogenous to expected global macroeconomic developments. We hence focus in Table A6.8 on small open economies. These economies are exposed to the global financial cycle, but it is unlikely that the global financial cycle responds to their expected macroeconomic developments. In particular, we exclude the five largest economies in our sample (U.S., Japan, Germany, France, United Kingdom) from the estimation. We find that the results are largely unchanged. Finally, one could imagine times where investors across the globe want to invest in a particular country that acts as a safe haven. In that case the supply of capital from around the globe to that particular country may actually be reflected by the estimated idiosyncratic demand term. Table A6.9 addresses that possibility by excluding the countries most likely associated with a safe haven status, the US and Germany, from the sample. Again, results are very similar to the ones reported for the full sample.

The same exercise can be applied to the analysis of financial crises. In Table 4 we show results for probit models instrumenting foreign-financed household credit expansion. Column (1) shows, again, that foreign-financed household credit expansion predicts financial crises. In column (2), we include instead of foreign-financed household credit the foreign supply variable and find a significant relationship with subsequent crises. Column (3) then contains the instrumental variable results and confirms the strong relationship between $\Delta_3 RoTW \rightarrow HH$ and financial crises. As for the business cycle relationships, the coefficient increases, suggesting a bias towards zero in the simple probit specification. Columns (4) to (6) repeat these exercises including country fixed effects and confirm previous findings. These results suggest that supply-based increases in foreign-financing of household debt trigger the macroeconomic developments that ultimately end in financial crises.

Expectations. Having established that foreign capital supply is associated with negative macroeconomic and financial dynamics, we ask whether these are expected at the time when foreigners fund domestic household credit? To answer this question, we follow the literature and look at forecasts for economic growth and at asset prices, which both contain information on expectations about the future (Mian et al., 2017; Baron and Xiong, 2017). We regress these measures on lagged household credit expansion decomposed by source of financing

$$y_{t+3} = \alpha_i + \sum_{u \in U} \beta^u \Delta_3 C_{i,t-1}^{u \to HH} + \gamma X_{i,t-1} + \epsilon_{i,t+3}, \tag{6}$$

where y_{t+3} refers to growth forecast errors ($e_{t+3|t}$) or cumulative asset returns ($R_{t \to t+3}$). The forecast error $e_{t+3|t}$ is computed as realized growth between t and $t+3$ minus the time t forecast of growth between t and $t+3$ produced by IMF staff. $X_{i,t-1}$ in this case contains non-financial credit and the current account. The results are presented in Table 5. Column (1) shows that this forecast error is significantly negative for foreign-financed household credit expansion. In other words, household credit financed by the rest of the world is associated with low output growth, but IMF staff economic forecasts do not account for this relationship. Domestically financed household credit or credit to the corporate non-financial sector are not associated with such forecast errors. This result holds when we instrument foreign-financed household credit with our supply measure in column (2).

Foreign investors, supplying capital for household credit expansions, do not necessarily share the same beliefs as IMF forecasters, so it is difficult to assess their private 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 aggregate sentiment, and hence low subsequent returns. In column (3) we use the cumulative real total return from t to $t+3$ on the bank index ($R_{i,t \to t+3}^{BankEquity}$) as our dependent variable. We find that household credit expansions financed by foreigners, predict low subsequent returns on the bank index. Financial markets, just as economic forecasters, do not reflect the link between foreign-financed credit growth and subsequent macroeconomic and financial outcomes. Again, this result holds in the instrumental variable specification in column (4).

Since loans to the household sector mostly consist of mortgages, we finally ask whether foreign-financed household credit predicts developments in housing markets, regressing three-year changes in the real house price index ($HP_{i,t \to t+3}^{Real}$) on measures of past credit expansion. Column (5) shows that foreign-financed household credit expansions are associated with a predictably negative effect on the subsequent growth of house prices over the following years. While this relation is significant for foreign financed household debt expansions, domestically financed credit is not significantly related to future growth in

Table 5: *Credit expansion and expectations*

	$e_{t+3\|t}$		$R^{BankEquity}_{t\to t+3}$		$HP^{Real}_{t\to t+3}$	
	OLS	*IV*	*OLS*	*IV*	*OLS*	*IV*
	(1)	(2)	(3)	(4)	(5)	(6)
$\Delta_3 RoTW \to HH_{i,t-1}$	-23.27***	-40.26**	-4.97***	-15.22***	-1.24***	-1.63**
	(7.59)	(16.34)	(1.29)	(4.37)	(0.20)	(0.81)
$\Delta_3 GG \to HH_{i,t-1}$	0.96	2.88	-2.02	-0.85	-0.60	-0.58
	(4.76)	(4.92)	(2.67)	(3.16)	(0.56)	(0.57)
$\Delta_3 HH \to HH_{i,t-1}$	-5.32	0.07	-0.76	0.70	-0.13	-0.03
	(3.75)	(8.50)	(1.59)	(2.06)	(0.40)	(0.45)
Country fixed effects	✓	✓	✓	✓	✓	✓
NF Credit	✓	✓	✓	✓	✓	✓
Current Account	✓	✓	✓	✓	✓	✓
p-value, $\beta_{RoTW} = \beta_{HH} = \beta_{GG}$	0.00	0.02	0.01	0.01	0.00	0.32
Kleibergen-Paap Weak ID		13.43		35.58		13.08
Observations	594	594	523	523	585	585

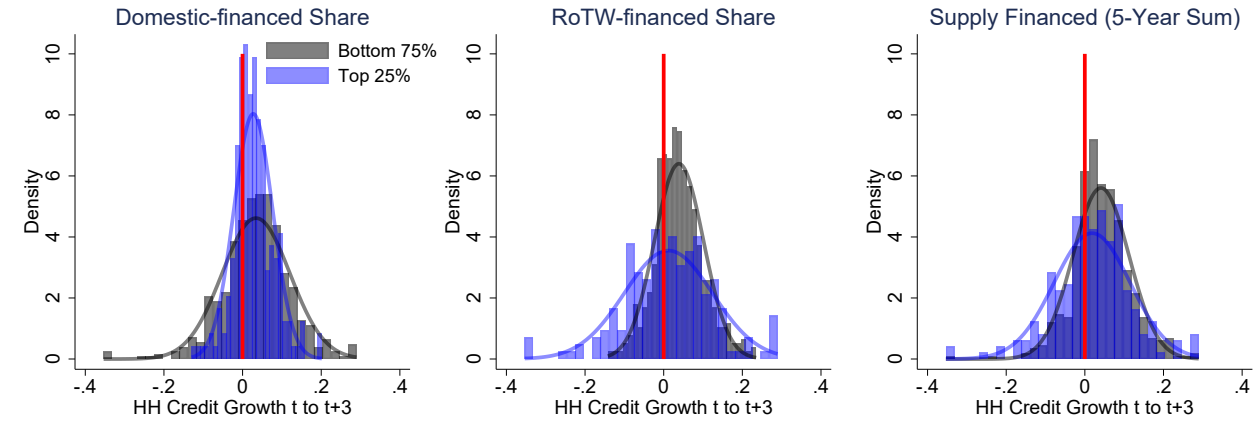
Notes: This table reports regression estimates of GDP growth forecast errors, returns on the bank index and changes in the real house price index between t to $t+3$ on changes in credit measures from $t-4$ to $t-1$. IV specifications use the supply shock measure as an instrumental variable for $\Delta_3 RoTW \to HH_{i,t-1}$. All specifications control for country fixed effects, non-financial credit and the current account. The reported p-value refers to a test for the equality of credit coefficients by different counterparty sector. Standard errors in parentheses are dually clustered on country and year. *,**,*** indicates significance at the 0.1, 0.05, 0.01 level, respectively.

house prices. As before, these findings hold in an IV-specification in column (6).

6. Foreign-financed household debt and business cycles: channels

How is foreign capital supply, that ends up financing domestic household credit expansions, linked to macroeconomic dynamics? In models of small open economies such as Schmitt-Grohé and Uribe (2016) low interest rates in international financial markets cause domestic credit booms and increase demand in the short run. While demand is partly satisfied through imports, domestic economic activity is reallocated towards the non-tradable sectors where prices and wages increase (Benigno et al., 2015; Bahadir and Gumus, 2016; Kalantzis, 2015). In the presence of reallocation frictions such as downward nominal wage rigidity, reversals in credit market conditions may then be associated with painful adjustments, especially if monetary policy cannot react. A high share of external financing for domestic credit exposes economies to these reversal dynamics. Furthermore, as argued in Drehmann et al. (2017), borrowing today comes with debt service payments in the future. When borrowing is financed by counterparties from abroad, this implies that future debt service payments will flow to foreigners. These transfers can reduce aggregate demand if constrained households have to reduce spending to make the payments. Foreigners receiving these payments, on the other hand, are less likely to spend this income domestically, and aggregate demand is reduced as a result. Several recent papers have highlighted such aggregate demand externalities and their effects (Korinek and Simsek, 2016; Farhi and

Figure 8: *Household credit expansion distributions, conditional on share of financing sector*



Notes: This figure shows the distribution of household credit expansion over the period t to $t+3$. The distribution is shown for two groups of observations. We compare observations with a high share (top quartile) of the respective financing source in total household credit in $t-1$, to all other observations and plot both distributions. We also overlay the respective normal distributions modeled on mean, standard deviation and range. The distributions are winsorized at the 0.5 and 99.5% levels.

Werning, 2016; Schmitt-Grohé and Uribe, 2016). In the following section, we take a closer look at the macroeconomic dynamics around credit expansions to study these channels in more detail.

6.1. Reversals

The strength of these channels should depend on reversals in international credit markets, capital account openness, and the ability to react with monetary policy. With open capital accounts, foreign-financed household credit measures the exposure of economies to reversals in the global credit cycle. To see how changes in domestic household credit depend on the counterparty financing credit, we plot in Figure 8 the distribution of future changes between t and $t+3$ in household credit to GDP, depending on the share of financing coming from domestic and foreign ultimate counterparties at $t-1$. In the left panel, we start with the distribution of household credit growth when the share of financing from domestic counterparties is in the top-quartile at $t-1$, and compare it to the distribution for all other observations. The figure shows that a high share of financing from domestic counterparties is associated with low dispersion in household credit growth over the following years – the top-25% distribution in blue is more concentrated than the gray bars covering all other observations. There is also very little mass in the negative domain of the distribution, meaning that household credit crunches are rare when household credit is financed domestically.

The results for observations with a high share of RoTW-financed household credit are strikingly different. The mean of household credit expansion from t to $t+3$ is shifted

slightly to the left, but more importantly, the dispersion is much higher with significantly more mass on large negative realizations. When a large share of household credit is financed from abroad, and therefore more exposed to global financial conditions, the frequency of credit crunches is significantly higher.

To isolate the supply driven component of foreign-financed household credit, we additionally include the supply measure of foreign inflows, summed over the years $t-5$ to $t-1$, and likewise bin the data based on the share at $t-1$.[13] The results, shown in the right panel, closely resemble the distributions from the middle panel. When the 5-year sum of foreign credit supply is in the highest quartile at $t-1$, the dispersion and the share of negative realizations of changes in household credit increase, reflecting higher volatility and a higher risk of future credit crunches.

6.2. Decomposition of GDP responses

To better understand the channels linking credit and business cycles, we then decompose GDP into its components distinguishing between consumption (of governments and households), investment, and net exports. We estimate the responses of each of these components to different types of credit expansion separately, based on the following specification

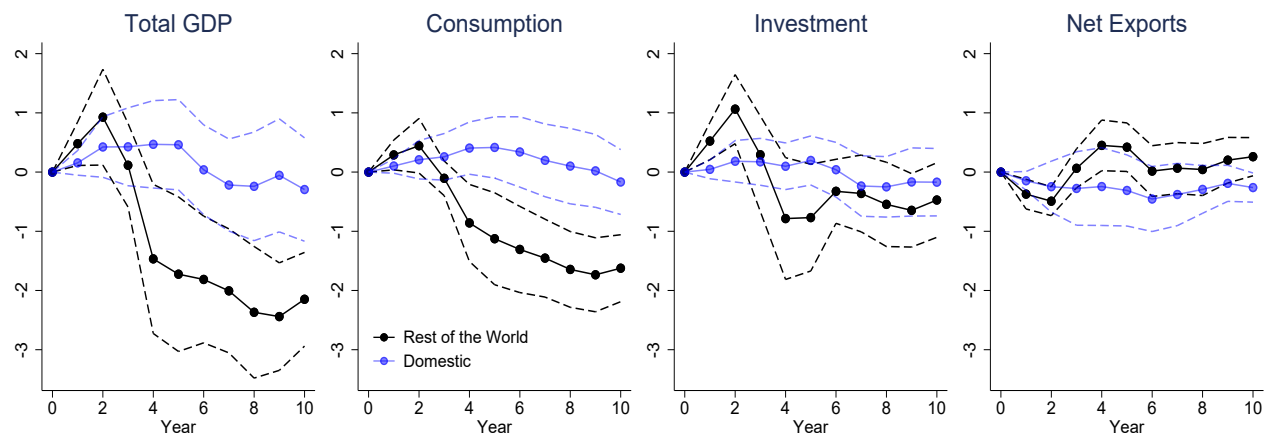
$$\frac{y_{it+h}-y_{it}}{GDP_{it}} = \alpha_{i,h} + \sum_{b\in B}\sum_{u\in U}\sum_{j=0}^{5}\beta_{h,j}^{u,b}\Delta C_{i,t-j}^{u\to b} + \sum_{j=1}^{5}\beta_{j}^{y}\Delta y_{i,t-j} + \gamma X_{i,t} + \epsilon_{i,t+h} \tag{7}$$

where the dependent variable is the change in the respective GDP component y between t and $t+h$ scaled by GDP at time t. Based on our previous results we distinguish between domestic and foreign counterparties ($u \in \{DM, RoTW\}$). We control for decomposed non-financial credit, lags of the dependent variable and changes in interest rates. In Figure 9 we show in blue responses to household credit expansion financed domestically (government and households) and in black responses to household credit financed by foreigners. For comparison, the left panel shows the response of total output. The black line closely corresponds to the estimate in the right panel of Figure 5, while the blue line contains both government- and household-financed household borrowing. The three right panels decompose the response of GDP into the responses of the individual GDP components. Since responses are normalized by GDP in year t they add up to the total response on the left (up to a small residual).

Starting with the largest component of GDP, the second panel shows that there is a significant difference in the response of domestic consumption to household credit financed

[13] We choose a five-year sum to better match the *flow*-based measure to the *levels* used in the other two panels.

Figure 9: *GDP component responses to changes in foreign and domestically sourced household credit*



Notes: This figure shows estimates of impulse responses of real GDP components (in%) to increases in the ratio of household credit to GDP financed by the rest of the world (black) and domestic counterparties, i.e. domestic households and the government (blue). Impulse responses are estimated based on Equation 7. Responses to foreign and domestic credit are estimated jointly. Dashed lines represent 95% confidence intervals computed based on standard errors dually clustered on country and year.

from abroad and domestically financed household credit. Foreign-financed household credit expansion is associated with a small, short-lived consumption boom that is followed by a decline in household consumption in the medium term. For horizons longer than four years, consumption growth is significantly lower. This response of consumption contributes significantly to the response of total GDP in the left panel.

The middle right panel shows that the boom and bust pattern following foreign-financed household credit expansions also has an investment component. An increase in foreign-financed household credit is followed by a short-lived investment boom (slightly stronger than for consumption). This boom lasts for two years, and reverses after year three.[14] For horizons larger than three years the response is close to zero and insignificant. The right panel shows that net exports decrease shortly, but reverse once the investment and consumption booms are over. These responses, in particular of consumption and investment, add up to create the patterns in total GDP shown in the left panel. Domestically-financed household credit expansion is, again, not associated with these dynamics.

6.3. The role of debt service payments

Zooming in on the strong response of consumption, the pattern seems consistent with a channel where households use foreign-financed credit to finance a short-lived consumption boom, but in the medium term debt service payments to foreign counterparties reduce households' disposable income and thereby aggregate demand. As argued in Mian et al.

[14]This investment cycle, however, does not directly relate to the productive capacity of the non-financial sector. A large share of increasing investment is investment into dwellings as shown in Table A7.11.

(2020b), the unveiling procedure not only assigns today's liabilities to a financing counterparty, but also contains information on the future flows of debt service and repayments. Financing by foreigners implies that future income flows abroad and is unlikely to be spent domestically. To study this channel, we compute household debt service payments flowing abroad, $Debt\ Service\ Ratio_{i,t}^{HH \to RoTW}$, using household sector debt-service-to-income ratios from the BIS debt service statistics (Drehmann et al., 2017) and multiplying them with the share of household credit ultimately financed from abroad[15]

$$DSR_{i,t}^{HH \to RoTW} = DSR_{i,t}^{HH} \times \frac{C_{i,t}^{RoTW \to HH}}{C_{i,t}^{HH}}. \tag{8}$$

Before turning to the relationship between debt service and GDP dynamics, we confirm in column (1) of Table 6 that this measure is increasing in foreign-financed household credit expansion. This relationship, however, holds by construction: we use foreign-financed household credit as an input to compute debt service flowing abroad. We hence include in our analysis the ratio of "primary incomes payable to the rest of the world" as a share of GDP from national accounting data.[16] This variable includes incomes from investment such as dividend and interest payments paid to foreign counterparties, capturing the payment streams associated with foreign financing of household credit.[17] We show in column (3) that this variable is increasing in foreign-financed household credit in a much larger sample (since the BIS debt service data is only available from 1999 onwards).[18] More broadly, this result serves as an additional validation of our unveiling approach: it shows that payment flows from national accounts data line up well with our unveiling results. In columns (2) and (4) we instrument foreign financed household credit with foreign capital supply. The relationship holds in both instances, with especially column (4) being noteworthy as it confirms the debt service channel through different datasets. Income streams to foreigners from national accounts are linked to our measure of foreign-financed household credit

[15] With a few small exceptions household credit in our data maps directly into the BIS statistics on domestic credit. Hence, this simple calculation provides a proxy for debt service payments to foreigners, not accounting for income of domestic intermediaries in the intermediation chain between households and foreigners, and it would over-/underestimate payments if there are systematic differences in interest rates/returns earned by foreign vs. domestic counterparties. As a simple sanity check, we confirm below that the measure calculated in Equation 8 is closely associated with income payments to foreigners from national accounting statistics.

[16] OECD classification code $D1\_D4NFRS2$.

[17] This variable also contains other payments associated with, e.g., compensation paid to foreign residents as well as reinvested earnings on FDI.

[18] We additionally report dynamic relationships in the left two panels of Figure A7.20 using local projections with changes in the DSR and in the ratio of primary income payments to the rest of the world relative to GDP as dependent variables. Both measures increase after foreign-financed household credit expansion. The binscatter in the rightmost panel of Figure A7.20 confirms that payment flows to the rest of the world are highly correlated with the computed $DSR_{i,t}^{HH \to RoTW}$.

expansion based on the unveiling exercise, which in turn is instrumented with a bank lending supply measure from bilateral BIS cross-border banking statistics.

We then study whether debt service payments flowing abroad weigh on future GDP growth. Importantly, we include debt service of households to domestic counterparties $DSR_{i,t}^{HH \to DM}$ and debt service of the non-financial corporate sector $DSR_{i,t}^{NF}$ as additional variables. The results in column (5) suggest a strong negative relationship between $DSR_{i,t}^{HH \to RoTW}$ and economic growth over the following years. The coefficient on $DSR_{i,t}^{HH \to DM}$ is negative, but far from magnitude and significance of the $DSR_{i,t}^{HH \to RoTW}$ coefficient. Borrowing from abroad, financially constrained domestic households have to reduce their spending to make debt service payments in the future. Foreigners receiving these debt service payments have a lower marginal propensity to spend domestically, and hence aggregate domestic demand is depressed. This result holds controlling for the lagged three-year changes in total household credit and non-financial credit, as well as current account and other capital inflows. In column (6) we instrument $DSR_{i,t}^{HH \to RoTW}$ with foreign capital supply and find our results confirmed.

In (7) and (8) we confirm that these findings also hold for the alternative measure of payments going to foreigners, which is available in a broader sample. A higher share of income paid to foreigners is associated with lower future GDP growth. This data also has the advantage that it allows for an additional check. With large two-way flows of financial capital, domestic households may also earn significant income on their foreign positions, and it may be the net position in payment flows that matters. Including this net position, however, does not affect the results in (7) and (8). One explanation could be that the domestic agents receiving these payment flows are less financially constrained and have a lower marginal propensity to consume out of their income earned abroad than households paying debt service to foreigners. This reinforces the importance of studying these channels based on gross financing of domestic credit instead of net capital flow measures.

Taken together, our results show that the boom- and bust dynamics in GDP following household credit expansions are driven by foreign-financed credit. A decomposition of GDP shows that the negative medium-term dynamics are mostly due to a negative response of consumption. These dynamics can be linked to debt service payments to foreigners, a channel that can only be identified in data reflecting gross external financing. Importantly, the p-values reported in Table 6 all demonstrate that payments to foreigners differ significantly from those to domestic agents in their effects on GDP growth.

Table 6: *Credit, debt service payments to foreigners, and economic activity*

	$DSR^{HH \to RoTW}_{i,t}$		$Pay \to RoTW_{i,t}$		$\Delta_3 ln(Y)_{i,t+3}$			
	OLS (1)	*IV* (2)	*OLS* (3)	*IV* (4)	*OLS* (5)	*IV* (6)	*OLS* (7)	*IV* (8)
$\Delta_3 RoTW \to HH_{i,t}$	0.12***	0.17***	0.06**	0.51***				
	(0.02)	(0.03)	(0.03)	(0.05)				
$DSR^{HH \to RoTW}_{i,t}$					-3.89***	-4.10***		
					(0.72)	(0.85)		
$DSR^{HH \to DM}_{i,t}$					-1.04	-0.95		
					(0.73)	(0.82)		
$DSR^{NF}_{i,t}$					0.03	0.03		
					(0.11)	(0.12)		
$Pay \to RoTW_{i,t}$							-0.74***	-1.82***
							(0.26)	(0.55)
$Net\ Pay \to RoTW_{i,t}$							0.04	-0.23
							(0.34)	(0.49)
Country fixed effects	✓	✓	✓	✓	✓	✓	✓	✓
LDV	✓	✓	✓	✓	✓	✓	✓	✓
Credit Controls	✓	✓	✓	✓	✓	✓	✓	✓
Additional Controls	✓	✓	✓	✓	✓	✓	✓	✓
Kleibergen-Paap Weak ID		29.52		14.87		16.66		14.96
p-value, $\beta_{RoTW} = \beta_{HH} = \beta_{GG}$	0.00	0.00	0.04	0.00				
p-value, $\beta_{RoTW} = \beta_{DM} = \beta_{NF}$					0.00	0.00		
p-value, $\beta_{RoTWPay} = \beta_{RoTWNet}$							0.08	0.00
Observations	235	235	671	657	265	265	632	618

Notes: The dependent variables in (1) to (4) are levels of household debt service to foreign counterparties ($DSR^{HH \to RoTW}_{i,t}$) and payments to the RoTW relative to GDP. The dependent variable in (5) to (8) is GDP growth from t to $t+3$. LDV refers to the third lag of the dependent variable. Credit controls include household credit financed by domestic sectors from (1)-(4) and total household credit from (5) - (8) as well as non-financial credit from (1) to (8). Additional controls include the current account and inflows not financing household credit. Standard errors in parentheses are dually clustered on country and year. *,**,*** indicates significance at the 0.1, 0.05, 0.01 levels, respectively.

6.4. Non-linearity and policy dependence

Building up these vulnerabilities and getting more exposed to reversals, the link between foreign-financed household debt and subsequent macroeconomic performance should be more pronounced for increases in indebtedness, than for decreases. In column (2) of Table 7 we show that our baseline coefficient, repeated for comparison in (1), is indeed driven by increases rather than decreases in foreign-financed household debt. Table A7.10 in the appendix contains the full set of interactions and shows that this non-linearity does not exist for any of the other counterparties. In column (5) we show that these results extend to unemployment as a dependent variable. In Schmitt-Grohé and Uribe (2016) these negative consequences are triggered by hard-to-reverse reallocation dynamics towards non-tradeable sectors during the boom that are associated with adverse outcomes when credit conditions reverse. Such reallocation dynamics are identified by Mian et al. (2020a) and Müller and Verner (2021). Table A7.11 shows that foreign-financed household credit expansions are also associated with such reallocation patterns. However, there is

Table 7: *State dependence and non-linearity*

	$\Delta_3 ln(Y)_{i,t+3}$			$\Delta_3 Unemployment_{i,t+3}$		
	(1)	(2)	(3)	(4)	(5)	(6)
$\Delta_3 RoTW \rightarrow HH_{i,t-1}$	-0.82***		-0.93***	0.23***		0.24***
	(0.18)		(0.18)	(0.04)		(0.04)
$\Delta_3 RotW \rightarrow HH_{i,t-1} * 1(\geq 0)$		-1.19***			0.28***	
		(0.28)			(0.07)	
$\Delta_3 RotW \rightarrow HH_{i,t-1} * 1(< 0)$		0.23			0.11	
		(0.42)			(0.08)	
$\Delta_3 RoTW \rightarrow HH_{i,t-1} \times Floating$			0.96***			-0.19**
			(0.28)			(0.08)
R^2	0.348	0.384	0.371	0.450	0.455	0.459
Country fixed effects	✓	✓	✓	✓	✓	✓
LDV	✓	✓	✓	✓	✓	✓
Credit Controls	✓	✓	✓	✓	✓	✓
Current Account	✓	✓	✓	✓	✓	✓
p-value, $\beta_{RoTW}(\geq 0) = \beta_{RoTW}(< 0)$		0.03			0.18	
Observations	667	667	667	623	623	623

Notes: The dependent variables are the growth of real GDP and the change in the unemployment rate between year t and $t+3$. Credit variables are expressed as lagged three-year changes in the ratio to GDP. LDV are distributed lags of the dependent variable. Credit controls contain household credit financed by domestic sectors and non-financial credit. In columns (2) and (5) we test for potential non-linearity in the relationship between credit and the business cycle, by estimating separate coefficients for positive and negative changes in household debt ultimately financed by foreigners. Floating is a dummy for economies with a floating exchange rate regime. The dummy-coefficient itself is included in the model, but small and insignificant. Standard errors in parentheses are dually clustered on country and year. The reported p-value refers to a test for the equality of coefficients for the three household credit by counterparty variables. *,**,*** indicates significance at the 0.1, 0.05, 0.01 levels, respectively.

no strong difference to domestically financed household credit expansion. Intuitively, the funding source is less important for the reallocation patterns, which mainly depend on the borrowing counterparty.

The links between reversals in credit market conditions and debt service on the one hand and aggregate demand and output on the other, could be countered by monetary policy. However, due to the open economy trilemma, this option is only available to policymakers in floating rate countries. Without floating exchange rates, countries do not have this margin of adjustment. Column (3) in Table 7 contains an interaction of foreign-financed household credit expansion and a dummy for floating rate exchange rate regimes. The coefficient for this interaction is positive and of the same magnitude, suggesting that the effects of foreign-financed household credit expansion can be offset in floating exchange rate regimes. Column (6) shows a similar relationship for changes in unemployment.

7. Conclusions

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. And it matters. Credit to the domestic

household sector ultimately financed with inflows driven by capital supply from abroad is associated with domestic boom and bust cycles. 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. Some of these relationships were previously documented separately for credit expansions and (less robustly) for capital flows, but they are strongest when the two measures both reflect the same underlying balance sheet dynamics and associated future flow of payments.

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

Figure A1.1: *Instrument holdings by Sector: Spain*

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

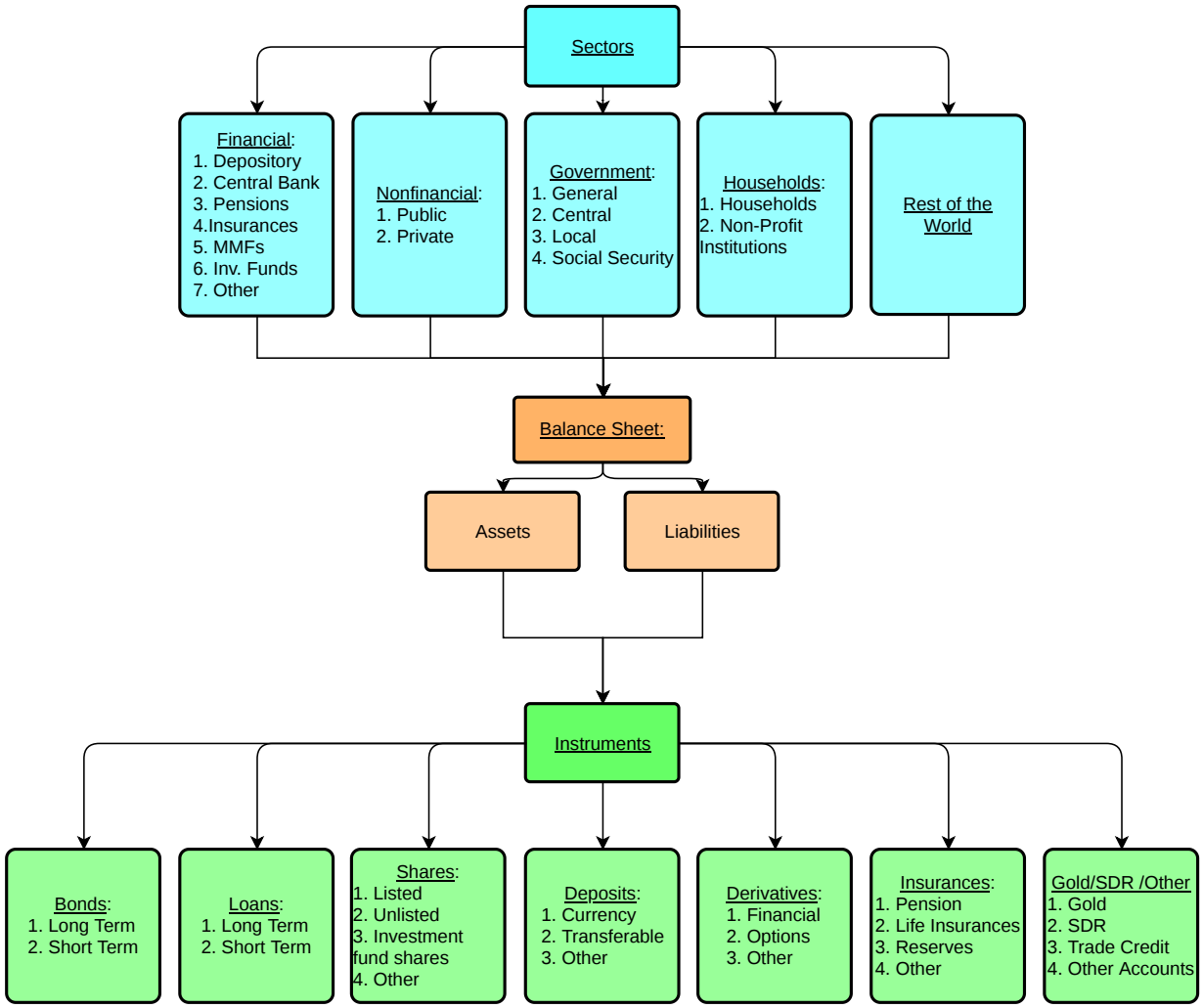
OUTSTANDING FINANCIAL ASSETS AND LIABILITIES OF FINANCIAL INSTITUTIONS

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 financial instrument, the Golden Books data often includes some counterparty information, i.e. the counterparty sector for an asset or liability position, as can be seen here for the example of Spain between 1981 and 1988.

Figure A1.2: *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 their respective subsectors, 2.) the split into asset and liability positions and 3.) in which financial instruments these positions are recorded.

Table A1.1: *Year range by country and dataset*

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

A2. Unveiling Approaches

This section describes our unveiling methodologies, with different approaches relaxing or altering key assumptions of our baseline.

A2-1 Proportional Unveiling (Baseline)

Which counterparty sectors ultimately finance credit to households and firms? This section describes our baseline procedure to answer this question in greater detail. In line with Mian et al. (2020b), we assume that ultimate counterparty sectors (u) can be domestic households, the government or the rest of the world ($u \in \{HH, GG, RoTW\}$). Corporate sectors (c) that cannot be ultimate counterparties and have to be unveiled are non-financial and financial corporations ($c \in \{NF, FI\}$). We use information on sectoral asset and liability composition to allocate loans to the ultimate counterparties providing financing.

Step 1: Our 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 liability composition of any given sector, while observing the asset composition of all other sectors. Without detailed counterparty information, we allocate liabilities proportionally to the sectoral distribution in holdings of this instrument on the asset side. For example, we allocate the deposits, used by the financial sector to finance loans, to a counterparty 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 (excluding deposits held as financial intermediary assets), we assign 70% of the deposit liabilities of the financial sector to the household sector.

More generally, we want to measure the bilateral claims held by financing sector s against borrowing sector r through financial instrument i, denoted as $\omega_i^{s \to r}$, for each sectoral creditor (holder)-borrower (issuer) pair. This information is observable in counterparty data (for some instruments i), but it is generally not available in our large panel of countries. The key assumption, when estimating these pairwise financing relationships, is that for a given financial instrument i the mix of financing sectors is the same across borrowing sectors and can be computed based on the proportional asset holdings of the other sectors.[19] Using this assumption, we estimate claims in instrument i held by counterparty sector s against recipient sector r as

$$\widehat{\omega}_i^{s \to r} = \frac{A_{i,s}}{\sum_{s \neq r}^{S} A_{i,s}} L_{i,r}, \tag{9}$$

[19] This assumption is used in Vom Lehn and Winberry (2022) and by the BEA to construct sectoral capital-flows tables.

where $(r, s) \in \{HH, GG, RoTW, NF, FI\}$ can be the borrowing and the supplying counterparty sectors, and i the instrument through which r has raised and s has provided financing. Instruments (i) can be deposits, bonds, loans, shares, insurances and pensions, gold and SDRs, derivatives and options, or other accounts. $A_{i,s}$ and $L_{i,r}$ are assets and liabilities of sectors s and r in instrument i respectively. We can then compute the sum over all financial instruments for directed sectoral pairs $\widehat{\omega}^{s \to r} = \sum_i^I \widehat{\omega}_i^{s \to r}$.

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

Intuitively, our approach will work best, when instruments are held predominantly by one sector. In our example above: if households are the only owner of deposits in the economy, we will allocate deposits correctly. It is therefore an advantage that asset and liability composition differ substantially across sectors. However, we will validate our results using two alternative approaches. First, if we observe $\omega_i^{s \to r}$ directly in the data, the allocation procedure becomes obsolete, allowing us to validate our baseline results for the part of the sample where this information is available. In a second exercise we compare our baseline to estimates where we using different assumptions in the computation of $\widehat{\omega}^{s \to r}$.

Step 2: We want to determine the ultimate counterparty of household and non-financial corporate credit, i.e. we want to estimate $C^{u \to b}$ with u being the ultimate supplying sector ($u \in \{HH, GG, RoTW\}$) and b the borrowing sector ($b \in \{HH, NF\}$). While we calculated the direct link above, we need to account for indirect links, which turn out to be very important in the data as most credit is intermediated. These indirect links can take two forms. First, borrowers and u-sectors could be linked via one intermediary, e.g. domestic households holding deposits of financial intermediaries which then lend to other households. Second, there could be more than one intermediation step: e.g., consumer loans to the household sector by the NF sector could be financed with loans from FIs.

To correctly assign credit to the ultimate counterparty, we estimate the total holdings of u-sectors in intermediary corporate c-sectors ($c \in \{NF, FI\}$), as the sum of direct holdings in the respective c sector, calculated in Equation 9 and indirect holdings channeled through the other c-sector c'. The second part of Equation 10 computes the claims of sector u against sector c channeled through c' via instrument i. Adding up the direct and intermediated

(indirect) holdings yields the total assets $\widehat{\Omega}_i^{u\to c}$ in the two intermediary sectors for our three final suppliers of capital:

$$\widehat{\Omega}_i^{u\to c} = \underbrace{\widehat{\omega}_i^{u\to c}}_{direct} + \underbrace{\frac{\widehat{\omega}^{u\to c'}}{\sum_u \widehat{\omega}^{u\to c'}}\widehat{\omega}_i^{c'\to c}}_{indirect}. \tag{10}$$

For loans to the corporate non-financial sector the unveiling ends with this step. For consistency with household credit we denote the special case of $\widehat{\Omega}_{Loans}^{u\to NF}$, identifying loans to the non-financial corporate sector financed by ultimate sector u, as $C^{u\to NF}$.

Step 3: To determine the final holders of household debt, one more step is neccessary, distributing credit from the two c-sectors to households between the three u-sectors. The total funds supplied by sector u to the household sector are then calculated as the sum of indirect and direct claims on the household sector[20]

$$C^{u\to HH} = \sum_c \frac{\widehat{\Omega}^{u\to c}}{\sum_u \widehat{\Omega}^{u\to c}}\widehat{\omega}^{c\to HH} + \widehat{\omega}^{u\to HH}. \tag{11}$$

Note, that the liabilities of the household sector almost exclusively consist of loans, so that we do not use a subscript for $i = Loans$. Corporates, on the other hand, also borrow using other financial instruments. Here, we want to focus on corporate loans to be able to allow comparisons with other datasets and results in the literature. Consequently, we focus on funds recorded as loans on the liability side of non-financial sector balance sheets and express this as $C^{u\to NF}$.

A2-2 Counterparty Unveiling

For robustness, we employ counterparty unveiling using three different sources of data: the historical 'Golden Books' published by the OECD, the 'who-to-whom' matrices of the European Central Bank and data newly made available under the System of National Accounts 2008 (SNA08) provided by the OECD on its website. These data contain counterparty information, i.e. a breakdown of counterparty sectors for a given financial instrument (on the asset or liability side of the balance sheet. This *counterparty data* is available from these datasets for a subset of countries, time periods, and financial instruments. Counterparty data makes step 1 of our baseline procedure obsolete, since we observe $\omega_i^{s\to r}$ directly in the data and do not have to estimate it. There are two potential ways to obtain information

[20]Note that the direct link $\widehat{\omega}^{u\to HH}$ only plays a role for government claims on the household sector as we have set $\widehat{\omega}_i^{RoTW\to HH} = 0$ and direct loans between households are not recorded in the financial accounts (and likely to be small), i.e. $\omega_{Loans}^{HH\to HH} = 0$. Direct lending relationships between households are not recorded in financial accounts.

about $\omega_i^{s\to r}$, where having information on one is sufficient. As an example, assume the domestic financial sector records loans on the asset side by counterparty sector. Even without the household sector reporting counterparties, we know which part of its liabilities was funded by the domestic financial sector through loans. Consequently, we can 'fill' this household counterparty with the information available in the data. Formally:

$$\omega_i^{s\to r} = \omega_i^{T,r\leftarrow s} \tag{12}$$

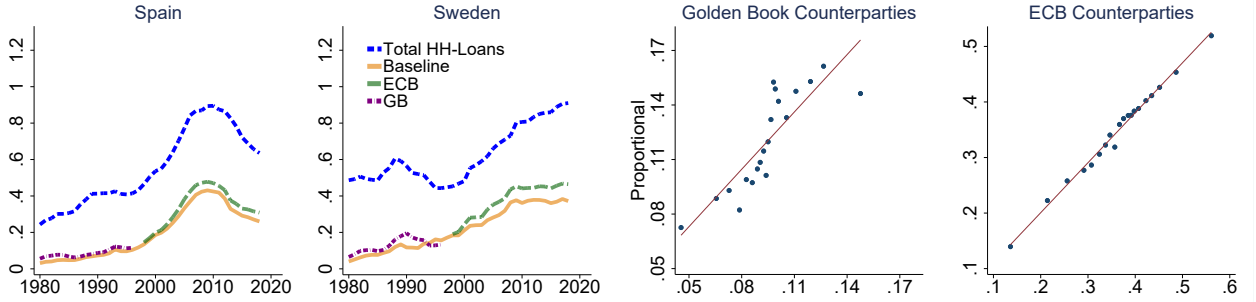
where $\omega_i^{s\to r}$ denotes the bilateral claims held by financing sector s against borrowing sector r through financial instrument i and sectors can be $(r, s) \in \{HH, GG, RoTW, NF, FI\}$. Correspondingly, $\omega_i^{T,r\leftarrow s}$ represents the transposed relationship where the receiving sector r reports the liabilities it owes to the financing sector s.

Counterparty information is often available only for a subset of the data, i.e. only for some of the reported sectors or financial instruments. In that case, for the remaining relationships, we can exploit the fact that bilateral claims that are observed in the data, must not be assigned to another counterparty during the unveiling process. The assets held by sector s against r through instrument i, $\omega_i^{s\to r}$ cannot be part of the estimated assets of sector s against any other sector. Consider again the example of a loan extended from the domestic financial sector to households recorded as a counterparty. This loan is already allocated to households and thus must not be assigned to any other counterparty. Only the remaining loans on the liability side of household balance sheets or the remaining loans on the asset side of the financial sector can, if needed, be allocated proportionally. Using this reasoning, any counterparty information improves the accuracy of the unveiling. To implement this, we subtract the amounts observed in counterparty relationships from the corresponding asset positions of the supplying sector s and the liability position of the receiving sector r.

The remainders are allocated using equation Equation 9 to the remaining positions of other sectors with incomplete counterparty information. When counterparties are complete, this term will simply be zero. We can then use observable counterparty data $\omega_i^{s\to r}$ and pairwise holdings estimated from the unallocated assets and liabilities $\widehat{\omega}_i^{s\to r}$ to apply our unveiling approach.

The two left panels of Figure A2.3 quantify the results using the ECB 'who-to-whom'-matrices and the historical golden book data for Spain and Sweden respectively, showing foreign-financed household credit relative to GDP using the baseline approach and the results from the counterparty data approaches. In both cases. levels and dynamics are very similar using the baseline and the counterparty data approaches. If anything it seems like the baseline approach in yellow yields more conservative results, with counterparty data

Figure A2.3: *Household debt financed by the rest of the world, proportional and counterparty unveiling*



Notes: The two left panels show the development of household debt financed by the rest of the world using different unveiling approaches. The short-dashed (blue) line corresponds to total outstanding household debt as a fraction of GDP for comparison. The solid (yellow) line is household debt ultimately financed by the rest of the world based on our baseline unveiling approach. The dotted (purple) line corresponds to an estimate using historical counterparty information. The dashed (green) line employs counterparty data from the ECB financial accounts. The two right panels compare the results using the baseline 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 20 equal sized bins. Each point represents the group specific means of household credit financed by the rest of the world relative to GDP using the baseline and the respective counterparty approach after controlling for country fixed effects. Fitted regression lines illustrate the correlation.

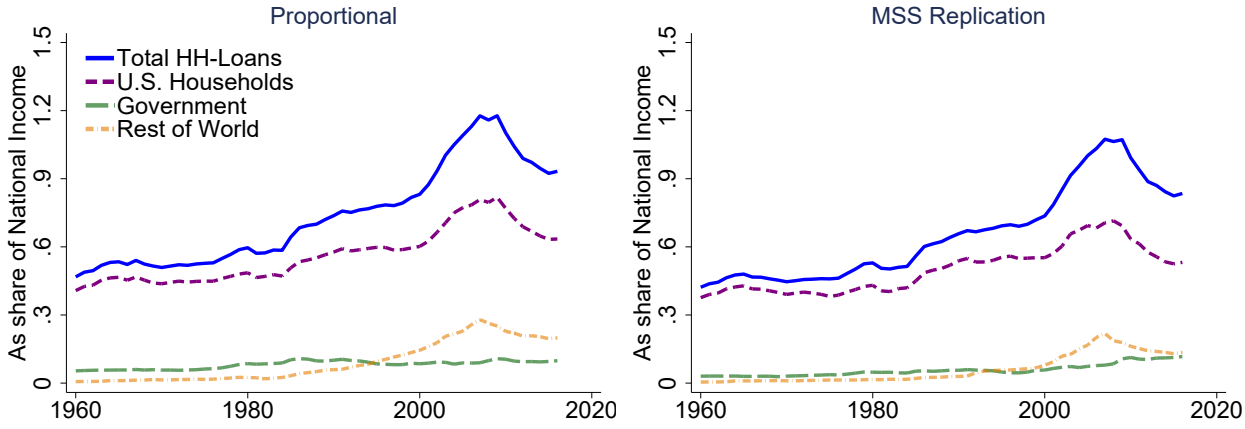
showing stronger increases around the 2008 crisis in both countries, and for the crisis in the early 1990s in Sweden. The binned scatterplots in the two right panels show that this strong mapping extends to the full sample.

A2-3 Subsector Unveiling

Our baseline procedure treats the financial sector as a single entity, where it does not matter through which entity or subsector funds enter the financial system. The data, however, sometimes includes additional breakdowns by subsector within the financial sector. Our subsector approach exploits this data by looking at the funding of each financial subsector individually. We calculate the weighted average financing of every instrument on the asset side of the total financial sector, given the financing structures of its subsectors. This means that the liability composition of the subsector that holds most loans, now matters most when assigning loans to ultimate holders. In doing so we assume, that funds are not channeled between financial subsectors at all, but exit the financial sector through the same subsector that raised them. The subsectors included in this approach are: Monetary Financial Institutions (MFI), Investment Funds (IF), Insurances and Pension Funds (IPF) and Other Financial Intermediaries (OFI). These four subsectors together add up to the total financial sector.

To unveil the ultimate holders of funds loaned out to households we start by calculating how much a subsector contributes to the assets of the total financial sector for any instrument i in Equation 13. We use this share as the weight a subsector has in holdings of a given instrument.

Figure A2.4: *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.

$$\theta_{s,i} = \frac{A_{s,i}}{\sum_s^S A_{s,i}} \tag{13}$$

with $\theta_{s,i}$ representing the share a subsector s holds in the total assets of the financial sector in instrument i. Included instruments are deposits, bonds, loans, shares, insurances and pensions, gold and SDRs, derivatives and options. To emphasize the difference between instruments on the asset and liability side of financial subsectors, instruments on the liability side are labeled j in the following equations. In Equation 14 we calculate the share that each instrument contributes to the total funding (i.e. the liabilities) of any subsector

$$\phi_{j,s} = \frac{L_{j,s}}{\sum_j^I L_{j,s}}. \tag{14}$$

$\phi_{j,s}$ now represents the share an instrument j contributes to the total liabilities of a financial subsector s. These two shares allow us to calculate the weighted average financing for each instrument on the asset side of the total financial sector:

$$\psi_{i,j} = \sum_s^S \theta_{s,i} \times \phi_{j,s}. \tag{15}$$

The left hand side $\psi_{i,j}$ now corresponds the share of instrument i on the asset side that is financed by instrument j. This captures the heterogeneity in financial sector balance sheets, as it is now possible for assets in the form of loans, bonds and shares to be financed by different liability compositions if they are held by different subsectors. These liabilities in turn might then be held by a different set of supplying sectors, leading to a potentially

different allocation of household loans to ultimate suppliers of funds. Equation 16 first transforms instrument financing shares $\psi_{i,j,s}$ into nominal values, by multiplying them with the total assets in instrument i by subsector s. Adding up these values over all subsectors delivers the amount of asset i being held by the entire financial sector financed with instrument j.

$$\widehat{\Psi}_{i,j} = \psi_{i,j} \sum_{s}^{S} A_{s,i}, \tag{16}$$

$\widehat{\Psi}_{i,j}$ consequently refers to the estimated nominal amount of instrument i on the asset side of the financial sector, that is financed by instrument j. From here on, we follow Equation 9 - Equation 11, with the deviation, that wherever the financial sector is concerned, we substitute $\widehat{\Psi}_{i,j}$ for $L_{FI,j}$ (the liabilities of the financial sector in instrument j are labelled with i in the baseline unveiling). Summing $\widehat{\Psi}_{i,j}$ over j yields the total assets of the financial sector in instrument i, while summing $\widehat{\Psi}_{i,j}$ over i gives the total liabilities of the financial sector in instrument j.

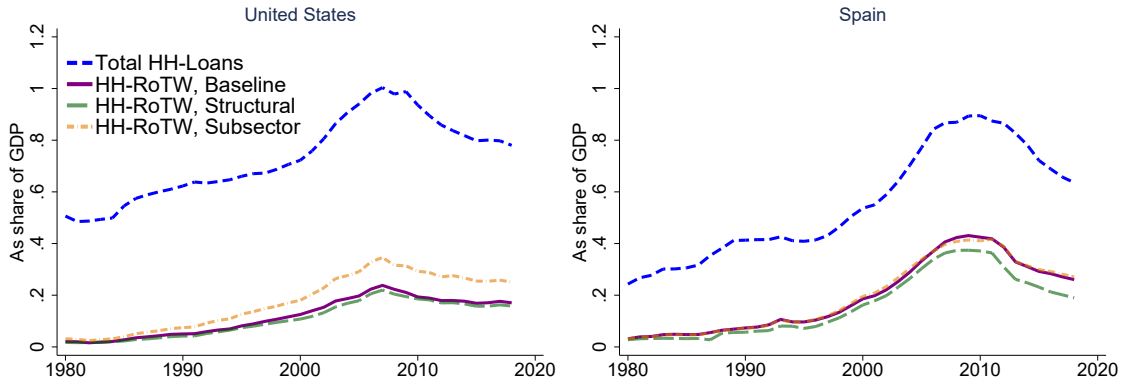
While the subsector unveiling marks the lower bound of financial intermediation, our baseline implicitly assumed that funds are channeled between subsectors often enough to render all subsector-specific funding differences irrelevant. It marks, in other words, the upper bound of financial intermediation within the financial sector. Figure A2.5 plots the results of the two approaches together. For the US, the subsector approach delivers a higher estimate for household credit ultimately financed by the foreign sector than our baseline, while for Spain the two are almost identical. If anything, this confirms that our baseline is on the conservative end of the spectrum when estimating the importance of foreign credit to households. The left panel of Figure A2.6 quantifies the comparison between subsector and proportional unveiling, showing that on average differences are marginal.

A2-4 Structural unveiling: imposing the structure of US flow of funds

Mian et al. (2020b) use detailed data on US financial accounts to allocate household debt to ultimate holders. While we normally have less information in the panel data, we can impose the structure of the US financial accounts on other countries. In this approach, the financial sector is divided into depository corporations, pensions, insurances, mutual funds, central banks and other financial institutions or pass throughs. The structure changes the assumption of proportional allocation of funds to a hierarchy in which each sector has bilateral relations with only a limited number of other sectors.

Starting with the total amount of household liabilities we go through seven separate stages (we mirror the structure from Mian et al. (2020b)), ending again with the three

Figure A2.5: *Alternative unveiling approaches*



Notes This figure shows total household debt and household debt ultimately financed by the foreign sector using three unveiling approaches. The dashed blue line is total household debt relative to GDP. The solid purple line is the share of household debt ultimately financed by the rest of the world, 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.

ultimate holders u ($u \in \{HH, GG, RoTW\}$). The key to this approach is that at each of the seven stages, only a limited number of sectors is permitted to hold claims on the sector that is being unveiled at that stage. Inside the given hierarchy the assumption of proportionality is maintained. This means, that the sectors identified by Mian et al. (2020b) to hold household debt in the first round of unveiling, are required to distribute all household debt between them. They in turn get unveiled in the second stage, but only between the sectors that have been identified to hold the respective first stage sectors. Any household debt held by 'first stage sectors' is distributed between the 'second stage sectors' that own them

$$\widehat{\omega}_{s\to r\to HH} = \widehat{\omega}_{r\to HH} \times \frac{\widehat{\omega}_{s\to r}}{L_r}. \tag{17}$$

The left hand side represents household debt held by sector s through sector r which is equal to household debt held by sector r multiplied with the share of sector r held by sector s. In later stages of the unveiling process, any sector s that is not one of the three final sectors (HH, GG, RoTW), will be unveiled itself. In this case the total household debt accumulated by s up to that point is summed and divided between the sectors that are permitted to hold assets in s. Table Table A2.2 shows the seven stages of the unveiling with r being the sector being unveiled at a given stage and s being the sectors between which it is distributed.

Table A2.2: *Structural Unveiling Steps*

Stage	r **(Receiving- \ Sector being unveiled)**	s **(permitted supplying sectors)**
1	Total Household Debt	Government, Other financial Institutions (Pass-throughs), Depository Corporations
2	Other financial Institutions (Pass-throughs)	Rest of the world, Government, Insurances and Pensions, Central Bank, Money Market Funds, Investment Funds, Depository Corporations, Households
3	Central Bank	Rest of the world, Government, Depository Corporations
4	Money Market funds, Investment Funds	Rest of the world, Government, Insurances and Pensions, Households
5	Depository Corporations	Rest of the world, Government, Insurances and Pensions, Non-financial Institutions, Households
6	Non-financial Institutions	Rest of the world, Government, Insurances and Pensions, Households
7	Insurances and Pensions	Rest of the world, Government, Households

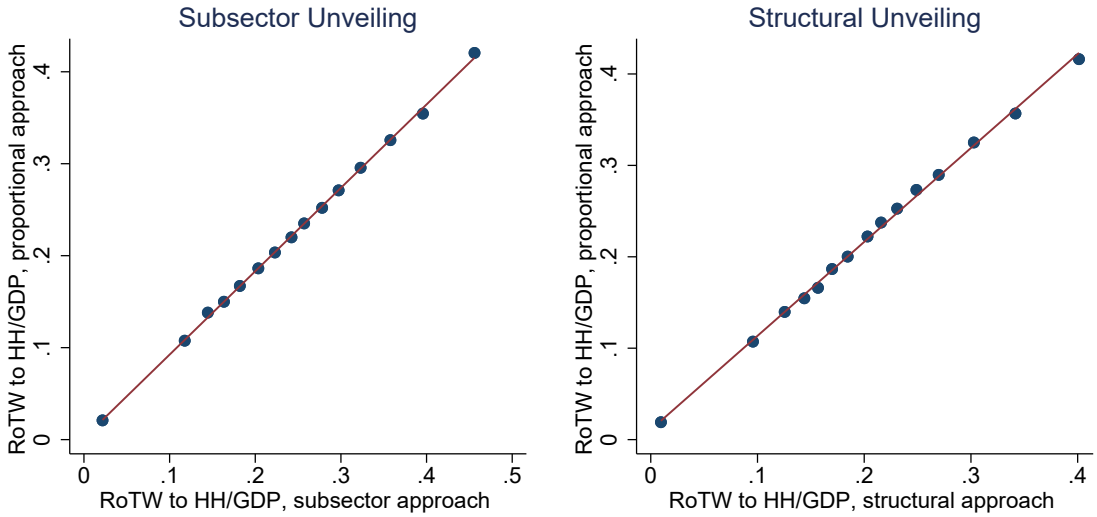
Finally, the household debt accumulated by the three ultimate sectors $u \in \{HH, GG, RoTW\}$, i.e. the ones that are not themselves divided between other sectors, is summed up

$$C^{u \to HH} = \sum_{r}^{R} \widehat{\omega}_{u \to r \to HH}. \tag{18}$$

In cases where an ultimate sector is not among the supplying sectors at a certain step of the unveiling (i.e. $u \notin S$ for r), the position within the sum on the right hand side is zero.

Figure A2.5 shows in blue total household debt, in green our estimate imposing the structure described above, in purple our proportional baseline and in yellow the results from subsector unveiling, for the United States and Spain. The difference between proportional and structural unveiling is virtually indistinguishable for the US. This is unsurprising, given that the structure was derived from the US financial sector. For Spain, the results differ marginally, hinting at homogeneous, if not identical structures in advanced OECD economies. The right panel of Figure A2.6 shows this result for all instances where unveiling imposing this structure is possible. Again, differences are marginal on average.

Figure A2.6: *Proportional compared to subsector and structural unveiling*



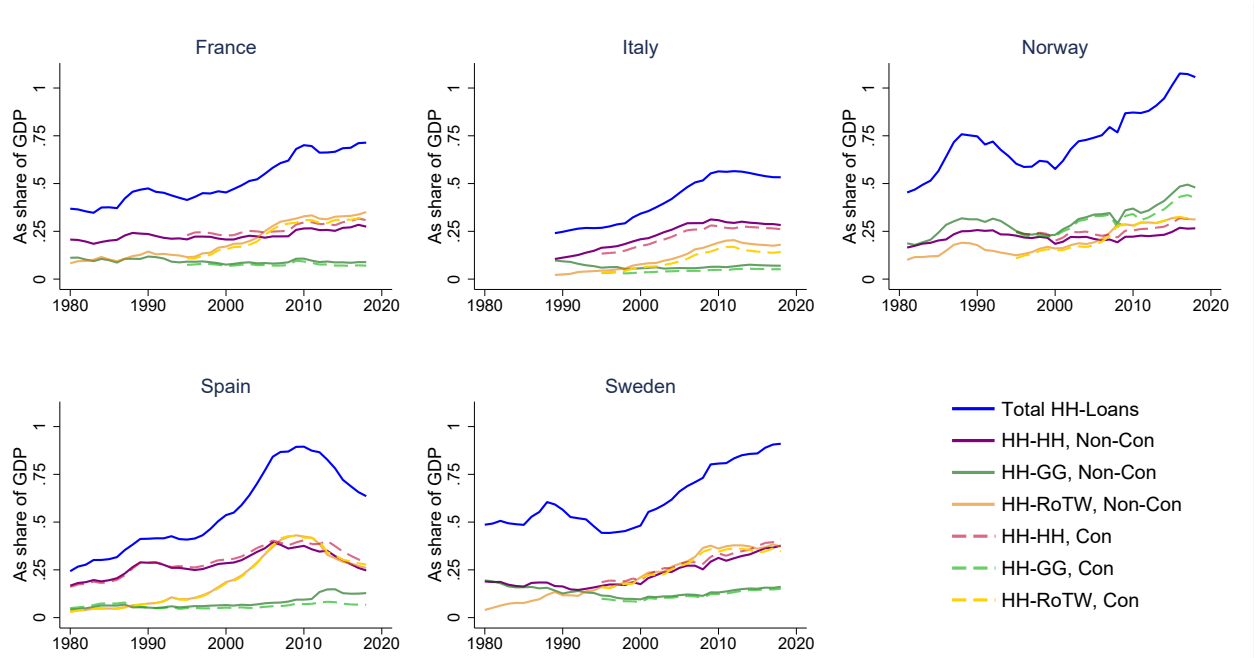
The figure shows the relationship between estimates of household credit funded by the foreign sector using different unveiling approaches. The left panel compares the results using the proportional approach to results using detailed subsector information in recent OECD data. The right panel compares our baseline to results using the structural approach derived from Mian et al. (2020b). Bins are constructed as in Figure A2.3.

A2-5 Additional OECD Data: Counterparty and Consolidated

For further verification we replicate our results using the consolidated data series from the OECD System of National Accounts 2008 (SNA08). Using our proportional unveiling with consolidated data, we plot the results against our baseline with non-consolidated data in Figure A2.7, showing that the results are almost identical across datasets. This is quantified in the left panel of Figure A2.8.

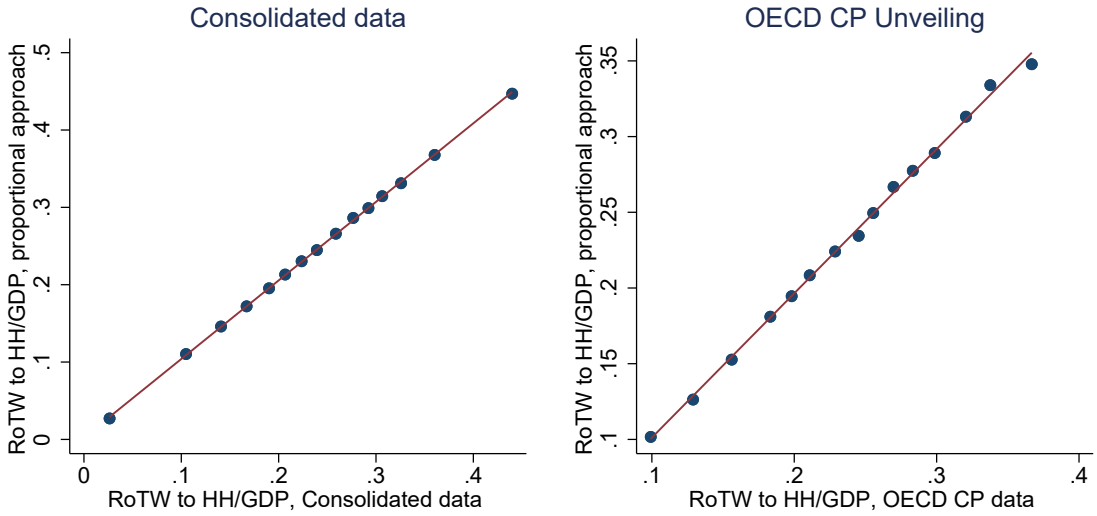
The OECD has also made available a new counterparty dataset under the SNA08 format, but so far, only a few countries are retrievable. We employ our previously described counterparty unveiling on this subset of countries and plot them against our baseline in the right panel of Figure A2.8. While the results again confirm our baseline results, this figure is not representative for the majority of our data, as the required information is only available for a very small subset.

Figure A2.7: *Household debt financing sources, Non-Consolodiated and Consolidated Data*



Notes: The figure compares sectoral sources of household debt for a number of countries using OECD data and the baseline unveiling approach. The solid lines represent the non-consolidated data used throughout our analysis. The dashed lines represent consolidated data from the same source. Since historical sources report non-consolidated data, the consolidated series generally start at a later point in time.

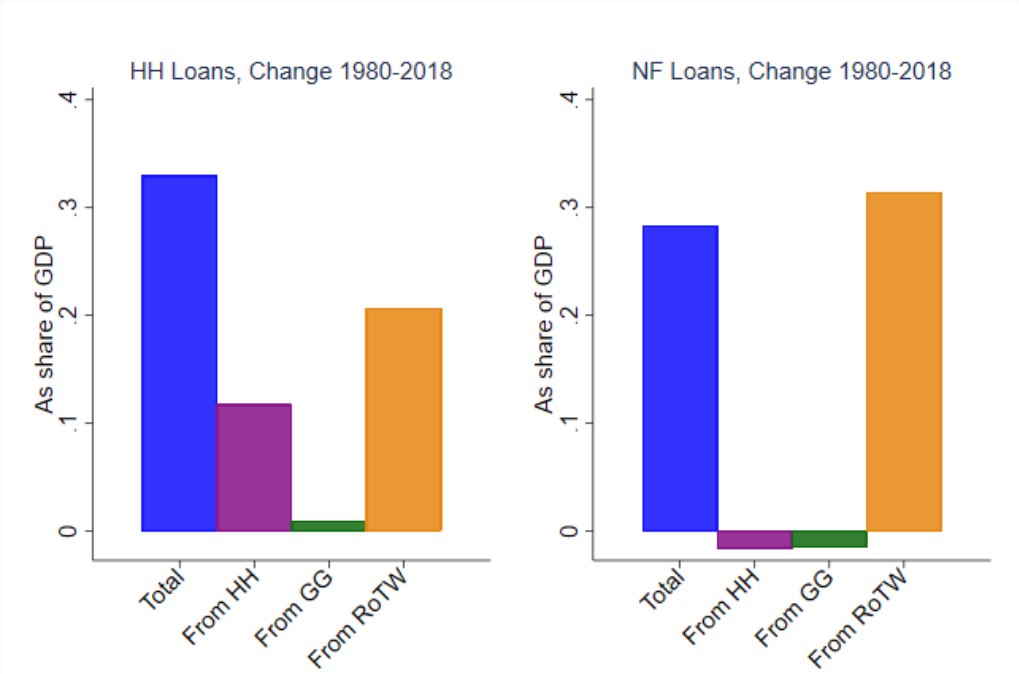
Figure A2.8: *Proportional compared to Consolidated and OECD Counterparties*



The figure shows the relationship between estimates of household credit funded by the foreign sector using different unveiling approaches. The left panel compares the results using the proportional approach to results using the proportional approach on the OECD consolidated Financial Statistics. The right panel compares our baseline to results using recent counterparty information provided by the OECD for selected Countries. Bins are constructed as in Figure A2.3.

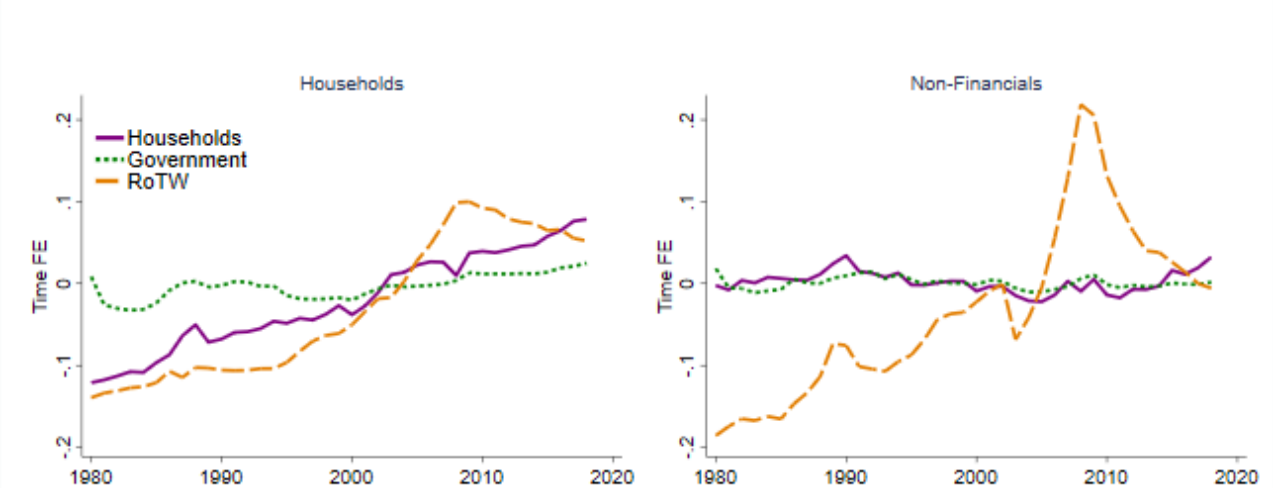
A3. The Changing Nature of Credit Intermediation

Figure A3.9: *Change in credit by source*



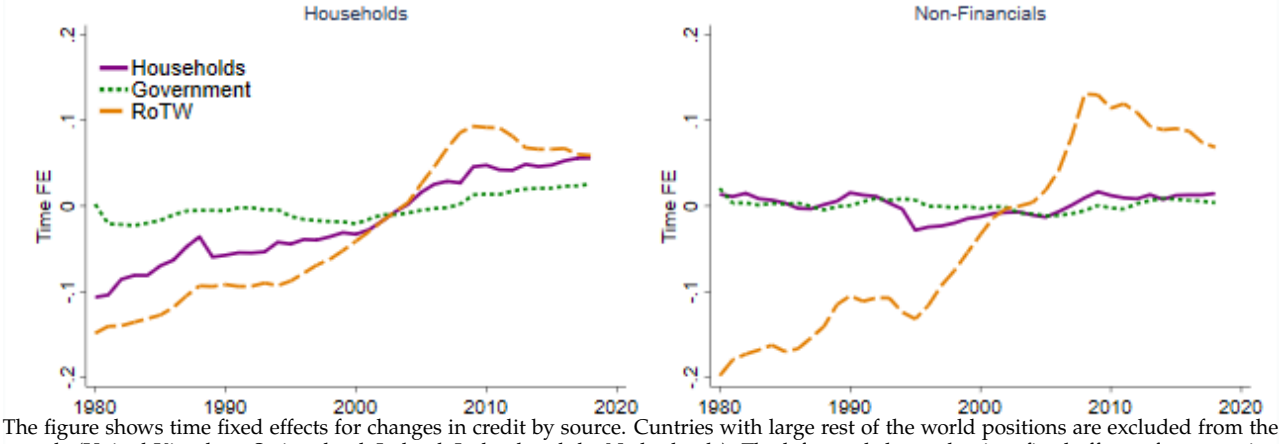
Notes: The figure shows the growth of credit by funding source from 1980 to 2018. The left panel shows the change in household credit to GDP and how much of this change was financed by the household sector, the government or the rest of the world. The right panel shows the change in loans to the corporate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

Figure A3.10: *Time trends in credit by source, excluding Euro area countries*



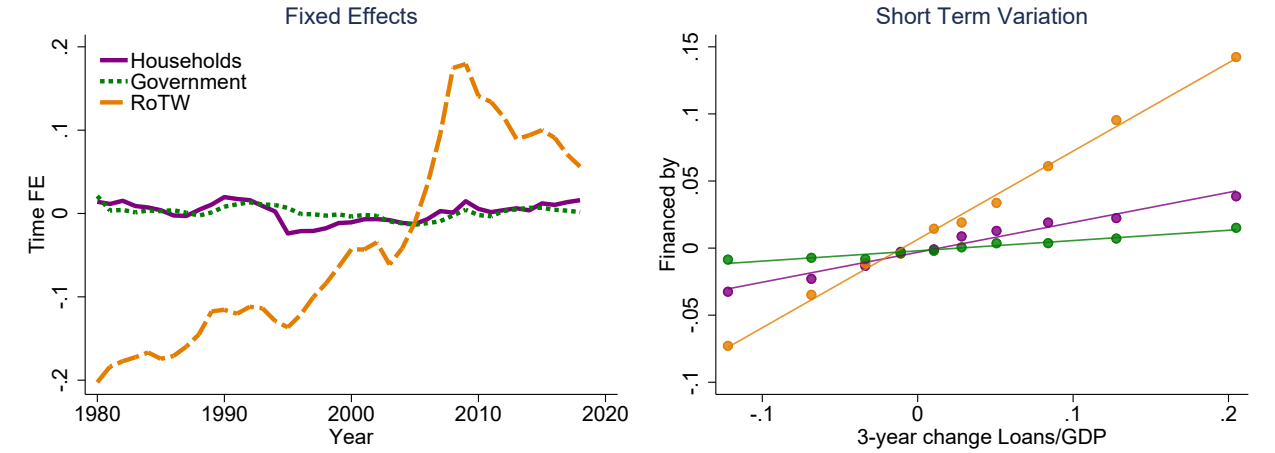
The figure shows time fixed effects for changes in credit by source. Euro area countries are excluded from the sample. The left panel shows the time fixed effects of a regression of household debt by financing sector on country and time fixed effects. The left panel shows the time fixed effects of a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

Figure A3.11: *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.

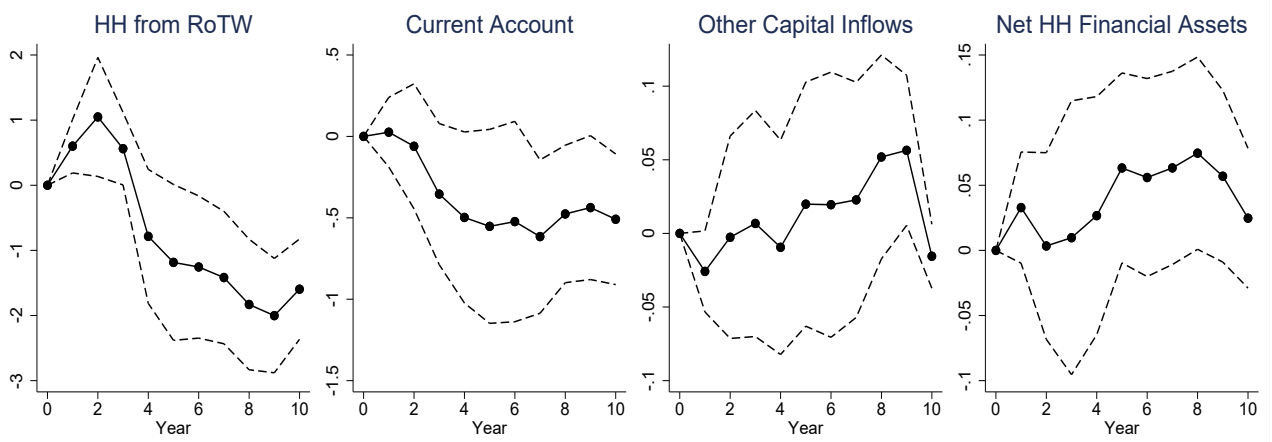
Figure A3.12: *Corporate credit by ultimate counterparty sector: trends and cycles*



Notes: The left panel plots time fixed effects α_t of a regression of non-financial corporate credit by ultimate sector $C_{i,t}^{u \to NF}$ on country (α_i) and year (α_t) fixed effects, i.e. $C_{i,t}^{u \to NF} = \alpha_i + \alpha_t + \epsilon_{it}$, where u refers to domestic households, government and the foreign sector respectively. The right panel shows the relationship between changes in total non-financial corporate credit and non-financial corporate credit decomposed by ultimate source of funds. Observations are collapsed into 10 equal sized bins based on three-year changes in the ratio of household credit to GDP. Each point represents the group specific means of three-year changes in total non-financial credit and non-financial credit financed by source sectors relative to GDP, after controlling for country fixed effects. Fitted regression lines illustrate the correlation.

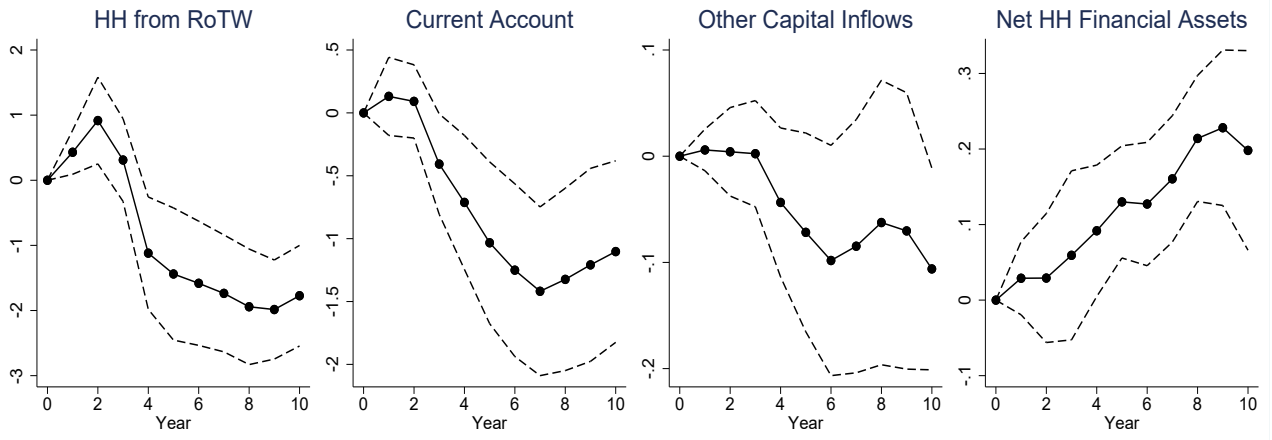
A4. Credit and Business Cycles

Figure A4.13: *GDP responses to changes in foreign financed household credit, the current account, other inflows and net household debt*



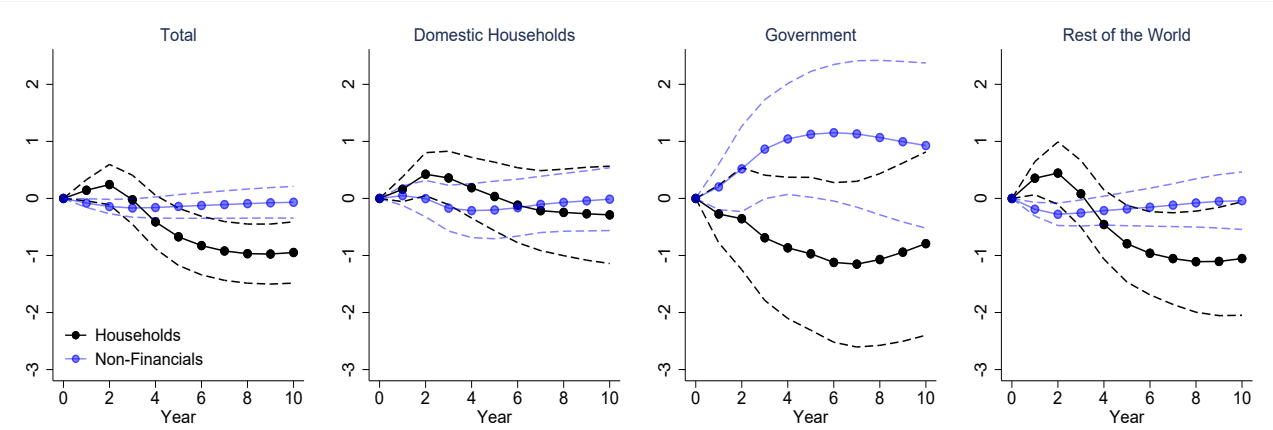
Notes: This figure shows estimates of impulse responses of real GDP (in %) to increases in the ratio of household credit financed from abroad, the (inverse) current account, claims of the rest of the world that are financing something else than household credit, and the change in net household financial assets, to GDP. All responses are estimated jointly in the specification with control variables. Dashed lines represent 95% confidence intervals around estimates computed based on standard errors dually clustered on country and year.

Figure A4.14: *GDP responses to changes in foreign financed household credit, the current account, other inflows and net household debt - univariate comparison*



Notes: This figure shows estimates of impulse responses of real GDP (in %) to increases in the ratio of household credit financed from abroad, the (inverse) current account, claims of the rest of the world that are financing something else than household credit, and the change in net household financial assets, to GDP. Responses are estimated only including contemporanoeus values and five lags of the respective variable and of real GDP growth and short-term interest rates. Dashed lines represent 95% confidence intervals around estimates computed based on standard errors dually clustered on country and year.

Figure A4.15: *GDP responses to increases in credit using a SVAR model*



Notes: This figure shows estimates of impulse responses of log real GDP to innovations in the ratio of household (non-fnancial) credit to lagged GDP. The left panel uses a three variable SVAR model with 5 lags of the ordering ($\Delta_3 ln(Y)_{i,t+3}$, $\Delta_3 NF_{i,t-1}$, $\Delta_3 HH_{i,t-1}$), showing the response to household credit in black and non-financial credit in blue. The right three panels use a six variable VAR model with 5 lags, where both credit variables are decomposed by financing source (rest of the world, domestic households, government) with the ordering ($\Delta_3 ln(Y)_{i,t+3}$, $\Delta_3 RoTW \rightarrow NF_{i,t-1}$, $\Delta_3 HH \rightarrow NF_{i,t-1}$, $\Delta_3 GG \rightarrow NF_{i,t-1}$, $\Delta_3 RoTW \rightarrow HH_{i,t-1}$, $\Delta_3 HH \rightarrow HH_{i,t-1}$, $\Delta_3 GG \rightarrow HH_{i,t-1}$). Responses to household credit are plotted in black, non-financial in blue. Dashed lines represent 95% confidence intervals computed based on monte carlo simulation draws.

Table A4.3: *GDP responses to increases in household credit, excluding countries with large RoTW sectors*

	$\Delta_3 ln(Y)_{i,t+3}$				$\Delta_3 Unemployment_{i,t+3}$			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$\Delta_3 RoTW \rightarrow HH_{i,t-1}$	-1.18***	-0.94***	-0.89***	-0.75***	0.42***	0.38***	0.31***	0.28***
	(0.36)	(0.24)	(0.24)	(0.27)	(0.08)	(0.07)	(0.06)	(0.07)
$\Delta_3 HH \rightarrow HH_{i,t-1}$	0.22	0.32**	0.32**	0.22	0.01	0.01	0.00	0.01
	(0.17)	(0.14)	(0.15)	(0.14)	(0.06)	(0.06)	(0.06)	(0.06)
$\Delta_3 GG \rightarrow HH_{i,t-1}$	-0.28	-0.24	-0.21	0.04	-0.15	-0.13	-0.14	-0.24*
	(0.32)	(0.29)	(0.28)	(0.36)	(0.10)	(0.11)	(0.11)	(0.12)
$\Delta_3 CA_{i,t-1}$			0.17	0.10			-0.18***	-0.17***
			(0.11)	(0.12)			(0.04)	(0.04)
R^2	0.324	0.577	0.581	0.601	0.434	0.590	0.613	0.656
Country fixed effects	✓	✓	✓	✓	✓	✓	✓	✓
LDV	✓	✓	✓	✓	✓	✓	✓	✓
NF Credit	✓	✓	✓	✓	✓	✓	✓	✓
Year fixed effects		✓	✓	✓		✓	✓	✓
Additional Controls				✓				✓
p-value, $\beta_{RoTW} = \beta_{HH} = \beta_{GG}$	0.01	0.00	0.00	0.02	0.00	0.00	0.00	0.01
Observations	603	590	589	522	565	552	551	497

Notes: This table presents results from estimating Equation 2, excluding countries with large foreign sectors from the estimation. The dependent variables are the growth of real GDP and the change in the unemployment rate between year t and $t+3$. Household credit is decomposed by ultimate counterparty sector. Credit variables are expressed as lagged three-year changes in the ratio to GDP. LDV are distributed lags of the dependent variable. NF Credit includes non-financial credit decomposed by ultimate counterparty sector and additional controls include changes in household sector net worth, short-term interest rates and foreign capital not financing household credit. Standard errors in parentheses are dually clustered on country and year. The reported p-value refers to a test for the equality of credit coefficients by counterparty sector. *,**,*** indicates significance at the 0.1, 0.05, 0.01 levels, respectively.

Table A4.4: *GDP growth prediction, estimation split for unveiled household credit*

	$\Delta_3 ln(Y)_{i,t+3}$							
	Benchmark		By source of HH		Only RoTW to HH		All others	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$\Delta_3 HH_{i,t-1}$	-0.48***	-0.34***						
	(0.14)	(0.12)						
$\Delta_3 NF_{i,t-1}$	-0.01	0.00						
	(0.02)	(0.02)						
$\Delta_3 RoTW \rightarrow HH_{i,t-1}$			-0.87***	-0.71***	-0.76***	-0.63***		
			(0.20)	(0.17)	(0.15)	(0.13)		
$\Delta_3 HH \rightarrow HH_{i,t-1}$			0.21	0.23			-0.03	0.08
			(0.18)	(0.15)			(0.21)	(0.15)
$\Delta_3 GG \rightarrow HH_{i,t-1}$			-0.35	-0.16			-0.77**	-0.40
			(0.31)	(0.29)			(0.37)	(0.30)
$\Delta_3 RoTW \rightarrow NF_{i,t-1}$			0.07*	0.05			-0.09***	-0.06**
			(0.04)	(0.03)			(0.02)	(0.02)
$\Delta_3 HH \rightarrow NF_{i,t-1}$			-0.20**	-0.11			-0.12	-0.07
			(0.09)	(0.09)			(0.09)	(0.08)
$\Delta_3 GG \rightarrow NF_{i,t-1}$			0.14	0.31			0.66*	0.64**
			(0.33)	(0.25)			(0.35)	(0.24)
$\Delta_3 CA_{i,t-1}$	0.28**	0.25**	0.25**	0.20*			0.34***	0.31**
	(0.13)	(0.11)	(0.12)	(0.11)			(0.12)	(0.12)
R^2	0.316	0.552	0.356	0.589	0.326	0.569	0.242	0.529
Country fixed effects	✓	✓	✓	✓	✓	✓	✓	✓
LDV	✓	✓	✓	✓	✓	✓	✓	✓
Year fixed effects		✓		✓		✓		✓
Observations	667	663	667	663	678	664	667	663

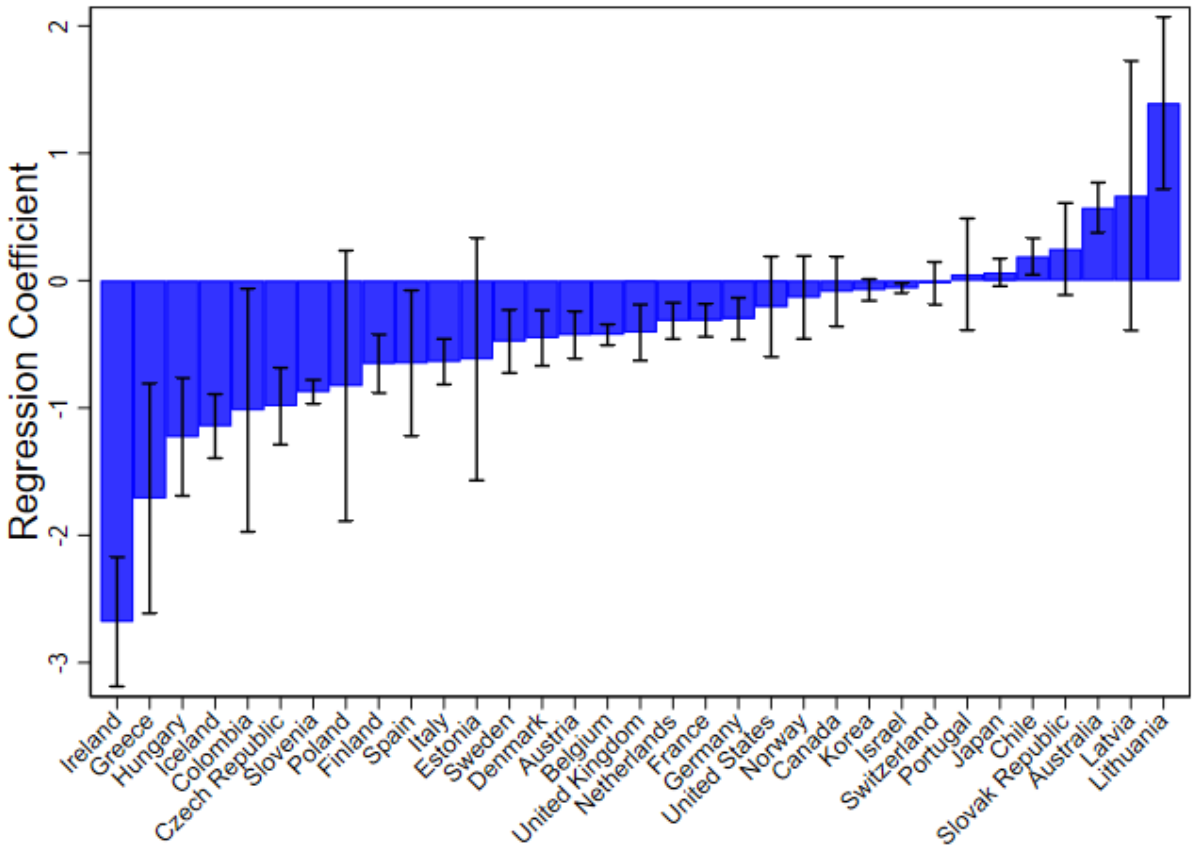
Notes: This table shows predictive regressions of GDP growth on credit expansions. The Benchmark specification uses non-decomposed Household credit, as it is standard in the literature. Columns (3) and (4) use unveiled credit. LDV refers to a distributed lag of the dependent variable. The negative relation is exclusively driven by foreign financed household credit. R^2 increases slightly. When only including foreign financed credit in colums (5) and (6) and comparing it to all other variables, the coeffcients for foreign credit hardly change. R^2 for only foreign credit is larger than for all other variables combined. 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.

Table A4.5: *Baseline regressions using different unveiling procedures*

	$\Delta_3 ln(Y)_{i,t+3}$				$\Delta_3 Unemployment_{i,t+3}$			
	Baseline	Counterparty	Instrument	MSS	Baseline	Counterparty	Instrument	MSS
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$\Delta_3 RoTW \rightarrow HH_{i,t-1}$	-0.69***	-0.39**	-0.58***	-0.52***	0.19***	0.10***	0.17***	0.14***
	(0.16)	(0.15)	(0.15)	(0.14)	(0.04)	(0.03)	(0.04)	(0.03)
$\Delta_3 HH \rightarrow HH_{i,t-1}$	0.13	0.02	-0.03	-0.23	0.06	-0.03	0.08	0.14
	(0.13)	(0.08)	(0.16)	(0.16)	(0.07)	(0.03)	(0.11)	(0.09)
$\Delta_3 GG \rightarrow HH_{i,t-1}$	0.17	-0.11	0.16	0.32	-0.14*	0.04	-0.09	-0.09
	(0.21)	(0.10)	(0.18)	(0.27)	(0.08)	(0.06)	(0.09)	(0.15)
$\Delta_3 CA_{i,t-1}$	0.21*	0.35**	0.23**	0.20*	-0.14***	-0.29***	-0.15***	-0.15***
	(0.11)	(0.16)	(0.11)	(0.11)	(0.03)	(0.08)	(0.04)	(0.04)
R^2	0.593	0.689	0.598	0.596	0.622	0.648	0.627	0.625
Country fixed effects	✓	✓	✓	✓	✓	✓	✓	✓
LDV	✓	✓	✓	✓	✓	✓	✓	✓
NF Credit	✓	✓	✓	✓	✓	✓	✓	✓
Year fixed effects	✓	✓	✓	✓	✓	✓	✓	✓
Additional Controls	✓	✓	✓	✓	✓	✓	✓	✓
p-value, $\beta_{RoTW} = \beta_{HH} = \beta_{GG}$	0.00	0.08	0.01	0.06	0.00	0.05	0.01	0.26
Observations	663	258	632	632	579	236	548	548

Notes: This table shows our baseline regression of GDP growth and changes in the unemployment rate on decomposed credit growth, including our full set of controls. We compare four different unveiling approaches, including counterparty, instrument level and structural (MSS) unveiling and find our results to be robust to the choice of method. All specifications control for country fixed effects, a distributed lag of the dependent variable, non-financial credit and year fixed effects. Additional controls include changes in household net worth and inflows not financing household credit. $\Delta_3 CA - i, t-1$ refers to a change in the current account betwwen $t-1$ and $t-4$. Standard errors in parentheses are dually clustered on country and year. *,**,*** indicates significance at the 0.1, 0.05, 0.01 level, respectively. See the appendix for detailed descriptions of the unveiling approaches.

Figure A4.16: *Country-level regression coefficients*



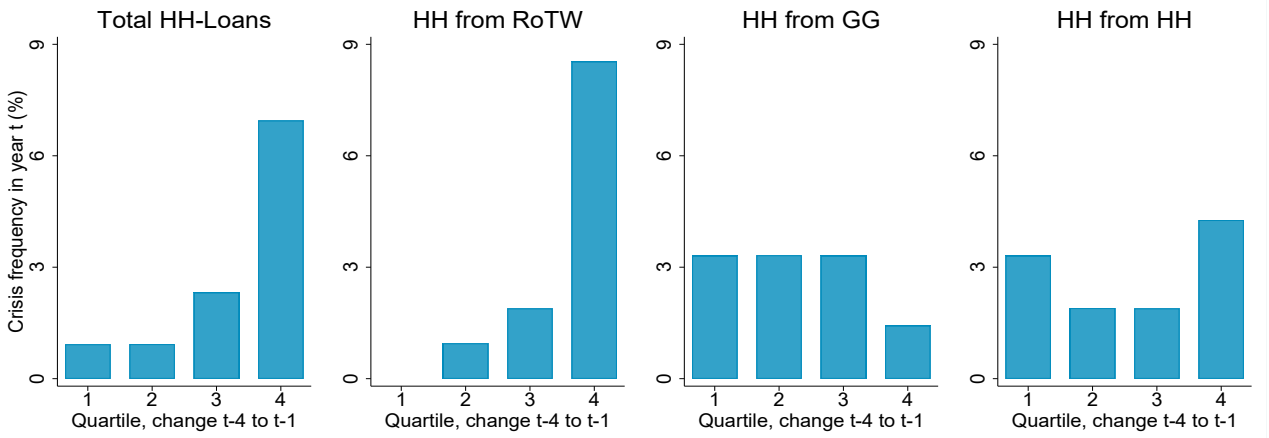
Notes: This figure plots regression coefficients and 90% confidence intervals from individual time series regressions of log real GDP growth from t to $t+3$ on Household credit decomposed by funding source $s \in$ (HH, GG, RoTW) and non-financial credit. The shown coefficients are for household credit funded by the rest of the world $\Delta_3 RoTW \rightarrow HH_{i,t-1}$. Variables are standardized by country prior to the regression. We use Newey-West Standard Errors with a maximum lag length of 6. The specification $\Delta_3 y_{i,t+3} = \alpha_i + \sum_{s \in S} \beta^s \Delta_3 C^{s \rightarrow HH}_{i,t-1} + \beta^{NF} \Delta_3 C^{NF}_{i,t-1} + u_{i,t+3}$ is estimated on individual country sub-samples.

A5. Crisis

As a simple way of analysing the link between credit expansion and crisis Figure A5.17 shows the financial crisis frequency for equal-sized bins of previous household credit expansions – in total and by financing sector. 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.

Consistent with previous findings in the literature, the left panel in Figure A5.17 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 points higher than in the lowest. This pattern is even stronger for household credit expansion financed from the rest of the world (middle left panel). Here crisis frequency in the highest quartile of the credit expansion measure is almost 9%, while it is zero in the lowest bin. On the other hand, crisis frequencies are similar across different quartiles of household credit expansions financed domestically by either the government or the domestic household sector.

Figure A5.17: *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.

Table A5.6: *Predicting financial crises: linear probability models*

	Baseline		By counterparty		Only RoTW to HH		All others	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$\Delta_3 HH_{i,t-1}$	0.27***	0.32***						
	(0.08)	(0.09)						
$\Delta_3 NF_{i,t-1}$	0.07***	0.05***						
	(0.02)	(0.02)						
$\Delta_3 RoTW \rightarrow HH_{i,t-1}$			0.63***	0.60***	0.61***	0.61***		
			(0.13)	(0.14)	(0.09)	(0.10)		
$\Delta_3 GG \rightarrow HH_{i,t-1}$			-0.39	-0.28			-0.11	0.04
			(0.38)	(0.45)			(0.36)	(0.43)
$\Delta_3 HH \rightarrow HH_{i,t-1}$			-0.28	-0.19			-0.04	0.05
			(0.34)	(0.40)			(0.33)	(0.38)
$\Delta_3 RoTW \rightarrow NF_{i,t-1}$			-0.02	-0.02			0.10**	0.11***
			(0.04)	(0.04)			(0.04)	(0.04)
$\Delta_3 GG \rightarrow NF_{i,t-1}$			0.14	-0.03			-0.18	-0.39
			(0.40)	(0.47)			(0.42)	(0.50)
$\Delta_3 HH \rightarrow NF_{i,t-1}$			0.16	0.17			0.10	0.11
			(0.22)	(0.25)			(0.22)	(0.26)
$\Delta_3 CA_{i,t-1}$	-0.20	-0.22	-0.16	-0.17			-0.29*	-0.31*
	(0.15)	(0.15)	(0.14)	(0.15)			(0.17)	(0.18)
AUC	0.75	0.81	0.80	0.85	0.79	0.85	0.76	0.80
s.e.	0.05	0.04	0.05	0.04	0.05	0.04	0.05	0.04
Country fixed effects		✓		✓		✓		✓
Observations	739	739	739	739	739	739	739	739

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. Standard errors in parentheses are clustered by country. *,**,*** indicates significance at the 0.1, 0.05, 0.01 levels, respectively.

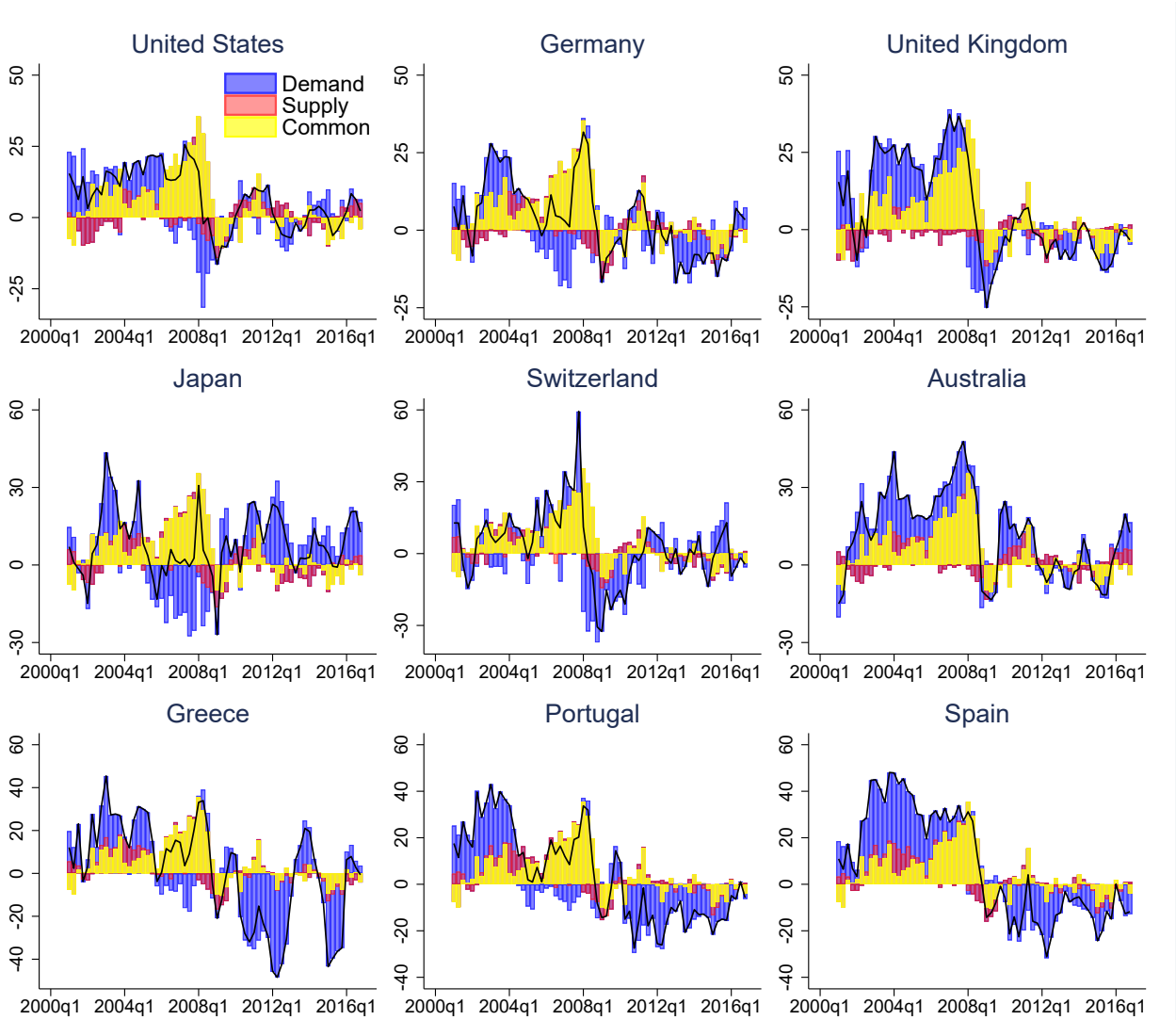
Table A5.7: *Predicting financial crises: (Baron et al., 2021) crisis chronology*

	Baseline		By counterparty		Only RoTW to HH		All others	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$\Delta_3 HH_{i,t-1}$	0.25**	0.29						
	(0.11)	(0.18)						
$\Delta_3 NF_{i,t-1}$	0.06**	0.26***						
	(0.03)	(0.09)						
$\Delta_3 RoTW \rightarrow HH_{i,t-1}$			0.55***	0.66**	0.53***	0.84***		
			(0.09)	(0.26)	(0.07)	(0.24)		
$\Delta_3 GG \rightarrow HH_{i,t-1}$			0.17	0.47			0.49	0.75
			(0.43)	(0.62)			(0.43)	(0.62)
$\Delta_3 HH \rightarrow HH_{i,t-1}$			-0.35	-0.56			-0.22	-0.48
			(0.27)	(0.45)			(0.28)	(0.43)
$\Delta_3 RoTW \rightarrow NF_{i,t-1}$			-0.06	0.16*			0.07	0.32***
			(0.05)	(0.09)			(0.04)	(0.10)
$\Delta_3 GG \rightarrow NF_{i,t-1}$			0.53	0.38			0.06	-0.13
			(0.42)	(0.80)			(0.39)	(0.75)
$\Delta_3 HH \rightarrow NF_{i,t-1}$			0.12	0.37			0.12	0.36
			(0.21)	(0.30)			(0.24)	(0.36)
$\Delta_3 CA_{i,t-1}$	-0.22	-0.51	-0.25	-0.51			-0.37**	-0.79**
	(0.21)	(0.40)	(0.19)	(0.39)			(0.18)	(0.36)
AUC	0.69	0.75	0.73	0.77	0.69	0.73	0.67	0.75
s.e.	0.04	0.04	0.04	0.03	0.05	0.04	0.04	0.03
Country fixed effects		✓		✓		✓		✓
Observations	739	537	739	537	739	537	739	537

Notes: The table shows probit classification models where the dependent variable is a financial crisis dummy. Coefficients are mean marginal effects. AUC is the area under the ROC-curve and below is its standard error. Standard errors in parentheses are clustered by country. *,**,*** indicates significance at the 0.1, 0.05, 0.01 levels, respectively.

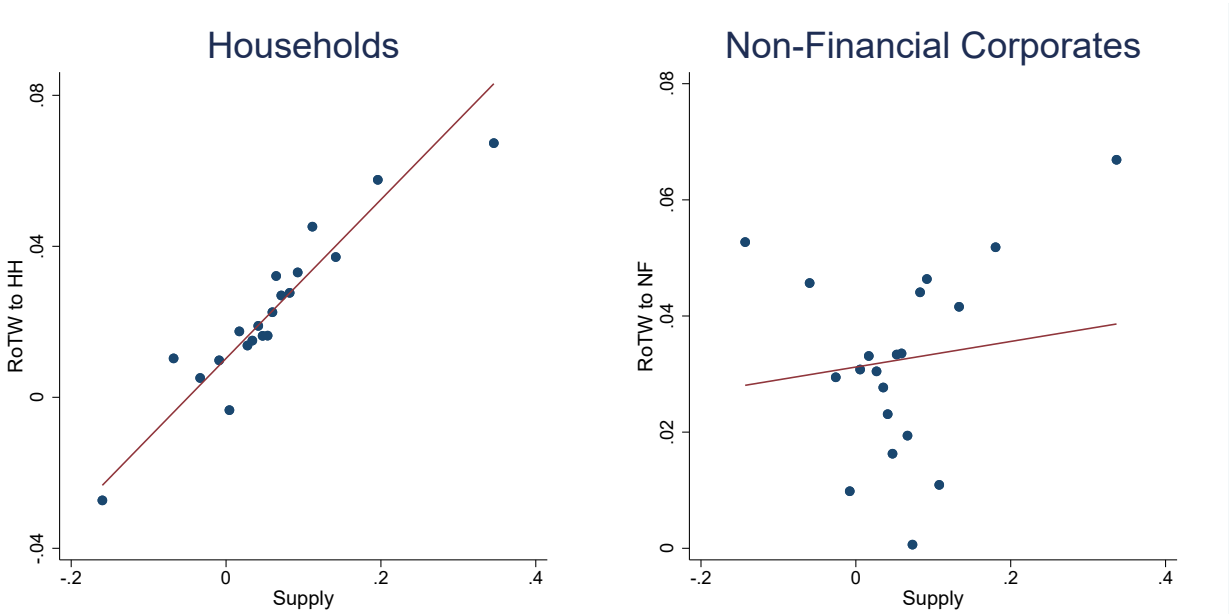
A6. Amiti-Weinstein decomposition and instrumental variable results

Figure A6.18: *Amiti Weinstein Shock Decomposition for selected developed economies*



Notes: This figure shows the Year-on-Year growth in claims of all reporting banks from the BIS locational banking statistics, on the country listed in the panel header. The total growth is decomposed into: first, estimated demand shocks (blue), unique to the borrower country listed in the panel header, second, estimated net supply shocks to the banking systems that have outstanding claims on the borrower country listed in the title, and third, esimated shocks that are common to all banking systems and borrower countries. This figure includes the same set of countries as Figure 10 in Amiti et al. (2019).

Figure A6.19: *Binned scatterplots for first-stage*



Notes: This figure shows the relationship between changes in foreign-financed household credit to GDP and accumulated supply shocks between $t-4$ and $t-1$. Observations are collapsed into 20 equal sized bins, with each point representing the group specific mean. We control for country fixed effects, household credit ultimately funded by domestic counterparties and non-financial credit. Fitted regression lines illustrate the correlation.

Table A6.8: *Foreign-financed household credit and business cycle dynamics - instrumental variable robustness- Excluding Major Economies*

	$\Delta_3 ln(Y)_{i,t+3}$				$\Delta_3 Unemployment_{i,t+3}$			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$\Delta_3 RoTW \rightarrow HH_{i,t-1}$	-0.92***		-2.20***	-2.19***	0.27***		0.33***	0.30***
	(0.19)		(0.79)	(0.80)	(0.04)		(0.08)	(0.08)
$\Delta_3 Supply_{i,t-1}$		-0.25***				0.06***		
		(0.06)				(0.02)		
$\Delta_3 HH \rightarrow HH_{i,t-1}$	0.01	-0.38*	0.49	0.48	0.08	0.22*	0.05	0.05
	(0.20)	(0.22)	(0.41)	(0.40)	(0.09)	(0.12)	(0.10)	(0.10)
$\Delta_3 GG \rightarrow HH_{i,t-1}$	-0.37	-0.43	-0.13	-0.13	-0.05	-0.08	-0.05	-0.05
	(0.27)	(0.27)	(0.44)	(0.44)	(0.08)	(0.10)	(0.08)	(0.08)
$\Delta_3 CA_{i,t-1}$				0.06				-0.13***
				(0.13)				(0.05)
Country fixed effects	✓	✓	✓	✓	✓	✓	✓	✓
LDV	✓	✓	✓	✓	✓	✓	✓	✓
NF Credit	✓	✓	✓	✓	✓	✓		✓
Kleibergen-Paap Weak ID	.	.	16.10	17.49	.	.	7.42	8.09
Observations	498	498	498	498	465	465	465	464

Notes: The dependent variable is GDP growth from t to $t+3$ in (1)-(4) and changes in unemployment between t and $t+3$ in (5)-(8). Columns (1) and (5) are based on Equation 2. Columns (2) and (6) replace $\Delta_3 RoTW \rightarrow HH_{i,t-1}$ with the supply shock measure. Columns (3)-(4) and (7)-(8) use the supply shock measure as an instrumental variable for $\Delta_3 RoTW \rightarrow HH_{i,t-1}$. This specification excludes the United States, Germany, France, Japan and the UK. All specifications control for country fixed effects and a distributed lag of the dependent variable (LDV). NF-credit controls for non-financial credit. Standard errors in parentheses are dually clustered on country and year. *,**,*** indicates significance at the 0.1, 0.05, 0.01 level, respectively.

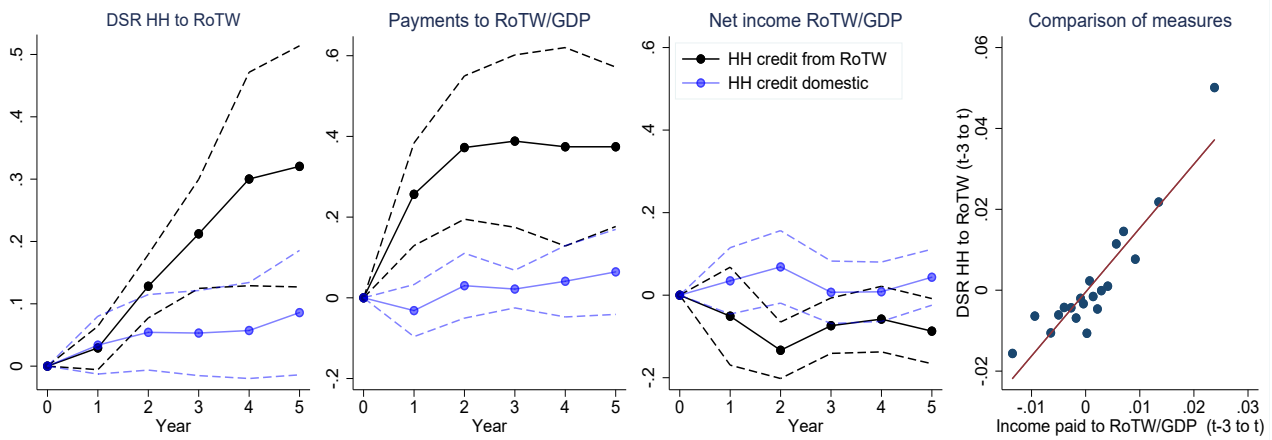
Table A6.9: *Foreign-financed household credit and business cycle dynamics - instrumental variable robustness- Excluding major suppliers of Safe Assets*

	$\Delta_3 ln(Y)_{i,t+3}$				$\Delta_3 Unemployment_{i,t+3}$			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$\Delta_3 RoTW \rightarrow HH_{i,t-1}$	-0.87***		-1.89***	-1.85***	0.25***		0.30***	0.28***
	(0.18)		(0.55)	(0.56)	(0.04)		(0.07)	(0.07)
$\Delta_3 Supply_{i,t-1}$		-0.26***				0.06***		
		(0.06)				(0.02)		
$\Delta_3 HH \rightarrow HH_{i,t-1}$	0.04	-0.28	0.29	0.29	0.09	0.20*	0.07	0.07
	(0.17)	(0.19)	(0.27)	(0.27)	(0.08)	(0.10)	(0.08)	(0.08)
$\Delta_3 GG \rightarrow HH_{i,t-1}$	-0.24	-0.32	-0.01	0.00	-0.04	-0.06	-0.04	-0.04
	(0.26)	(0.27)	(0.36)	(0.36)	(0.07)	(0.09)	(0.07)	(0.07)
$\Delta_3 CA_{i,t-1}$				0.15				-0.14***
				(0.12)				(0.05)
Country fixed effects	✓	✓	✓	✓	✓	✓	✓	✓
LDV	✓	✓	✓	✓	✓	✓	✓	✓
NF Credit	✓	✓	✓	✓	✓	✓	✓	✓
Kleibergen-Paap Weak ID	.	.	22.12	22.95	.	.	11.34	12.16
Observations	590	590	590	590	554	554	554	553

Notes: The dependent variable is GDP growth from t to $t+3$ in (1)-(4) and changes in unemployment between t and $t+3$ in (5)-(8). Columns (1) and (5) are based on Equation 2. Columns (2) and (6) replace $\Delta_3 RoTW \rightarrow HH_{i,t-1}$ with the supply shock measure. Columns (3)-(4) and (7)-(8) use the supply shock measure as an instrumental variable for $\Delta_3 RoTW \rightarrow HH_{i,t-1}$. This specification excludes the United States and Germany. All specifications control for country fixed effects and a distributed lag of the dependent variable (LDV). NF-credit controls for non-financial credit. Standard errors in parentheses are dually clustered on country and year. *,**,*** indicates significance at the 0.1, 0.05, 0.01 level, respectively.

A7. Channels

Figure A7.20: *Credit and debt service payments to RoTW*



Notes: The three left panels show the relationships between household credit financed from the RoTW and subsequent payment flows. The left panel shows the response of debt service payments attributed to the RoTW to an increase in household credit financed from the RoTW (black) or from domestic sources (blue). The two middle panels show the response of gross primary incomes payable to RoTW (second panel) and net primary incomes from RoTW (third panel). The right panel shows the relationship between debt service payments attributable to RoTW and gross primary incomes payable to RoTW. See text.

Table A7.10: *Credit expansion and subsequent outcomes, non-linearity*

	$\Delta_3 ln(Y)_{i,t+3}$				$\Delta_3 Unemployment_{i,t+3}$			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$\Delta_3 RotW \rightarrow HH_{i,t-1} * 1(\geq 0)$	-1.21***	-0.97***	-0.93***	-0.84***	0.35***	0.32***	0.28***	0.24***
	(0.28)	(0.24)	(0.23)	(0.23)	(0.08)	(0.06)	(0.06)	(0.06)
$\Delta_3 RotW \rightarrow HH_{i,t-1} * 1(< 0)$	0.27	0.05	-0.02	-0.15	0.05	0.05	0.08	0.12**
	(0.39)	(0.34)	(0.33)	(0.33)	(0.09)	(0.07)	(0.06)	(0.05)
$\Delta_3 GG \rightarrow HH_{i,t-1} * 1(\geq 0)$	-0.46	-0.27	-0.02	0.20	-0.08	-0.13	-0.22	-0.30*
	(0.55)	(0.45)	(0.45)	(0.44)	(0.16)	(0.15)	(0.14)	(0.16)
$\Delta_3 GG \rightarrow HH_{i,t-1} * 1(< 0)$	-0.35	-0.18	-0.27	0.07	0.08	0.00	0.04	-0.14
	(0.54)	(0.45)	(0.45)	(0.48)	(0.15)	(0.16)	(0.14)	(0.12)
$\Delta_3 HH \rightarrow HH_{i,t-1} * 1(\geq 0)$	-0.02	0.20	0.29	0.17	0.01	-0.02	-0.07	-0.03
	(0.33)	(0.25)	(0.23)	(0.26)	(0.10)	(0.10)	(0.10)	(0.10)
$\Delta_3 HH \rightarrow HH_{i,t-1} * 1(< 0)$	0.57*	0.24	0.14	0.19	0.03	0.10	0.13	0.12
	(0.30)	(0.29)	(0.31)	(0.34)	(0.09)	(0.09)	(0.10)	(0.10)
$\Delta_3 RotW \rightarrow NF_{i,t-1} * 1(\geq 0)$	0.06	0.09**	0.10**	0.06	-0.03	-0.04**	-0.05***	-0.03*
	(0.06)	(0.04)	(0.04)	(0.04)	(0.02)	(0.02)	(0.02)	(0.02)
$\Delta_3 RotW \rightarrow NF_{i,t-1} * 1(< 0)$	-0.01	-0.05	-0.03	-0.02	-0.03	-0.01	-0.02	-0.02*
	(0.06)	(0.05)	(0.05)	(0.05)	(0.02)	(0.02)	(0.02)	(0.01)
$\Delta_3 GG \rightarrow NF_{i,t-1} * 1(\geq 0)$	0.67	0.39	0.32	0.16	-0.05	0.04	0.08	0.13
	(0.56)	(0.39)	(0.37)	(0.37)	(0.19)	(0.13)	(0.12)	(0.11)
$\Delta_3 GG \rightarrow NF_{i,t-1} * 1(< 0)$	-0.16	0.36	0.32	-0.06	0.17	0.03	0.05	0.20**
	(0.46)	(0.37)	(0.36)	(0.38)	(0.15)	(0.12)	(0.10)	(0.09)
$\Delta_3 HH \rightarrow NF_{i,t-1} * 1(\geq 0)$	-0.18	-0.04	-0.01	0.03	0.17***	0.09	0.07	0.01
	(0.22)	(0.17)	(0.17)	(0.17)	(0.06)	(0.06)	(0.07)	(0.08)
$\Delta_3 HH \rightarrow NF_{i,t-1} * 1(< 0)$	-0.22	-0.29**	-0.26**	-0.17	0.10	0.12**	0.12***	0.07
	(0.17)	(0.13)	(0.13)	(0.20)	(0.06)	(0.05)	(0.04)	(0.06)
$\Delta_3 CA_{i,t-1} * 1(\geq 0)$			-0.13	-0.26			-0.03	-0.01
			(0.22)	(0.22)			(0.05)	(0.05)
$\Delta_3 CA_{i,t-1} * 1(< 0)$			0.61*	0.67*			-0.36***	-0.37***
			(0.31)	(0.35)			(0.10)	(0.12)
R^2	0.393	0.597	0.608	0.634	0.431	0.589	0.622	0.669
Country fixed effects	✓	✓	✓	✓	✓	✓	✓	✓
LDV	✓	✓	✓	✓	✓	✓	✓	✓
Year fixed effects		✓	✓	✓		✓	✓	✓
Additional Controls				✓				✓
Observations	678	664	663	596	688	675	674	604

Notes: The dependent variables in this table are log GDP grwoth and changes in the unemployment rate between t and $t+3$. This table tests for potential non-linearity in the relationship between credit and the business cycle, by estimating separate coefficients for positive and negative changes for household debt for our full set of source sectors. Standard errors in parentheses are dually clustered on country and year. *,**,*** indicates significance at the 0.1, 0.05, 0.01 levels, respectively

Table A7.11: *Credit expansion and sectoral reallocation*

	$\Delta_3 ln(\frac{Y_{NT}}{Y_T})_{i,t}$		$\Delta_3 ln(\frac{Emp_{NT}}{Emp_T})_{i,t}$		$\Delta_3 ln(\frac{Inv_{Housing}}{Inv_{Other}})_{i,t}$	
	(1)	(2)	(3)	(4)	(5)	(6)
$\Delta_3 RoTW \rightarrow HH_{i,t}$	0.56***	0.54***	0.14**	0.20***	1.02***	1.17***
	(0.12)	(0.15)	(0.06)	(0.06)	(0.36)	(0.40)
$\Delta_3 HH \rightarrow HH_{i,t}$	0.05	-0.06	0.35***	0.33***	1.13**	1.00
	(0.21)	(0.22)	(0.10)	(0.12)	(0.42)	(0.71)
$\Delta_3 GG \rightarrow HH_{i,t}$	0.17	0.08	0.56***	0.55***	0.21	-0.22
	(0.22)	(0.21)	(0.15)	(0.16)	(0.66)	(0.68)
$\Delta_3 RoTW \rightarrow NF_{i,t-1}$	-0.01	0.04	0.06	0.06	-0.11	-0.14
	(0.12)	(0.12)	(0.04)	(0.05)	(0.12)	(0.12)
$\Delta_3 HH \rightarrow NF_{i,t-1}$	0.16	0.07	0.16	0.17*	0.49	0.26
	(0.14)	(0.12)	(0.09)	(0.09)	(0.34)	(0.45)
$\Delta_3 GG \rightarrow NF_{i,t-1}$	-0.11	0.03	-0.32	-0.35	-1.32	-0.85
	(0.26)	(0.26)	(0.20)	(0.21)	(1.20)	(1.28)
$\Delta_3 CA_{i,t}$		-0.42***		0.15*		-0.61
		(0.14)		(0.08)		(0.74)
$\Delta_3 NetHH_{i,t}$		-0.01		0.01		-0.06
		(0.02)		(0.02)		(0.11)
$\Delta_3 OtherRoTW_{i,t}$		-0.02		-0.01		-0.01
		(0.02)		(0.01)		(0.04)
R^2	0.245	0.277	0.317	0.324	0.225	0.236
Country fixed effects	✓	✓	✓	✓	✓	✓
Observations	620	618	584	582	733	676

Notes: The dependent variables are three-year changes in the log ratio of output (employment, investment) in the non-tradable to tradable sectors between t and $t-3$. For investment, investment in the construction of dwellings (housing) is considered as non-tradable investment. Credit variables are expressed as contemporaneous three year changes in the ratio of credit relative to GDP. 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.

A8. Non-Linearity and policy dependence

Table A8.12: *State dependence and non-linearity, reduced form estimates*

	$\Delta_3 ln(Y)_{i,t+3}$			$\Delta_3 Unemployment_{i,t+3}$		
	(1)	(2)	(3)	(4)	(5)	(6)
$\Delta_3 Supply_{i,t-1}$	-0.25***		-0.25***	0.05***		0.05***
	(0.05)		(0.06)	(0.02)		(0.02)
$\Delta_3 Supply_{i,t-1} * 1(\geq 0)$		-0.30***			0.06***	
		(0.05)			(0.02)	
$\Delta_3 Supply_{i,t-1} * 1(< 0)$		0.89***			-0.18**	
		(0.29)			(0.08)	
$\Delta_3 Supply_{i,t-1} \times Floating$			-0.05			0.03
			(0.09)			(0.02)
R^2	0.303	0.321	0.303	0.379	0.386	0.380
Country fixed effects	✓	✓	✓	✓	✓	✓
LDV	✓	✓	✓	✓	✓	✓
Credit Controls	✓	✓	✓	✓	✓	✓
Current Account	✓	✓	✓	✓	✓	✓
Observations	653	653	653	609	609	609

Notes: The dependent variables are the growth of real GDP and the change in the unemployment rate between year t and $t+3$. Household credit is decomposed by ultimate counterparty sector, with $\Delta_3 RoTW \rightarrow HH_{i,t-1}$ being replaced by our supply measure in this reduced form estimation. Credit variables are expressed as lagged three-year changes in the ratio to GDP. LDV are distributed lags of the dependent variable. Credit controls contain household credit financed by domestic sectors and non-financial credit. Floating is a dummy for economies with a floating exchange rate regime. The dummy-coefficient itself is included in the model, but small and insignificant. Standard errors in parentheses are dually clustered on country and year. The reported p-value refers to a test for the equality of coefficients for the three household credit by counterparty variables. *,**,*** indicates significance at the 0.1, 0.05, 0.01 levels, respectively.

In columns (2) and (5) we test for potential non-linearity in the relationship between credit and the business cycle, by estimating separate coefficients for positive and negative changes in household debt ultimately financed by foreigners.