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Does mortgage lending impact business credit? Evidence from a new disaggregated bank credit data set[☆]

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ABSTRACT

We present a new data set for 74 economies over 1990–2016 on domestic bank credit distinguishing between four categories: household mortgages, household consumption credit, loans to non-bank financial institutions, and loans to non-financial business. We offer a description of sources and data collection methods and a comparison with similar data sets. We document the key data trends including a shift in bank credit allocation away from business lending. The literature suggests that this ‘debt shift’ has substantial consequences for growth, income distribution and macroeconomic resilience, which motivates the construction of a new data set. We apply the data to analyze the effect of an increase in mortgage lending flows on business credit flows. We identify several theoretical transmission channels which involve collateral and bank balance sheet effects and wealth effects on consumption. The impact of mortgage credit expansion on business credit growth is found to be positive in advanced economies and negative in emerging and developing economies.

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1. Introduction

The allocation of bank credit to firms and households and between different uses of credit has shifted dramatically in recent decades. An emerging literature discusses the consequences of this ‘debt shift’ for macroeconomic outcomes. Different categories of bank credit have starkly different impacts on macroeconomic performance indicators. This motivates the construction of a new data set, presented in this paper, of domestic bank credit allocation in 74 economies over the period 1990–2016.

We report bank credit in four categories: household mortgages, household consumption credit, loans to non-bank financial institutions, and loans to non-financial business. In a balanced sample of 14 economies over 1990–2016, we observe that 32 of the 42 percentage points rise in domestic bank credit as a share of GDP (from

about 74% to 116%) was due to household credit, almost all of it as mortgages. Loans to non-financial firms have constituted a falling share of total bank credit in recent decades. The new data allow for the analysis of what this ‘debt shift’ has meant for macroeconomic performance. It also offers opportunities to study the interdependences of different kinds of financial development.

To demonstrate these interdependences, we exploit a feature in our data set that is new compared to other existing data sets. We observe not just aggregate household credit, but specifically household mortgage credit. The literature suggests that growth of credit to non-financial business is influenced by other lending flows, notably household mortgages. We identify five theoretical channels. Four channels suggest a positive effect of an increase in mortgage credit flows on business credit flows; the conditions for these channels to operate are most prevalent in advanced economies. Alternatively, conditions for a negative impact (crowding out) are most likely to occur in emerging and developing economies (hereafter, EDEs).

We apply the data in an analysis of the impact of mortgage credit flows on the growth of business credit, using three different methods. Our findings from a VAR model estimation suggest that a one percentage point (pp) of GDP increase in mortgage lending flows initially increases the flow of non-financial business credit, with the effect peaking after 2 years at +0.6 pp of GDP in advanced

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economies. A positive shock to mortgage lending flows significantly reduces the flow of business credit in EDEs, reaching a trough at -0.35 pp of GDP after 4 years. Thus, changes in mortgage lending affect the dynamics of bank credit to business significantly, but differentially across levels of economic and institutional development. The mortgage flows shock has initially a short-lived positive effect on GDP growth in advanced economies but turns negative after 2 years, bottoming at -0.2 pp after 4 years. Consistent with the literature, the response of GDP growth in EDEs is negative: it falls to -0.5 pp after 2 years and remains negative for the 10-year horizon. These results hold also for other methods, namely local projections and single equation estimations. To the best of our knowledge, we are the first to demonstrate the dynamic relation between mortgage and business credit flows.

This paper's contributions include a discussion, drawing on the literature, of the relevance of the 'debt shift' apparent in the new data set (Section 2); a presentation of the new data set (Section 3); and the empirical analysis (Section 4). We conclude with a discussion of limitations and policy uses of the new data in Section 5.

2. Differentiating bank credit: relevance to growth, stability, and inequality

Distinguishing between the different uses of bank credit and their macro-level consequences goes back to Schumpeter's classic work on the link between financial development and economic development (Schumpeter, 1939; Bezemer, 2014). Schumpeter (1939, p. 147) noted that neither consumption credit nor household mortgages are directly linked to productivity growth in the way that loans to non-financial firms are, by financing innovation and productive investment. The transmission channels from bank credit to income growth vary for different credit categories, while their dynamics diverge. In recent decades, the rising share of mortgages in total bank credit may be one reason for falling credit-growth coefficients (Rousseau and Wachtel, 2011; Arcand et al., 2015; Bezemer et al., 2016). It could also help explain the rising financial fragility connected to credit expansion (Loayza and Ranciere, 2006; Jordà et al., 2016).

In the empirical financial-development literature, disaggregation of credit was mostly neglected until the 1990s. Werner (1997) offers an early distinction between income growth effects of mortgages and business loans in Japan. Jappelli and Pagano (1994) argue in a theoretical model that higher household credit depresses savings and thereby growth. This is in line with Xu (2000) who shows that business investment, not household spending, is a channel through which financial development affects growth. Beck et al. (2012) is a groundbreaking study, using a broad distinction between household and business credit. It finds that household credit has negligible growth effects. In contrast, Bezemer et al. (2016) and Samatas et al. (2019) find negative growth effects.

Apart from the extensive credit-growth literature, a second area where the distinction between bank credit types appears relevant is in the field of financial crisis, fragility and instability. Jappelli et al. (2013) use individual credit data for the U.K., the U.S. and Germany and find that more household debt leads to more insolvencies and arrears. Büyükkarabacak and Valev (2010), using a data set similar to Beck et al. (2012), show that household credit increases the probability of crisis. Büyükkarabacak and Krause (2009) report that countries with more household credit have weaker external balances. Sutherland et al. (2012) find that when private sector debt levels (particularly for households) rise above trend, the likelihood of recession increases. Mian and Sufi (2014) show that U.S. households with higher mortgage debt reduced their spending more than others after 2007 (see also Mian and Sufi, 2009; Dynan, 2012). IMF (2012) reports for advanced

economies over the past three decades that recessions are more severe if they are preceded by larger increases in household debt. Jordà et al. (2016) use long-term data on 17 economies and find that growth in real estate lending has caused episodes of financial instability. They also show that these are often followed by deeper recessions and slower recoveries than after other shocks. A number of other studies find that higher private debt increases the probability of a financial crisis and worsens the consequences in terms of output loss and duration (Claessens et al., 2010; Cecchetti et al., 2011; Lane and Milesi-Ferretti, 2011; Berkmen et al., 2012; Babecky et al., 2013; Beck et al., 2014). In sum, differentiating household credit from non-financial business credit, and household mortgage credit from household consumption credit is important for understanding the impact of credit on both growth and stability. This disaggregation is what our new data offers.

Finally, credit growth and allocation is also likely to affect a third area of macro-level outcomes: inequality in wealth and income. Growth of bank credit may reduce income inequality if it reduces investment barriers and risk (Banerjee and Newman, 1993; Galor and Moav, 2004). This is empirically supported by studies for developing countries (Clarke et al., 2006; Beck et al., 2007), but the conclusions for advanced economies are mixed.¹ Beck et al. (2007) find that growth in credit-to-GDP decreases income inequality in the U.S., but Van Arnum and Naples (2013) report that growth of the U.S. financial sector increased inequality. Denk and Cournède (2015) find that financial expansion has held back income growth of low- and middle-income households in OECD economies. The effect of financial development on increasing income disparities was also confirmed in broader country samples (see e.g., Gimet and Lagoarde-Segot, 2011; Jaumotte et al., 2013). This may be connected to the rising share of bank credit to (real estate and financial) asset markets as opposed to non-financial business. The re-allocation of credit leading to rising asset prices may entail redistribution of income between wage earners and asset owners with rising income inequality (Piketty, 2014), since most of the rise in income inequality is driven by capital income, not wage income. Another transmission channel from the mortgage credit boom to income inequality is that the 'Great Mortgaging' (Jordà et al., 2016) after the 1980s generated large income growth in the Finance, Insurance and Real Estate (FIRE) sectors, where typically above-average incomes are earned.

3. The new data set

3.1. Content

The new data set provides detailed data on monetary financial institutions' (banks and credit unions) loan assets, where the counterparty is a domestic non-government non-bank. We collect data from the consolidated balance sheets of monetary financial institutions from central bank statistics for 74 countries.² The time period coverage is conditional on data availability. For most countries in our sample we have credit data over 1990–2016 at most; for several countries (Germany, Greece, Hong Kong, Japan, Portugal, Switzerland, Turkey, the U.K., and the U.S.), the data goes back much fur-

¹ See Demirgüç-Kunt and Levine (2009), Bazillier and Hericourt (2017), De Haan and Sturm (2017) for a survey of the literature on the relationship between financial development and inequality.

² We collected data from the asset side of banks' balance sheets. An alternative method would be to have data from the liabilities side of firms and households in the flow of funds data. However, few countries provide sufficiently detailed flow of funds data on bank loans by sector. What is often reported is total borrowing including equity market borrowing, while we focus on bank credit so as to preserve comparability across countries. Additionally, to the extent that equity is held in the private non-financial sector, this is treated as debt from the private non-financial sector to the private non-financial sector.

ther than 1990. The credit data is observed at annual frequency, although for about 50 countries we have also quarterly data. A country is included in the data set if we find publicly available data on bank loans reported separately for credit to non-financial business, credit to financial business, mortgages to households, and household consumption credit (the latter is sometimes imputed). Table 1 provides an overview of the data set with the list of countries, time period coverage and averages of credit categories in % GDP.³ Appendix A discusses the consistency and reliability of the data.

Non-financial business credit includes loans to non-financial companies. For some countries, loans are reported according to the classification of economic activities. In these cases, non-financial business credit includes loans to agriculture, industry, and services sectors (excluding public sector, financial and real estate services). Credit to financial business includes loans to insurance companies, pension funds, other financial intermediaries and financial auxiliaries, and other non-bank financial institutions. We include this as a separate category since it is part of what banks lend to the private sector, although not to the private non-financial sector. These loans may be relevant in some analyses, and the data accommodate this need. We excluded interbank lending.

Mortgages in our data are household mortgages, which is only a part of total mortgage lending. A substantial part of lending to business is secured by real estate. But globally, only few countries report business mortgage lending separately from other lending to business, so we cannot consistently include total mortgages in the data. Jordà et al. (2017) do this for 17 countries.

Bank-issued household consumption credit includes all types of household loans that are not mortgages. These include loans for the purchase of passenger vehicles, other consumer durable goods, student loans, and credit card advances, among others. For countries which do not report consumer loans separately, they are calculated as total household loans minus household mortgages.

Domestic bank credit includes loans by both domestic and foreign banks, in domestic and foreign currency. For reasons of consistency across countries, it excludes non-bank lending and securitized bank loans, both of which are only rarely reported in central bank statistics. Advanced countries have large non-bank debt markets and securitization, so that loan assets on banks' balance sheets paint an incomplete picture of all debt. For one extreme example, this is why 'total bank credit' values for the U.S. are comparatively low: most credit in the U.S. is non-bank credit (bonds and short-term papers) and a large part of loans (especially, mortgages) is securitized; that is why it cannot be observed on banks' balance sheets. However, the U.S. is exceptional in this respect. Especially for many developing countries, bank lending is the bulk of official lending to the private sector.

3.2. Comparison with other data sets

Two published data sets comparable to ours merit discussion: by Jordà et al. (2017) and by BIS (2013).⁴ Our data differ from theirs in two respects: they do not separately report bank credit to non-bank financial business and/or they combine mortgage and other household credit into one category. Our data are dis-

tinguished by these two features. Bank lending to non-bank financial institutions has become a growing part of bank activities (Hardie and Howarth, 2013), so that isolating this credit category opens up new analytical options that are likely to be empirically relevant. Also, household mortgages – and not the total household credit – play a distinct role in macroeconomic dynamics; and, as we analyze in the present paper, they have significant impacts on non-financial business credit. For these reasons, our data set provides opportunities to ask new and topical research questions which cannot be addressed using more aggregated data sets.

Jordà et al. (2017) constructed long time series for real estate lending and its share in total lending for 17 advanced countries over the period 1870–2016. This includes loans from banks, savings banks, credit unions, and building societies. The obvious advantage of this data set is its longer time span and a broader coverage of real estate lending. In comparison with Jordà et al. (2017), we include more countries, we separate household mortgages from total real estate lending, we also report household consumer loans, and we include bank loans to non-bank financial institutions.

Another comprehensive data set is the BIS 'Long series on credit to private non-financial sectors' (BIS, 2013) described in Dembiermont et al. (2013). As to disaggregation of credit, this data source reports 'lending by all sectors' (i.e., banks and securities markets) separately for households and enterprises. Since bank credit is not disaggregated, we cannot directly compare the BIS data to ours. By including in one credit measure bank and non-bank lending (mostly through securities markets), it is not possible to use the BIS data to study issues unique to banks, such as links to the payment system, credit creation, and banks' role in information collection. On the other hand the BIS data provide a more complete picture of total credit to the private non-financial sector. These data are being continually updated.⁵

Table B.2 in Appendix B shows that our data and those of Jordà et al. (2017) are very similar for most countries. The BIS data are less similar to ours due to inclusion of non-bank lending and cross-border credit (see Table B.3). Table B.1 shows pairwise correlations of credit categories from our data with similar categories from the data sets of Jordà et al. (2017) and BIS (2013). The correlations between these data sets are high, especially for household credit.

3.3. Data presentation and trends

Table 2 reports descriptive statistics of total bank credit and disaggregated credit categories (in % of nominal GDP) in our data. Bank credit to non-financial business and household mortgage credit are the two largest categories. There is considerable variation around the averages, especially between countries.

Some stylized trends are worth noting. Fig. 1 displays the development of total bank credit over 1990–2016. There is a substantial increase in credit over time, in both advanced and emerging countries. Advanced economies have much higher credit-to-GDP levels (note the scale difference), which remained high after the crisis. The drop in China's credit-to-GDP ratio before 2007 is fairly unique. The uncertainties around GDP and credit statistics in China should be noted. With that caveat, the V-shaped development of China's credit-to-GDP is consistent with its GDP growth

³ The Online Source Appendix offers details on the data collection and construction for each country.

⁴ Other, earlier data sets include Beck et al. (2012) for 73 countries over 1994–2005 and Büyükkarabacak and Valev (2010) for 37 countries over 1990–2007. These studies pioneered cross-country research on growth effects of different credit aggregates. Their data sets, however, cover relatively short time spans and include a limited number of countries. A comparison of our data to these two data sets is provided in Bezemer et al. (2017).

⁵ Another related data set is 'Lending to households and non-financial corporations in Europe' by the European Credit Research Institute. It covers 42 countries over 1995–2019 and provides data on credit to households (consumer credit and loans for house purchases) and to non-financial corporations. It appears to be constructed from similar sources to ours. This data set is, however, not publicly available; hence, we cannot compare it with ours.

Table 1
Overview of the data set.

Country	Period	Freq.	Total credit	Non-fin. bus.	Fin. bus.	Hh mortgage	Hh consum.
Albania	2002–2016	Y	25.47	20.35	0.75	4.62	2.29
Argentina	1993–2016	Y,Q	14.81	8.74	0.97	1.72	3.38
Armenia	2004–2016	Y,Q	24.13	15.70	0.55	2.36	5.52
Australia	1990–2016	Y,Q	101.36	34.91	7.37	51.76	7.31
Austria	1995–2016	Y,Q	90.16	48.26	6.65	26.95	8.30
Azerbaijan	2005–2016	Y	20.84	12.49	0.44	1.25	6.67
Belarus	1999–2016	Y	29.99	23.12	0.35	4.79	1.73
Belgium	1999–2016	Y,Q	71.08	28.26	10.18	27.98	4.65
Botswana	2004–2016	Y	28.14	10.39	0.74	5.49	11.53
Brazil	1994–2016	Y	35.72	20.94	–	4.32	10.45
Bulgaria	1997–2016	Y,Q	39.51	27.01	1.03	6.06	6.45
Cambodia	2000–2016	Y	26.86	23.58	0.30	2.37	2.07
Canada	1990–2016	Y,Q	123.94	39.44	12.11	44.79	25.99
Chile	1990–2016	Y,Q	64.57	43.57	1.08	13.06	6.87
China	2002–2016	Y	136.35	104.87	12.14	17.73	8.64
Colombia	2002–2016	Y,Q	32.39	19.85	–	4.14	8.41
Croatia	1998–2016	Y	55.40	25.55	0.55	12.13	17.17
Cyprus	2005–2016	Y,Q	236.90	110.34	17.08	54.44	55.03
Czech Rep	1993–2016	Y,Q	45.39	26.83	2.75	11.39	5.74
Denmark	2000–2016	Y,Q	173.63	52.49	11.19	83.08	26.87
Egypt	1991–2015	Y	47.22	39.54	–	–	7.67
Estonia	1997–2016	Y,Q	64.52	29.14	7.31	22.89	5.17
Finland	1997–2016	Y,Q	71.67	25.54	2.26	36.06	13.31
France	1993–2016	Y,Q	82.80	36.03	4.60	29.84	12.34
Georgia	2003–2016	Y,Q	26.84	15.47	1.15	7.08	4.77
Germany	1968–2016	Y,Q	83.23	48.39	2.47	23.11	9.27
Greece	1980–2016	Y,Q	68.53	38.70	1.49	19.61	8.73
Hong Kong	1980–2016	Y,Q	135.46	76.03	14.08	33.17	12.18
Hungary	1989–2016	Y,Q	42.49	23.19	4.50	8.27	6.53
Iceland	2003–2016	Y,Q	153.32	75.31	33.03	28.16	16.82
India	2001–2016	Y	38.52	28.85	2.88	3.59	3.42
Indonesia	2002–2016	Y	27.95	17.34	2.54	2.24	5.83
Ireland	2003–2016	Y,Q	133.20	51.61	19.59	49.05	12.95
Israel	1999–2016	Y,Q	84.01	51.59	–	21.56	10.86
Italy	1998–2016	Y,Q	90.47	47.94	12.63	16.31	13.59
Japan	1977–2016	Y	85.44	50.82	7.39	23.53	3.70
Kazakhstan	1997–2016	Y	33.24	23.55	1.79	2.30	5.60
Kenya	1997–2016	Y	28.66	22.11	1.33	1.99	3.24
Korea	2008–2016	Y,Q	108.52	54.91	4.41	30.00	19.21
Kyrgyz Rep	1996–2016	Y,Q	9.57	7.74	–	1.38	0.91
Latvia	2010–2016	Y,Q	65.46	33.33	2.63	24.11	5.39
Lithuania	1993–2016	Y,Q	33.26	18.91	1.83	9.29	3.23
Luxembourg	1999–2016	Y,Q	124.61	30.49	49.10	36.72	8.30
Macedonia	2003–2016	Y	36.91	22.98	0.02	3.05	10.85
Malaysia	1996–2016	Y,Q	109.93	47.50	13.73	27.30	21.38
Malta	1996–2016	Y,Q	91.97	49.18	14.76	27.79	7.84
Mexico	2000–2016	Y,Q	20.92	8.49	–	8.83	3.59
Moldova	1993–2016	Y	26.88	22.18	1.03	2.21	1.46
Mongolia	2004–2016	Y,Q	45.53	25.41	2.00	6.82	11.32
Morocco	2001–2016	Y,Q	32.12	15.38	0.30	12.96	3.48
Netherlands	1990–2016	Y,Q	125.88	46.90	19.69	51.65	7.64
New Zealand	1990–2016	Y,Q	121.60	33.75	24.36	60.63	4.69
Norway	1995–2016	Y,Q	102.38	34.61	2.85	54.21	10.71
Pakistan	2006–2016	Y,Q	17.58	15.00	0.70	0.34	1.56
Peru	2001–2016	Y,Q	27.95	20.50	–	4.01	5.57
Philippines	1993–2016	Y	35.63	24.54	8.05	1.57	2.54
Poland	1996–2016	Y,Q	37.20	15.00	1.58	10.29	10.32
Portugal	1979–2016	Y,Q	92.00	43.02	8.38	31.70	8.89
Romania	2007–2016	Y,Q	35.43	17.58	0.63	5.77	11.45
Russia	1995–2016	Y	33.07	25.20	1.31	1.66	4.90
Singapore	1991–2016	Y,Q	104.32	55.77	14.14	27.46	13.89
Slovakia	2004–2016	Y	42.46	19.76	1.90	15.54	5.25
Slovenia	2004–2016	Y	67.55	42.04	4.22	10.79	10.49
Spain	1994–2016	Y,Q	115.64	53.55	3.91	46.62	11.55
Sri Lanka	1996–2016	Y	26.37	16.22	1.31	1.92	6.92
Sweden	1996–2016	Y,Q	156.56	51.32	46.99	47.01	11.24
Switzerland	1977–2016	Y	157.10	40.54	9.83	106.23	1.33
Thailand	2003–2016	Y,Q	105.26	45.09	4.06	18.21	37.90
Tunisia	2003–2016	Y	67.42	43.56	7.64	12.40	3.79
Turkey	1986–2016	Y,Q	22.82	15.62	0.28	2.53	3.05
Ukraine	2002–2016	Y	50.98	36.69	0.84	5.62	7.83
U.K.	1986–2016	Y,Q	84.66	19.78	22.45	34.86	7.57
Uruguay	2005–2016	Y	24.33	14.60	0.56	4.48	4.70
U.S.	1947–2016	Y,Q	26.33	9.20	–	11.49	5.63

Notes: The Table reports the means of total bank credit and four credit categories (in % of nominal GDP) for all countries included in our data set. '–' indicates that the data for a particular credit type are not available. Y indicates that the data are available at annual frequency, Q – at quarterly frequency.

Table 2
Descriptive statistics.

Description	Mean	Min	Max	Std	Stdw	Stdb	Obs
Total bank credit	70.57	1.74	285.47	48.73	20.11	46.27	1552
Non-financial business credit	33.60	1.41	131.70	20.78	9.14	19.81	1564
Financial business credit	7.71	0.00	92.14	11.03	5.21	10.03	1338
Household mortgage credit	22.71	0.00	145.90	24.52	10.18	20.67	1497
Household consumption credit	8.64	0.00	58.05	7.76	2.91	8.31	1509

Note: Stdw and Stdb denote the within and between standard deviations, respectively.

spurt (faster than credit growth, possibly) before the crisis and massive credit injections after 2008.

A comprehensive overview of total and disaggregated credit categories (in % GDP) for different country groups is presented in Table 3. It reports averages of credit over country groups for selected years as well as over as much as the period 1990–2016 as data allow. We observe substantial growth of total credit in advanced countries with increasing shares of mortgage lending. In EDEs, bank credit increased more slowly and was largely directed towards non-financial business, while household lending was mostly dominated by consumer credit with a negligible role for household mortgages.

Fig. 2 plots the credit composition for a balanced sample of 14 (mostly advanced) economies for which we have data over 1990–

2016. Household mortgage lending more than doubled as a share of total bank credit and GDP, which is proportionally similar to what Jordà et al. (2016) report. Credit to non-financial business was stable until about 2005 and then rose from 37.5% to 43.4% of GDP on average. The other two credit categories – household consumption credit and credit to financial business – oscillated around 6–12% of GDP.

Fig. 3 shows trends for selected countries with data availability prior to 1990. While patterns vary across economies, a common trend is the rise in mortgage credit, mirrored in a fall of the credit share to non-financial business. The exception is Hong Kong, where the share of household consumer credit in total bank credit is unusually large, and the share of mortgage lending small relative to other advanced economies.

(a) Total credit – balanced panel of 14 countries

(b) Total credit for selected advanced countries

(c) Total credit for selected emerging countries

Fig. 1. Development of total bank credit over 1990–2016. Notes: Panel (a) plots the unweighted average for a balanced panel of 14 countries, namely Canada, Chile, Germany, Greece, Hong Kong, Hungary, Japan, the Netherlands, New Zealand, Portugal, Singapore, Switzerland, the U.K., and the U.S.

Table 3
Bank credit composition by country groups.

	1995	2000	2005	2010	2016	1990–2016
All countries (74)						
Total bank credit	61.64	62.50	65.01	80.74	79.69	71.44
Non-financial business credit	32.33	31.16	29.66	36.85	34.59	33.70
Financial business credit	5.50	7.52	7.67	8.89	8.22	7.89
Hh mortgage credit	20.31	20.01	21.26	25.93	27.46	23.07
Hh consumer credit	5.78	6.67	9.00	10.62	10.24	8.87
Advanced economies (36)						
Total bank credit	76.91	83.24	97.44	120.09	109.85	98.76
Non-financial business credit	37.29	37.95	37.82	47.40	40.37	41.01
Financial business credit	7.07	9.90	12.41	15.40	12.01	11.91
Hh mortgage credit	27.24	28.41	36.07	44.56	46.06	36.40
Hh consumer credit	7.49	8.74	11.92	13.80	12.08	10.87
Euro Area (19)						
Total bank credit	60.76	73.67	92.49	117.10	95.76	91.83
Non-financial business credit	34.47	36.78	39.03	50.49	38.35	41.49
Financial business credit	2.58	7.97	10.84	13.95	9.84	9.84
Hh mortgage credit	16.76	21.45	30.75	39.64	36.99	30.52
Hh consumer credit	6.96	8.27	12.07	13.46	10.58	10.49
Other advanced economies (19)						
Total bank credit	82.49	86.86	99.21	118.84	117.46	100.62
Non-financial business credit	37.16	37.19	35.74	43.52	40.58	39.25
Financial business credit	9.70	10.98	13.73	15.58	13.45	13.10
Hh mortgage credit	32.46	32.10	39.89	47.84	52.11	39.76
Hh consumer credit	7.20	8.59	11.34	13.53	12.74	10.67
Emerging and developing economies (38)						
Total bank credit	25.38	27.94	32.59	43.47	50.35	39.18
Non-financial business credit	21.88	19.83	21.49	26.85	28.96	25.13
Financial business credit	1.44	2.58	2.08	1.98	4.20	2.45
Hh mortgage credit	2.49	3.77	4.53	7.80	9.36	6.24
Hh consumer credit	2.16	3.27	5.89	7.61	8.45	6.52
CIS and transition economies (7)						
Total bank credit	14.88	11.60	22.57	40.61	37.78	29.00
Non-financial business credit	14.50	10.69	16.97	29.39	27.05	21.73
Financial business credit	0.02	0.14	0.76	1.48	2.69	1.03
Hh mortgage credit	0.20	0.48	1.88	4.82	3.24	2.83
Hh consumer credit	0.17	0.42	3.07	5.13	5.20	3.72
Emerging and developing Asia (10)						
Total bank credit	x	47.97	52.20	56.54	79.88	60.38
Non-financial business credit	32.18	28.87	32.84	33.41	42.94	35.80
Financial business credit	6.50	6.73	3.92	3.70	9.80	5.53
Hh mortgage credit	x	8.04	7.85	8.85	14.27	9.31
Hh consumer credit	x	8.34	11.88	11.00	12.66	11.34
Emerging and developing Europe (9)						
Total bank credit	13.50	11.37	21.17	46.48	41.89	31.95
Non-financial business credit	12.42	9.07	14.03	27.18	24.43	19.82
Financial business credit	0.04	0.42	1.07	1.19	1.72	0.91
Hh mortgage credit	0.63	0.83	3.02	10.84	9.47	6.10
Hh consumer credit	0.41	1.19	4.11	7.69	6.74	5.46
Latin America (7)						
Total bank credit	32.63	31.88	25.72	32.74	43.44	33.59
Non-financial business credit	23.24	20.40	15.96	19.61	24.09	20.99
Financial business credit	1.72	1.84	1.02	0.31	0.55	0.94
Hh mortgage credit	5.27	6.73	4.74	5.80	8.61	6.14
Hh consumer credit	2.97	3.82	4.90	7.57	10.50	6.26
Middle East and Africa (5)						
Total bank credit	48.39	45.73	36.90	38.66	46.13	40.65
Non-financial business credit	41.15	39.63	25.56	23.28	23.77	27.52
Financial business credit	x	1.54	2.22	2.24	3.12	2.35
Hh mortgage credit	x	1.03	5.24	9.18	12.43	7.81
Hh consumer credit	7.24	4.82	5.36	6.24	6.82	5.85

Fig. 4 plots the extent of ‘debt shift’ (the shift in bank credit composition over time) for each country in the sample. On the vertical and horizontal axes of panel (4 a) are the shares of non-financial business credit in total credit at the end and at the start of a country’s time series, respectively. If the country is located below the 45 degree line, there was ‘debt shift’ as defined above: bank credit allocation shifted away from non-financial business. Strikingly, our graph suggests that this holds for almost all countries in our sample. Panel (4 b) suggests that the counterpart to this was rising shares of household mortgage credit almost everywhere (except in Argentina, Brazil, Colombia, and Hungary). In some countries, household

mortgages now constitute the largest bank loan category. Consumer credit and bank credit to non-bank financial-business have gained in relative importance, as panel (4 c) and (4 d) show.

In sum, in a striking reversal of late 19th century trends, banks have moved away from ‘credit mobilier’ for industrial development in recent decades. They have become, as noted by Jordà et al. (2016), much like real estate funds. There is a gap between the textbook description of banks as financial institutions lending to non-financial firms and the actual allocation of bank credit. This motivates new directions for research into the role of banks in the economy.

Fig. 2. Development of credit composition over 1990–2016 Note: Fig. 2 plots the unweighted average for a balanced panel of 14 countries as in Fig. 1a.

4. Analysis: effects of mortgage flows on business credit growth

In this section we demonstrate the possible uses of our new data with an empirical analysis. The implications of the global mortgage credit boom prior to the crisis (Jordà et al., 2016) have been widely studied, as noted in Section 2. Its causes have also been analyzed. One aspect that has so far not received much attention is the impact of this mortgage boom on the change in non-financial business credit. A better understanding of this would appear to be important, since it is the growth of non-financial business lending that accounts for the positive effect (if any) of financial development on income growth (Xu, 2000; Beck et al., 2012; Doerr et al., 2018). Dell'Ariccia et al. (2017) show that increased firm investment in intangible assets may cause banks to reallocate their portfolios towards residential real estate loans and liquid assets. Another reason that mortgage credit comes to dominate more in domestic bank loan portfolios is the increasing access to non-bank funding by non-financial firms, for instance from foreign sources (Samarina and Bezemer, 2016).

There are a few studies which analyze the impact of mortgage credit growth before a housing market crisis on non-financial business credit after the crisis. Zhang et al. (2017) show that banks in the U.K. which were more heavily invested in mortgages before the crisis, had more trouble rebuilding their balance sheets and resuming lending to business after the crisis. Similarly, the effect is found to be negative for Japan in the early 1990s after its housing market crisis (Gan, 2007). The question we address in the present paper is whether this finding can be generalized beyond the U.S. to a large panel of countries and beyond the 1988–2006 years to recent years, until 2016.

4.1. Theoretical framework

There are a number of theoretical transmission channels from an increase in mortgage credit flows to a change in business credit flows. This section discusses five channels. Four are positive and expected to be stronger in advanced economies than in EDEs. One is negative and likely to be stronger in EDEs. Theoretically, therefore, there are grounds to expect opposite effects of a mortgage credit expansion on the growth in business credit in advanced economies as compared to EDEs.

A first theoretical possibility is the collateral channel of transmission. A rise in mortgage lending leads to rising real estate valuations (Favara and Imbs, 2015). This increases firms' net worth, so that they can offer better collateral to lenders and therefore bor-

row more (Chaney et al., 2012; Liu et al., 2013) – at least if property rights are well defined and the legal system supports collateral arrangements through bankruptcy legislation and creditor protection. The law and finance literature emphasizes the importance of this condition (La Porta et al., 1997; 1998; Beck and Levine, 2008). De Haas et al. (2010) report that where pledge and mortgage laws are perceived to be of high quality, banks engage more in mortgage lending. But where these legal arrangements are of low quality, as in many emerging economies, the collateral channel is probably weak or absent. To the extent that this channel operates, a rise (fall) in mortgage lending leads to more (less) business lending. For the above 'law and finance' reasons, this channel is likely to be most relevant for advanced economies and less for EDEs.

A second theoretical option is a bank balance sheet channel. Banks engaged in profitable mortgage lending are in a better shape to extend also other loans; conversely, banks distressed by mortgage market pressures and defaults are likely to restrict business credit. The result would again be that a rise (fall) in mortgage lending leads to more (less) business lending. For instance, Glancy (2017) reports that U.S. banks exposed to distressed housing markets cut both mortgages and small business lending relative to other banks in the same county. Zhang et al. (2017) find the same for U.K. banks. This effect is stronger with larger shares of mortgages in total bank loan portfolios, so that housing market and mortgage market problems weigh heavier on bank's balance sheets. In our data, we observe a large difference in this respect, with much higher shares of mortgages in all loans for banks in advanced economies than in EDEs. Just as the positive collateral channel discussed above, this positive bank balance sheet channel is thus likely to be strong in advanced economies and weak or absent in EDEs.

Third, there may be a housing net worth channel, as defined by Mian and Sufi (2014). A rise in mortgage credit leading to higher real estate valuations may boost consumption and therefore increase demand for business output.⁶ The housing net worth channel is stronger in economies where more residential real estate is mortgage-financed and with higher home ownership rates, so that (i) residential real estate values are more sensitive to mortgage credit flows and (ii) the response in terms of consumption is more widespread among households, respectively. Widespread mortgage-financed home ownership is typical for many advanced economies but rare in EDEs. Thus, also this positive channel is plausibly weak or absent in EDEs but present in advanced economies.

A fourth channel is a funding channel. Both non-deposit funding and loan securitization possibilities are larger for mortgages than for other loans due to their lower monitoring costs, more predictable revenue streams and longer maturities. These are key reasons that financial innovation and deregulation since the 1990s favored the expansion of mortgage markets (Hardie and Howarth, 2013). The replacement of deposit funding of mortgages by non-deposit funding was making more deposit funding available for business lending. Opportunities for mortgage loan sales through securitization created room for expansion of business lending in bank balance sheets within capital ratio and reserve ratio limitations. These financial innovation effects are less relevant to EDEs where securitization markets, non-deposit funding, and shadow banking are much less developed and more regulated (Korinek and Kremer, 2014; Fernández and Gulán, 2015). Like the other channels, the funding channel is expected to be stronger in advanced economies with highly developed and innovative financial markets.

⁶ Bahadir and Gumus (2019) construct a real business cycle model where household and business credit shocks lead to an expansion via such real estate effects.

Fig. 3. Development of credit composition: selected countries.

Fig. 4. Shift in credit composition across countries *Note:* Fig. 4 uses data from 1970 onwards. Countries with a minimum of 10 observations over time are included. The number of countries varies in four different panels.

A final theoretical impact of an increase in mortgage credit flows on business credit flows is crowding out. If bank capital and central bank reserves pose limitations to credit expansion, then in favorable housing market conditions banks will face the choice whether to extend more mortgages or more business loans (Chakraborty et al., 2018). In favorable housing market conditions, the risk-return profile on mortgage loans is more attractive than the risk-return profile on business loans, so banks will more often opt for an expansion of mortgage lending. Given limitations on the overall expansion of loan portfolios, this implies a negative impact on the change in business lending. In emerging economies, less developed capital and interbank markets do indeed pose more stringent limitations than in advanced economies. Therefore, not only are the four positive channels discussed above all likely to be weaker in EDEs, this negative channel is likely to be stronger in EDEs.

The consequences for macroeconomic performance of higher mortgage credit growth are likely to be negative beyond the short term. In advanced economies, a rise in mortgage credit that facilitates a rise also in business credit may fuel a short-term increase in GDP growth driven by consumption – and, to a lesser extent, investment – that would not have occurred otherwise (Mian and Sufi, 2014). Jensen et al. (2014) isolate the collateral channel and show that in these conditions, it is the weaker

firms and entrepreneurs that gain access to credit, lowering GDP growth. Moreover, rising household-debt-to-income ratios (hence rising debt obligations) depress consumption (Drehmann et al., 2018). The resulting GDP growth decline is consistent with Bezemer et al. (2016) and Samatas et al. (2019), who find negative mortgage credit-growth correlations.

In sum, growth of bank credit to non-financial business is plausibly influenced by growth of mortgage lending. Theoretically, there are several possible channels of transmission, which we cannot disentangle in this study. But they do give us reason to expect different effects across advanced economies and EDEs. Four of the channels imply a positive effect of mortgage credit on the growth of business credit. Arguments in the law and finance literature and in the banking literature suggest that these channels are stronger in advanced economies and weak or absent in EDEs. A fifth channel (crowding out) implies a negative effect and is likely to be stronger in EDEs.

4.2. VAR model estimations

We follow the approach of Mian et al. (2017) and apply three methodologies which are suitable for analyzing the dynamic relation between mortgage credit growth and business credit growth:

Fig. 5. Impulse responses to 1 pp. positive shock to mortgage credit flows, 3-variable VAR model, full sample. *Notes:* The figure plots impulse responses of mortgage credit flows, non-financial business credit flows, and real GDP growth to 1 pp. positive shock to mortgage credit flows, based on a VAR with Cholesky identification. The blue lines are median responses, black solid lines are 68% confidence intervals, and black dashed lines are 90% confidence intervals.

a VAR model, linear local projections, and single equation estimations. Below we describe each method and discuss the results.

The estimated baseline VAR has the following reduced form (Eq. (1)):

$$Y_{it} = \sum_{j=1}^p C_j Y_{i,t-j} + u_{it}, \quad (1)$$

where Y_{it} is a matrix of endogenous country-specific variables, including real GDP growth (GDP), non-financial business credit flows (BC), and mortgage credit flows (MC), $Y_{it} = (GDP_{it}, BC_{it}, MC_{it})$. A credit flow in country i in year t is defined as Eq. (2):

$$Creditflow_{i,t} = \frac{Creditstock_{i,t} - Creditstock_{i,t-1}}{GDP_{i,t-1}} * 100, \quad (2)$$

The credit flow variables are scaled by one-year-lagged nominal GDP to avoid capturing innovations to GDP while normalizing credit flows by the size of the economy, as also in Mian et al. (2017).

P is the lag length for endogenous variables, set to $p = 3$ by Akaike and Bayesian information criteria.⁷ u_{it} is a vector of reduced-form shocks with mean 0 and covariance matrix Σ_u . The structural shocks are identified through a recursive Cholesky decomposition, where real GDP growth is ordered first, business credit flows second, and mortgage flows third. Our results hold for alternative ordering of the variables. Confidence intervals for impulse responses are constructed by iterative bootstrapping.

As a baseline, we estimate a VAR model for the full sample using annual data for 74 countries over 1990–2016. The impulse responses of included variables to a one unit positive shock, i.e. a one percentage point (pp.) of GDP increase, in mortgage credit flows are shown in Fig. 5. Blue lines show the median responses, black solid lines are 68% confidence intervals,⁸ and black dashed lines are 90% confidence intervals.

The responses show that after a shock to itself, mortgage flows increase; this positive effect diminishes over time and dies out after ten years. This implies that the mortgage credit flows shock is temporary and dissipates in the medium run.

A one pp. positive shock to mortgage flows initially increases business credit flows by 0.3 pp of GDP at the peak. After three years, this positive effect starts declining and reverses after 8 years,

with business credit flows dropping by about -0.1 pp of GDP. This suggests that mortgage lending expansion by banks does not have a detrimental impact on business lending in the short run, as both types of credit continue increasing after a mortgage shock. However, in the medium run (i.e. at the horizon 8 years and longer) the growth in mortgages may eventually reduce the growth in business credit. In economic terms, the effect is moderate. In our sample of 74 countries, the average mortgage credit growth during 1990–2016 was 1.95 pp of GDP. Based on the estimated response, this implies a maximum rise in business credit growth by 0.59 pp of GDP. Given that the average sample growth of business credit was 2.75 pp of GDP, the effect of a mortgage shock accounts for roughly 20% of this change.

The right-hand panel of Fig. 5 shows that after a one pp. rise in mortgage credit flows the real GDP growth initially increases by 0.1 pp. This boost appears to be short-lived as already two years after the shock, GDP growth declines by up to -0.2 pp. This response remains negative throughout the remaining horizon and does not dissipate fully after 10 years. This result is line with the findings of Mian et al. (2017) for the impact of household debt on real GDP. The medium-run negative effect of mortgage credit growth on GDP growth is also consistent with recent literature on the finance-growth nexus (Arcand et al., 2015; Bezemer et al., 2016; Samatas et al., 2019). In terms of the size of this effect, an increase in mortgage flows on average over the sample by 1.95 pp of GDP decreases GDP growth by -0.39 pp at the trough. With the average sample GDP growth of 2.4% annually, this effect is not negligible.

To check if the results were different during the mortgage credit boom before the crisis, we also estimate a VAR for 1990–2007 (see Fig. C.1 in Appendix C). The responses of mortgage flows and GDP growth to a mortgage shock are comparable to the full sample. A rise in mortgage flows increases the flow of business credit also in the pre-crisis sample; this effect turns negative and insignificant after 9 years. Thus, the positive effect is most clearly observable during an upswing in the mortgage market.

Given the large heterogeneity in credit allocation and dynamics across countries, we examine the relation between business and mortgage credit flows separately for advanced economies versus EDEs. These country groups differ on several dimensions that could be relevant in our context. We follow the World Bank classification and split the sample into 36 advanced and 38 EDEs. We estimate the baseline VAR and calculate impulse responses for each country group, presented in Figs. 6 and 7.

The VAR results show that in EDEs the response of business credit flows to an increase in mortgage flows is larger in magnitude and becomes negative faster than is the case in advanced countries. The flows of non-financial business credit in EDEs initially increase by 0.2 pp of GDP after a mortgage flows shock. Af-

⁷ Alternative specifications with 2–4 lags were tested and robustness of VAR results was confirmed.

⁸ Reporting the 68% confidence band is common in VAR studies and means that we expect 68% of observations to lie within one standard deviation from the mean. Sims and Zha (1999) argue that error bands corresponding to 50% or 68% probability are often more informative than 95% or 99% bands as they offer a more precise estimate of the coverage probabilities.

Fig. 6. Impulse responses to 1 pp. positive shock to mortgage credit flows, 3-variable VAR model, advanced countries. *Notes:* The figure plots impulse responses of mortgage credit flows, non-financial business credit flows, and real GDP growth to 1 pp. positive shock to mortgage credit flows, based on a VAR with Cholesky identification for 36 advanced countries. The blue lines are median responses, black solid lines are 68% confidence intervals, and black dashed lines are 90% confidence intervals.

Fig. 7. Impulse responses to 1 pp. positive shock to mortgage credit flows, 3-variable VAR model, emerging and developing countries. *Notes:* The figure plots impulse responses of mortgage credit flows, non-financial business credit flows, and real GDP growth to 1 pp. positive shock to mortgage credit flows, based on a VAR with Cholesky identification for 38 EDEs. The blue lines are median responses, black solid lines are 68% confidence intervals, and black dashed lines are 90% confidence intervals.

ter two years the response reverses and remains below zero until the end of 10-year horizon, with business credit flows decreasing by about -0.3 pp of GDP at the trough. For advanced countries, a positive shock to mortgage flows raises business credit flows for 6 years by 0.6 pp of GDP at the peak; this response reverses after 7 years. The average mortgage credit growth during 1990–2016 was 2.70 pp of GDP in advanced economies and 1.02 pp of GDP in EDEs. This implies a maximum rise in business credit flows by 1.62 pp of GDP in advanced economies; this is a relatively large effect given that the average growth of business credit in this country group was 1.89 pp of GDP. For EDEs, the total effect on business credit growth is -0.31 pp of GDP at the trough. This is roughly 10% of an average change in business credit growth in EDEs over 1990–2016 (3.73 pp of GDP).

The GDP growth response to a mortgage flows shock in advanced economies is similar to response in the full sample. For EDEs, GDP growth responds more strongly: it drops immediately after a mortgage flows shock by up to -0.4 pp of GDP. To put the numbers into perspective, the average GDP growth in EDEs in our sample was 2.75% annually; thus, the effect of mortgage flows is relevant and moderate in size. The response gradually diminishes but stays negative for the rest of 10-year horizon.

The country-group analysis suggests that the full-sample responses of business credit flows and GDP growth are driven by results in the advanced economies. The rise in mortgage flows seems to have more detrimental and long-lasting effects in EDEs, both for business lending and output growth. One possible explanation is that given their less developed mortgage markets, a one pp. of GDP increase in mortgage flows constitutes a relative larger mortgage credit expansion, with larger effects on business credit

growth than in advanced economies. Additionally, financial frictions and limited financial depth in EDEs may make it more difficult for banks to expand both mortgage and business credit simultaneously, as discussed. In addition, firms may have better access to financial markets in advanced economies so that substitutes to bank lending are more readily available, which is less the case in EDEs.

As an extension, we include real house price growth in the VAR model, ordered as last (the alternative ordering does not alter the results). House prices might be important drivers of mortgages and business lending. At the same time, changes in mortgage credit might have direct effects on house prices (Favara and Imbs, 2015). Note that the house price data are available for 62 countries in our sample and a shorter time span in some cases. This reduces the number of observations, especially for EDEs.⁹ Results might have changed not necessarily due to the house price inclusion, but due to the change in the sample size. Hence, the results should be interpreted with caution.

Figs. C.3, C.4, C.5 and C.6 in Appendix C show the responses from 4-variable VARs including house prices. The lag length is set to 2 based on the information criteria. We find that a one pp. positive shock to mortgage flows initially increases house price growth by 0.75 pp at the peak but after three years this effect reverses. It then stays below zero for the rest of the horizon. The response of house prices growth in EDEs is stronger: it drops by over -1.5 pp after two years. These findings suggest that mortgage lending

⁹ The inclusion of house price growth in the estimation reduces the full sample by 20%, pre-crisis sample by 20%, advanced country sample by 2%, and EDEs sample by 41%.

Fig. 8. Impulse responses to 1 pp. increase in mortgage credit flows, local projections, full sample. Notes: The figure plots impulse responses of mortgage credit flows, non-financial business credit flows, and real GDP growth to 1 pp. increase in mortgage credit flows at t_0 , using local projections for horizons $h = 1, \dots, 10$. The blue lines are median responses, black solid lines are 68% confidence intervals, and black dashed lines are 90% confidence intervals.

expansion boosts house prices in the short run, likely due to increased housing demand, but in the medium run this effect dissipates with house prices returning to pre-shock level. The responses of mortgage flows and GDP growth to a mortgage shock are comparable to the results from a 3-variable VAR. The responses of business credit flows do not turn negative in the full and advanced economies samples. As discussed, this could be due to the change in the sample size. For EDEs we still observe a significant negative effect – business credit flows drop immediately after a mortgage shock and remain negative.

Our results might be affected by interpolation of some data points for about 10 countries in our data set by assuming stable proportional allocation for credit categories (see the Online Source Appendix for details on data collection and imputation). As a robustness check we repeat all VAR estimations after excluding the imputed data points. Figs. C.11, C.12, C.13 and C.14 in Appendix C show the corresponding impulse responses from 3-variable VARs. The shape and significance of responses are not affected by this modification, suggesting that our results are not driven by data interpolation.

4.3. Linear local projections

In this section we examine the dynamic relation between mortgage and business credit flows using an alternative approach. We estimate impulse responses through linear local projections a la Jordà (2005). This follows Mian et al. (2017) and Drehmann et al. (2018) who apply this approach to the analysis of credit growth. The advantage of local projections, compared to VAR, is that they are robust to misspecification due to the choice of variables and the number of lags, and do not require imposing restrictions on the causal relations between variables.

For each horizon $h = 1, \dots, 10$ we estimate projections of the change in non-financial business credit flows in response to a one unit increase in mortgage credit flows. The baseline specification is the following:

$$BC_{i,t+h} = \alpha_i^{h+1} + \beta^{h+1} BC_{i,t-1} + \gamma^{h+1} MC_{i,t-1} + \theta^{h+1} CTRL_{i,t-1} + \varepsilon_{i,t+h}^h \quad (3)$$

where α_i^{h+1} are country fixed effects, h is a projection horizon, set to 10 years; $\varepsilon_{i,t+h}^h$ is the projection residual; $CTRL$ is a matrix of control variables; BC are non-financial business credit flows, MC are mortgage credit flows, calculated by formula (2). Errors are clustered on country and year to account for heteroscedasticity and autocorrelation.

Based on Eq. (3), the h successive γ^{h+1} coefficients trace out the impulse response of future business credit flows to a one

unit increase in mortgage credit flows at time t over h successive years.

To be consistent with the VAR analysis, we include three variables (real GDP growth, mortgage flows, business credit flows), with the first three lags. Then we extend this baseline estimation by adding house price growth. As a robustness check, we used different lags and included additional controls such as a time trend, the short-term interest rate, CPI inflation, investment growth, capital inflows, and trade openness; the results are robust to these modifications (available on request). We refer to Table C.1 in Appendix C for definitions and descriptions of all variables.

The impulse responses from the baseline specification for the full sample (see Fig. 8) reveal dynamic patterns comparable to the VAR results. The response of mortgage flows to the shock to itself is positive in the first three years, but turns negative afterwards and stays below zero for the rest of the projection horizon. A one pp of GDP rise in mortgage credit flows increases the flow of business credit immediately after the shock by 0.34 pp of GDP. After four years, this response reverses and business credit flows drop by –0.32 pp of GDP. A positive mortgage shock initially boosts GDP growth, but this effect turns negative in the medium run. The size of the effect for business credit and GDP growth is comparable to VAR results.

Excluding the post-crisis years does not qualitatively change our results (see Fig. C.2 in Appendix C). The patterns are similar to the full sample, but the positive response of business credit flows is more short-lived and the negative response is larger.

Next, we estimate the baseline specification (3) separately for advanced economies and EDEs. The responses from local projections confirm our results from the VAR models (see Figs. 9 and 10). In particular, in EDEs, business credit flows are more sensitive to a rise in mortgage flows than in advanced countries. The flow of business credit in EDEs increases after a mortgage flows shock by 1 pp of GDP; after two years the response reverses and remains below zero until the end of the horizon, with business credit flows dropping by –0.5 pp of GDP. For advanced countries, a one unit increase in mortgage flows raises business credit flows for three years by 0.5 pp of GDP; this response reverses afterwards, but is then smaller.

In the extended specification, we add house price growth and re-estimate local projections (see Figs. C.7, C.8, C.9 and C.10 in Appendix C). The results are largely in line with what we observe from the baseline specification. They seem to be less significant, which could be due to a smaller sample, excluding 12 countries for which we did not have house price data. Generally, a one pp. positive shock to mortgage flows initially increases house price growth, but after two years this effect reverses and stays below zero. This result holds for different samples and country groups, suggesting that mortgage expansion boosts house prices in the short run (as also in Favara and Imbs, 2015).

Fig. 9. Impulse responses to 1 pp. increase in mortgage credit flows, local projections, advanced countries. Notes: The figure plots impulse responses of mortgage credit flows, non-financial business credit flows, and real GDP growth to 1 pp. increase in mortgage credit flows at t_0 , using local projections for horizons $h=1,\dots,10$, for 36 advanced countries. The blue lines are median responses, black solid lines are 68% confidence intervals, and black dashed lines are 90% confidence intervals. (For interpretation of the references to color in this figure legend, the reader is referred to the web version of this article.)

Fig. 10. Impulse responses to 1 pp. increase in mortgage credit flows, local projections, emerging and developing countries. Notes: The figure plots impulse responses of mortgage credit flows, non-financial business credit flows, and real GDP growth to 1 pp. increase in mortgage credit flows at t_0 , using local projections for horizons $h=1,\dots,10$, for 38 EDEs. The blue lines are median responses, black solid lines are 68% confidence intervals, and black dashed lines are 90% confidence intervals. (For interpretation of the references to color in this figure legend, the reader is referred to the web version of this article.)

Again, we probed the robustness of our results to excluding the imputed data points. Figs. C.15, C.16, C.17 and C.18 in Appendix C suggest that the results are not affected.

4.4. Single equation estimations

In this section we adopt an alternative framework to demonstrate the full dynamic relationship between non-financial business credit flows and mortgage credit flows. We estimate the baseline regression equation as follows (see Eq. (4)):

$$\Delta_3 BC_{i,t+h} = \alpha_i + \beta \Delta_3 MC_{i,t-1} + \gamma \Delta_3 X_{i,t-1} + \varepsilon_{i,t+h} \quad (4)$$

where $BC_{i,t+h}$ is non-financial business credit flow; $MC_{i,t-1}$ is mortgage credit flow; X_{it} is a vector of control variables; h is the projection horizon, $h = -1, 0, 1, \dots, 8$; α_i captures country fixed effects; Δ_3 refers to the change over three years. In the baseline analysis, we include real GDP growth as a control variable, capturing broad macroeconomic conditions. We conduct two robustness tests using this dynamic regression framework: (i) including housing prices; and (ii) including additional control variables, such as short-term interest rate, inflation, investment, capital inflows, and trade openness.

The right-hand-side variable is the change in mortgage lending from 4 years ago to last year. The left-hand-side variable is the 3-year non-financial business credit growth which is shifted one year forward with each projected horizon.¹⁰

The baseline results are reported in Table 4. As column (1) shows, a rise in mortgage credit flows over a 3-year period is contemporaneously positively correlated with the 3-year business

credit growth. As we examine business credit flows further into the future, the positive correlation gradually weakens and then turns negative and significant in columns (6)–(10). A one pp of GDP increase in 3-year mortgage flows is associated with a drop in 3-year business credit flows by -0.595 pp of GDP 8 years in the future. In our sample, average 3-year mortgage credit growth was 6.67 pp of GDP. Based on the estimates in column (10), this implies a decrease in 3-year business credit growth by -3.97 pp of GDP, 8 years in the future. This is over 40% of the sample average 3-year change in business credit 8 years in the future (9.29 pp of GDP). The correlations between GDP growth and business credit growth are mostly positive and significant, suggesting that GDP growth stimulates future business lending. These findings are consistent with the VAR and local projections results.

Next, to examine the differential effects between advanced economies and EDEs, we interact mortgage credit flow with an ADV dummy, which takes the value 1 for an advanced country and 0 for an emerging and developing country. The results are reported in Table 5. Most interaction terms are insignificant. While the positive association between mortgage and business credit flows appears to be more relevant for advanced countries, the negative medium-run effect is present in both country groups. Based on the estimated coefficients in column (10), in the advanced economies group the average 3-year mortgage credit growth by 9 pp of GDP implied a reduction in the 3-year business credit growth by -4.58 pp of GDP 8 years in the future, which is a large effect given that the average 3-year change in business credit in this group was 5.68 pp of GDP. For EDEs, the effect is smaller: the average 3-year mortgage credit growth by 3.66 pp of GDP reduced the 3-year business credit growth by -4.42 pp of GDP 8 years in the future, which is one third of the average 3-year change in business credit (13.17 pp of GDP). The findings are robust to including additional controls (see Table C.6).

¹⁰ For example, at $h=4$, β captures the effect of a rise in mortgage credit flow from 4 years ago ($t-4$) to the previous year ($t-1$) on business credit flow from next year ($t+1$) to 4 years in the future ($t+4$).

Table 4

Mortgage and business credit flows: baseline results.

	(1) $\Delta_3 BC_{i,t-1}$	(2) $\Delta_3 BC_{i,t}$	(3) $\Delta_3 BC_{i,t+1}$	(4) $\Delta_3 BC_{i,t+2}$	(5) $\Delta_3 BC_{i,t+3}$	(6) $\Delta_3 BC_{i,t+4}$	(7) $\Delta_3 BC_{i,t+5}$	(8) $\Delta_3 BC_{i,t+6}$	(9) $\Delta_3 BC_{i,t+7}$	(10) $\Delta_3 BC_{i,t+8}$
$\Delta_3 MC_{i,t-1}$	1.123*** (0.166)	1.099*** (0.158)	0.821*** (0.202)	0.373** (0.181)	−0.097 (0.151)	−0.472*** (0.178)	−0.678*** (0.192)	−0.739*** (0.181)	−0.694*** (0.198)	−0.595*** (0.208)
$\Delta_3 GDP_{i,t-1}$	−0.053 (0.099)	0.459*** (0.074)	0.733*** (0.099)	0.711*** (0.110)	0.526*** (0.108)	0.354*** (0.125)	0.270** (0.123)	0.179* (0.101)	0.079 (0.096)	0.025 (0.131)
Observations	1087	1088	1015	941	869	796	723	651	582	514
R-squared	0.250	0.328	0.341	0.238	0.121	0.126	0.169	0.171	0.145	0.097
Countries	73	73	73	72	72	71	69	66	63	58

Notes: The table reports the estimation results from a single equation regression where 3-year business credit growth is a dependent variable. Each column leads the dependent variable by one year. Standard errors in parentheses are dually clustered on country and year. ***, **, * indicate statistical significance at 0.01, 0.5, and 0.1 levels, respectively.

Table 5

Mortgage and business credit flows: advanced economies vs. EDEs.

	(1) $\Delta_3 BC_{i,t-1}$	(2) $\Delta_3 BC_{i,t}$	(3) $\Delta_3 BC_{i,t+1}$	(4) $\Delta_3 BC_{i,t+2}$	(5) $\Delta_3 BC_{i,t+3}$	(6) $\Delta_3 BC_{i,t+4}$	(7) $\Delta_3 BC_{i,t+5}$	(8) $\Delta_3 BC_{i,t+6}$	(9) $\Delta_3 BC_{i,t+7}$	(10) $\Delta_3 BC_{i,t+8}$
$\Delta_3 MC_{i,t-1}$	1.771*** (0.193)	1.331*** (0.238)	0.567*** (0.210)	−0.071 (0.189)	−0.378 (0.269)	−0.566 (0.366)	−0.846** (0.414)	−1.136*** (0.392)	−1.159*** (0.338)	−1.208*** (0.285)
$\Delta_3 MC_{i,t-1} \cdot \text{ADV}$	−0.756*** (0.249)	−0.271 (0.241)	0.297 (0.277)	0.519** (0.227)	0.327 (0.199)	0.108 (0.325)	0.192 (0.409)	0.457 (0.404)	0.545 (0.353)	0.699** (0.299)
$\Delta_3 GDP_{i,t-1}$	−0.053 (0.093)	0.459*** (0.073)	0.731*** (0.098)	0.705*** (0.109)	0.520*** (0.109)	0.352*** (0.124)	0.266** (0.122)	0.166* (0.099)	0.068 (0.094)	0.050 (0.122)
Observations	1087	1088	1015	941	869	796	723	651	582	514
R-squared	0.264	0.330	0.343	0.248	0.125	0.127	0.170	0.178	0.156	0.111
Countries	73	73	73	72	72	71	69	66	63	58

Notes: The table reports the estimation results from a single equation regression where 3-year business credit growth is a dependent variable. Each column leads the dependent variable by one year. Standard errors in parentheses are dually clustered on country and year. ***, **, * indicate statistical significance at 0.01, 0.5, and 0.1 levels, respectively.

Table 6

Mortgage credit flows and real GDP growth: baseline results.

	(1) $\Delta_3 GDP_{i,t-1}$	(2) $\Delta_3 GDP_{i,t}$	(3) $\Delta_3 GDP_{i,t+1}$	(4) $\Delta_3 GDP_{i,t+2}$	(5) $\Delta_3 GDP_{i,t+3}$	(6) $\Delta_3 GDP_{i,t+4}$	(7) $\Delta_3 GDP_{i,t+5}$	(8) $\Delta_3 GDP_{i,t+6}$	(9) $\Delta_3 GDP_{i,t+7}$	(10) $\Delta_3 GDP_{i,t+8}$
$\Delta_3 MC_{i,t-1}$	0.200** (0.079)	0.080 (0.084)	−0.090 (0.087)	−0.263*** (0.088)	−0.346*** (0.100)	−0.345*** (0.103)	−0.312*** (0.094)	−0.263*** (0.102)	−0.135 (0.114)	−0.021 (0.122)
$\Delta_3 BC_{i,t-1}$	0.100** (0.040)	−0.018 (0.031)	−0.102*** (0.023)	−0.123*** (0.023)	−0.094*** (0.029)	−0.060* (0.034)	−0.023 (0.044)	0.019 (0.047)	0.066* (0.039)	0.077** (0.033)
Observations	1084	1087	1015	941	869	795	724	652	583	515
R-squared	0.099	0.004	0.066	0.174	0.184	0.139	0.086	0.048	0.021	0.021
Countries	73	73	73	72	72	70	69	66	63	58

Notes: The table reports the estimation results from a single equation regression where 3-year GDP growth is a dependent variable. Each column leads the dependent variable by one year. Standard errors in parentheses are dually clustered on country and year. ***, **, * indicate statistical significance at 0.01, 0.5, and 0.1 levels, respectively.

As a robustness check, we re-estimate the baseline regression for the pre-crisis period 1990–2007 (see Table C.4 in Appendix C). The positive relation between mortgage and business credit flows is unchanged, although the negative relation in the medium term became insignificant, in line with VAR and local projections results. Excluding the interpolated data has no influence on our results (see Table C.5).

We proceed by adding house prices as a control variable in our baseline specification. The results in Table C.2 show that while the changes in house prices correlate positively with business credit flows in the medium term, the dynamic relation between mortgage and business credit flows is comparable to the baseline. Including additional controls such as inflation, interest rate, investment, capital flows and trade openness, as shown in Table C.3 somewhat weakens the relation between mortgage and business credit flows in the distant future, i.e. after 7 years, possibly due to smaller samples. However, the dynamic nature of this relation remains significant.¹¹

As an extension and to make our analysis comparable across different methods, we also examine the dynamic relation between mortgage credit flow and GDP growth. We do so by regressing real GDP growth on mortgage (and business) credit flows, using specification (4). The results in Table 6 show that both mortgage and business credit flows are contemporaneously positively associated with GDP growth. However, mortgage credit flows exert a long-lasting negative effect on output growth. In economic terms, the effect is moderate: the sample average 3-year growth in mortgage credit by 6.67 pp of GDP is associated with a drop in 3-year GDP growth by −2.3 pp 4 years in the future, with the sample average 3-year GDP growth of 7.73% at this horizon. These results survive a battery of robustness checks, such as including house prices

be driven by a third factor in a same way. Finding good instruments for mortgage shocks poses a challenge given the nature of our data. Unlike Mian et al. (2017), we are not able to use mortgage spreads as instruments for mortgage credit shocks, as the data is not available on the aggregate level for our country sample. We tried to tackle this issue by using alternative instruments, such as financial deregulation and interest rate spread, which could be considered as potential drivers of mortgage credit. Neither performed well enough to be included in the regression. This remains an area for future research conditional on data availability.

¹¹ We are aware of a potential endogeneity problem in our framework. Mortgage shocks could be in some way affected by changes in business lending, or both could

Table 7

Mortgage credit flows and real GDP growth: advanced economies vs. EDEs.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	$\Delta_3 GDP_{i,t-1}$	$\Delta_3 GDP_{i,t}$	$\Delta_3 GDP_{i,t+1}$	$\Delta_3 GDP_{i,t+2}$	$\Delta_3 GDP_{i,t+3}$	$\Delta_3 GDP_{i,t+4}$	$\Delta_3 GDP_{i,t+5}$	$\Delta_3 GDP_{i,t+6}$	$\Delta_3 GDP_{i,t+7}$	$\Delta_3 GDP_{i,t+8}$
$\Delta_3 MC_{i,t-1}$	0.505*** (0.162)	0.083 (0.147)	-0.308** (0.146)	-0.470 (0.298)	-0.346 (0.416)	-0.252 (0.376)	-0.358 (0.232)	-0.540*** (0.160)	-0.431*** (0.143)	-0.312* (0.169)
$\Delta_3 MC_{i,t-1} \cdot ADV$	-0.345** (0.159)	-0.004 (0.127)	0.247** (0.124)	0.234 (0.283)	0.000 (0.399)	-0.103 (0.350)	0.051 (0.214)	0.312* (0.166)	0.336** (0.151)	0.322* (0.170)
$\Delta_3 BC_{i,t-1}$	0.092** (0.038)	-0.018 (0.029)	-0.096*** (0.022)	-0.117*** (0.022)	-0.094*** (0.026)	-0.063* (0.032)	-0.022 (0.044)	0.031 (0.044)	0.079** (0.035)	0.087*** (0.031)
Observations	1084	1087	1015	941	869	795	724	652	583	515
R-squared	0.110	0.004	0.072	0.179	0.184	0.139	0.086	0.057	0.031	0.029
Countries	73	73	73	72	72	70	69	66	63	58

Notes: The table reports the estimation results from a single equation regression where 3-year GDP growth is a dependent variable. Each column leads the dependent variable by one year. Standard errors in parentheses are dually clustered on country and year. ***, **, * indicate statistical significance at 0.01, 0.5, and 0.1 levels, respectively.

and additional control variables, limiting the sample to the pre-crisis period, and excluding the interpolated data points.¹² We then examined the differential effects between advanced countries and EDEs in Table 7. While the contemporaneous positive relation between mortgage credit flows and GDP growth is stronger for EDEs, the negative relation is present in both country groups, suggesting that large mortgage credit flows may constitute a drag on economic growth in the medium to long term.

5. Concluding remarks

In this paper, we presented a new data set on bank credit allocation covering 74 countries over 1990–2016. Bank credit is reported in four categories: household mortgages, household consumer credit, loans to non-bank financial institutions, and loans to non-financial business. We presented key data features and included a full description of sources and methods of data collection and construction. We compared the data to similar data sets. The advantage of the present data set is that it allows for analysis of topics specific to the banking sector, such as linkages between credit extension and money growth, to the payment system, or to securitization of bank loans. We used the data to explore for selected countries the shift in bank credit since the 1990s away from traditional business lending. We discussed recent literature on the consequences of this ‘debt shift’ for economic growth, macro-financial stability, and inequality. This motivates research into the nature, causes and implications of the ‘debt shift’.

We applied the new data to an empirical analysis of the dynamic relation between mortgage credit flows and non-financial business credit flows, using three methodologies. Our findings show that an increase in mortgage lending flows in advanced economies raises business credit flows in the short run, but crowds out business credit in the medium run. This effect is more negative in EDEs. Given the key role of business credit in the transmission channels from financial development to income growth, this finding raises new questions about trade-offs implied in the expansion of household mortgage markets. Consistent with the literature, we find a mostly negative effect of mortgage credit expansion on GDP growth, especially in EDEs.

A limitation of the data is that they are macro-level data. This is useful to the extent that ‘debt shift’ is related to changes in macro-level structural and regulatory changes, and has impacts on macro-level variables including growth, stability and inequality, as discussed. A drawback is that micro-level heterogeneity in bank credit allocation cannot be observed. Also, micro-level data offer better opportunities to tackle endogeneity concerns and to delve into causal mechanisms. The new data are complementary to micro-level data sets.

Our analysis suggests that the finance-growth literature can be usefully extended to examine finance-finance interactions – such as the effect of rising mortgage credit flows on business lending flows – which may help us understand the changing impacts of financial development on economic development. We offer the new data as a contribution to analyzing the rapidly changing financial markets landscape and its consequences for macroeconomic performance.

Appendix A

Data Reliability and Consistency

Reliability

The data is based on publicly available, official statistics reported by national central banks and statistical bureaus. The quality and quantity of the data varies over countries. For most advanced countries, variables are clearly defined and consistently measured. Also countries in Central and Eastern Europe and South-East Asia provide well-organized bank credit data. For Latin America and Africa, we encountered more often unclear definitions of lending sectors and methodologies of data construction, but still no substantial measurement problems. This was a criterion for data collection from the start. We included 74 countries where data definitions and sources are comprehensible and consistent with international practice.

Consistency

We ensured international consistency in terms of definitions and construction of credit categories. In 10 countries (Belarus, Iceland, Kazakhstan, Lithuania, Moldova, Mongolia, Russia, Slovakia, Turkey, Ukraine) separation of household credit into mortgages and consumption credit was available only for the latest few years, while for earlier years in the available data period only total household credit was reported. To extend the series of these credit categories, we calculated their average shares in total household credit over the period for which the separation into mortgages/consumer credit was available. Since these shares were quite stable over time, we used them to impute mortgages and consumer loans for earlier periods. For China we did not find household credit separated into sectors, only by maturity. Since short-term household credit is mainly used to finance consumption, we assumed that medium- and long-term household credit are mortgages and short-term loans are consumption credit.

To ensure intertemporal consistency, we checked that there are no serious breaks in time series. In Singapore there was a break in non-financial business credit in March 2004, when total loans to Professional and Private Individuals (PPI) were split into loans

¹² The results of all robustness checks are available in the Online Appendix.

to PPI by business purposes and consumer loans. To smooth this break, we added PPI loans for business purposes back to non-financial business.

There is large diversity in reporting formats of central banks with respect to business credit. Most do not differentiate between lending to public sector firms and private sector firms, some do (e.g., Canada, Egypt, Latvia, Mongolia, the Netherlands, Thailand). We include credit to both private and public non-financial firms in non-financial business credit.¹³ Some central banks (e.g., in Czech Republic, Indonesia, Malaysia, Switzerland, Tunisia, Uruguay) report credit to 10–15 separate industries. In the interest of cross-country consistency, we collapsed these into aggregate 'financial' and 'non-financial' sectors. The central bank of Egypt reports only 'household' and 'business' lending. We assigned all household lending to consumption credit (other evidence suggests little household mortgage lending in Egypt) and business lending to non-financial business (according to available sources, bank lending to financial business is negligible).

Appendix B

Table B.1

Pairwise correlations of credit categories for our data set and others.

Credit category	BIS (2013)	Jordà et al. (2017)
Total (private non-financial sector) credit	0.775	0.893
Non-financial business credit	0.487	0.807
Household credit	0.911	0.899

Notes: The table reports pairwise correlations of total credit (private non-financial sector credit), non-financial business credit and household credit (sum of mortgage and consumer credit) between our data and two data sets: Jordà et al. (2017) and BIS (2013). Credit categories are in % of nominal GDP.

Table B.2

Comparison: our data and Jordà et al. (2017).

Country	Total credit		Non-fin. business credit		Household credit	
	Our data	Jordà et al. (2017)	Our data	Jordà et al. (2017)	Our data	Jordà et al. (2017)
AUS	93.98	97.42	34.91	38.28	59.08	59.13
BEL	60.89	84.64	28.26	37.56	32.64	47.08
CAN	111.83	77.87	39.44	21.95	72.39	55.92
CHE	147.76	134.87	40.54	38.82		96.05
					107.23	
DEU	80.77	82.30	48.39	48.31	32.38	34.07
DNK	162.44	169.86	52.49	84.85		85.01
					109.95	
ESP	111.73	116.35	53.55	63.44	58.17	52.90
FIN	62.57	74.38	25.54	26.71	49.37	53.45
FRA	78.21	81.48	36.03	39.09	42.18	42.39
GBR	62.21	91.98	19.78	22.94	42.43	69.04
ITA	77.84	84.67	47.94	51.10	29.90	33.57
JPN	78.05	85.57	50.82	65.57	27.23	19.99
NLD	106.19	119.31	46.90	62.66	59.29	56.65
NOR	99.53	98.54	34.61	31.10	64.92	61.35
PRT	83.61	87.69	43.02	47.12	40.59	40.57
SWE	109.57	98.14	51.32	43.35	58.25	54.78
USA	26.76	48.72	9.31	17.57	17.45	31.16

Notes: The table reports the averages of total credit (private non-financial sector credit), non-financial business credit and household credit (sum of mortgage and consumer credit) for 17 countries based on our data and Jordà et al. (2017). The time period runs until 2016 and varies across countries. For the sake of comparability, we calculate averages of credit for the same periods as available in our data. Credit stocks are in % of nominal GDP.

Table B.3

Comparison: our data and BIS.

Country	Total credit		Non-fin. business credit		Household credit	
	Our data	BIS data	Our data	BIS data	Our data	BIS data
ARG	13.84	28.77	8.63	24.23	5.15	4.80
AUS	93.98	152.50	34.91	69.25	59.08	83.24
AUT	83.52	131.89	48.26	83.73	35.25	48.39
BEL	60.89	178.44	28.26	130.31	32.64	48.12
BRA	35.59	54.58	20.59	36.79	15.00	17.61
CAN	111.83	161.83	39.44	90.26	72.39	71.56
CHE	147.76	186.32	37.34	92.88	125.44	111.56
CHL	63.49	98.49	46.90	80.71	25.60	31.35
CHN	124.21	146.40	99.95	127.63	26.37	27.27
COL	32.39	48.79	19.85	31.46	12.54	17.33
CZE	41.11	78.81	24.48	59.14	17.14	18.79
DEU	80.77	105.14	48.65	52.01	32.96	54.22
DNK	162.44	214.56	52.49	98.86	109.95	115.76
ESP	111.73	152.83	53.55	92.93	58.17	60.28
FIN	62.57	146.50	25.54	98.29	49.37	53.89
FRA	78.21	154.14	36.03	111.70	42.18	42.95
GBR	62.21	144.43	19.78	73.40	42.43	71.03
GRC	67.04	77.19	40.73	49.29	32.41	35.94
HKG	121.39	171.41	83.11	132.26	53.50	53.00
HUN	37.99	78.08	23.19	59.86	14.80	18.22
IDN	25.41	29.84	17.34	16.92	8.07	12.92
IND	35.86	51.35	33.62	48.81	8.10	9.60
IRE	113.60	261.68	51.61	174.20	61.99	87.29
ISR	84.01	118.83	51.59	80.26	32.42	38.56
ITA	77.84	103.73	47.94	69.53	29.90	34.19
JPN	78.05	175.37	50.82	114.99	27.23	60.38
KOR	104.12	182.86	54.91	101.35	49.21	80.35
LUX	79.96	286.53	31.28	262.39	47.50	53.73
MEX	20.92	29.36	8.49	17.26	12.43	12.11
MYS	96.19	132.10	35.63	61.70	54.51	60.88
NLD	106.19	223.90	46.90	134.46	59.29	90.62
NOR	99.53	192.14	34.61	121.85	64.92	70.32
NZL	99.07	151.96	33.75	84.39	65.32	67.61
POL	35.62	55.77	15.00	35.32	20.62	20.45
PRT	83.61	142.43	43.02	97.14	40.59	46.29
RUS	31.76	39.90	27.15	35.42	7.57	7.94
SGP	90.18	127.74	55.77	86.11	34.41	41.20
SWE	109.57	186.46	51.32	123.14	58.25	63.33
THA	101.20	103.49	45.09	49.75	56.11	53.74
TUR	22.08	34.39	15.62	28.79	5.58	8.24
USA	27.41	111.01	9.48	53.24	17.93	57.77

Notes: The table reports the averages of total credit (private non-financial sector credit), non-financial business credit and household credit (sum of mortgage and consumer credit) for 41 countries based on our data and BIS 'Long series on credit to private non-financial sectors'. The time period runs until 2016 and varies across countries. For the sake of comparability, we calculate averages of credit for the same periods as available in our data. Credit stocks are in % of nominal GDP.

¹³ In this respect we differ from some literature which uses a measure for 'credit to the private sector'. This is not possible in our data since we cannot always observe public and private sectors separately. It may also understate credit growth to non-financial business by excluding part of the non-financial business sector based on the ownership status. We do not include lending to government itself.

Appendix C

Fig. C.1. Impulse responses to 1 pp. positive shock to mortgage credit flows, 3-variable VAR model, 1990–2007. *Notes:* The figure plots impulse responses of mortgage credit flows, non-financial business credit flows, and real GDP growth to 1 pp. positive shock to mortgage credit flows, based on a VAR with Cholesky identification. The blue lines are median responses, black solid lines are 68% confidence intervals, and black dashed lines are 90% confidence intervals.

Fig. C.2. Impulse responses to 1 pp. increase in mortgage credit flows, local projections, 1990–2007. *Notes:* The figure plots impulse responses of mortgage credit flows, non-financial business credit flows, and real GDP growth to 1 pp. increase in mortgage credit flows at t_0 , using local projections for horizons $h=1,\dots,10$. The blue lines are median responses, black solid lines are 68% confidence intervals, and black dashed lines are 90% confidence intervals.

Fig. C.3. Impulse responses to 1 pp. positive shock to mortgage credit flows, 4-variable VAR model, full sample. *Notes:* The figure plots impulse responses of mortgage credit flows, business credit flows, real GDP growth, and real house prices growth to 1 pp. positive shock to mortgage credit flows, based on VAR with Cholesky identification. The blue lines are median responses, black solid lines are 68% confidence intervals, and black dashed lines are 90% confidence intervals.

Fig. C.4. Impulse responses to 1 pp. positive shock to mortgage credit flows, 4-variable VAR model, 1990–2007. *Notes:* The figure plots impulse responses of mortgage credit flows, business credit flows, real GDP growth, and real house prices growth to 1 pp. positive shock to mortgage credit flows, based on VAR with Cholesky identification. The blue lines are median responses, black solid lines are 68% confidence intervals, and black dashed lines are 90% confidence intervals.

Fig. C.5. Impulse responses to 1 pp. positive shock to mortgage credit flows, 4-variable VAR model, advanced countries. *Notes:* The figure plots impulse responses of mortgage credit flows, business credit flows, real GDP growth, and real house prices growth to 1 pp. positive shock to mortgage credit flows, based on VAR with Cholesky identification for 36 advanced countries. The blue lines are median responses, black solid lines are 68% confidence intervals, and black dashed lines are 90% confidence intervals.

Fig. C.6. Impulse responses to 1 pp. positive shock to mortgage credit flows, 4-variable VAR model, emerging and developing countries. *Notes:* The figure plots impulse responses of mortgage credit flows, business credit flows, real GDP growth, and real house prices growth to 1 pp. positive shock to mortgage credit flows, based on VAR with Cholesky identification for 26 EDEs. The blue lines are median responses, black solid lines are 68% confidence intervals, and black dashed lines are 90% confidence intervals.

Fig. C.7. Impulse responses to 1 pp. increase in mortgage credit flows, 4-variable local projections, full sample. *Notes:* The figure plots impulse responses of mortgage credit flows, business credit flows, real GDP growth, and real house prices growth to 1 pp. increase in mortgage credit flows at t_0 , using local projections for horizons $h=1, \dots, 10$. The blue lines are median responses, black solid lines are 68% confidence intervals, and black dashed lines are 90% confidence intervals.

Fig. C.8. Impulse responses to 1 pp. increase in mortgage credit flows, 4-variable local projections, 1990–2007. *Notes:* The figure plots impulse responses of mortgage credit flows, business credit flows, real GDP growth, and real house prices growth to 1 pp. increase in mortgage credit flows at t_0 , using local projections for horizons $h=1, \dots, 10$. The blue lines are median responses, black solid lines are 68% confidence intervals, and black dashed lines are 90% confidence intervals.

Fig. C.9. Impulse responses to 1 pp. increase in mortgage credit flows, 4-variable local projections, advanced countries. *Notes:* The figure plots responses of mortgage credit flows, business credit flows, real GDP growth, and real house prices growth to 1 pp. increase in mortgage flows at t_0 , using local projections for horizons $h=1,\dots,10$, for 36 advanced countries. The blue lines are median responses, black solid lines are 68% confidence intervals, and black dashed lines are 90% intervals.

Fig. C.10. Impulse responses to 1 pp. increase in mortgage credit flows, 4-variable local projections, emerging and developing countries. *Notes:* The figure plots responses of mortgage credit flows, business credit flows, real GDP growth, and real house prices growth to 1 pp. increase in mortgage flows at t_0 , using local projections for horizons $h=1,\dots,10$, for 38 emerging and developing countries. The blue lines are median responses, black solid lines are 68% confidence intervals, and black dashed lines are 90% intervals.

Fig. C.11. Impulse responses to 1 pp. positive shock to mortgage credit flows, 3-variable VAR model, full sample without interpolated data. *Notes:* The figure plots responses of mortgage credit flows, business credit flows, and real GDP growth to 1 pp. mortgage flows shock. Blue lines are median responses, black solid lines are 68% confidence intervals, black dashed lines are 90% intervals.

Fig. C.12. Impulse responses to 1 pp. positive shock to mortgage credit flows, 3-variable VAR model, 1990–2007 without interpolated data. *Notes:* The figure plots responses of mortgage credit flows, business credit flows, and real GDP growth to 1e pp. mortgage flows shock. Blue lines are median responses, black solid lines are 68% confidence intervals, black dashed lines are 90% intervals.

Fig. C.13. Impulse responses to 1 pp. positive shock to mortgage credit flows, 3-variable VAR model, advanced countries without interpolated data. *Notes:* The figure plots responses of mortgage credit flows, business credit flows, and real GDP growth to 1 pp. mortgage flows shock. Blue lines are median responses, black solid lines are 68% confidence intervals, black dashed lines are 90% intervals.

Fig. C.14. Impulse responses to 1 pp. positive shock to mortgage credit flows, 3-variable VAR model, emerging and developing countries without interpolated data. *Notes:* The figure plots responses of mortgage credit flows, business credit flows, and real GDP growth to 1 pp. mortgage flows shock. Blue lines are median responses, black solid lines are 68% confidence intervals, black dashed lines are 90% intervals.

Fig. C.15. Impulse responses to 1 pp. increase in mortgage credit flows, local projections, full sample, without interpolated data. *Notes:* The figure plots responses of mortgage flows, business credit flows, and real GDP growth to 1 pp. increase in mortgage flows. Blue lines are median responses, black solid lines are 68% confidence intervals, and black dashed lines are 90% intervals.

Fig. C.16. Impulse responses to 1 pp. increase in mortgage credit flows, local projections, 1990-2007, without interpolated data. *Notes:* The figure plots responses of mortgage flows, business credit flows, and real GDP growth to 1 pp. increase in mortgage flows. Blue lines are median responses, black solid lines are 68% confidence intervals, and black dashed lines are 90% intervals.

Fig. C.17. Impulse responses to 1 pp. increase in mortgage credit flows, local projections, advanced countries, without interpolated data. *Notes:* The figure plots responses of mortgage flows, business credit flows, and real GDP growth to 1 pp. increase in mortgage flows. Blue lines are median responses, black solid lines are 68% confidence intervals, and black dashed lines are 90% intervals.

Fig. C.18. Impulse responses to 1 pp. increase in mortgage credit flows, local projections, emerging and developing countries, without interpolated data. *Notes:* The figure plots responses of mortgage flows, business credit flows, and real GDP growth to 1 pp. increase in mortgage flows. Blue lines are median responses, black solid lines are 68% confidence intervals, and black dashed lines are 90% intervals.

Table C.1

Empirical analysis: variables, data sources, and descriptive statistics.

Variable	Variable	Data sources	Obs.	Mean	Sd	Min	Max
Mortgage flows (MC)	Household mortgage credit flow (in % GDP)	central banks' statistics	1308	1.95	2.51	-11.45	16.07
Business credit flows (BC)	Non-financial business credit flow (in % GDP)	central banks' statistics	1307	2.66	5.05	-46.47	52.86
Real GDP growth	Annual growth rate of GDP per capita	WDI WB	1304	2.53	3.73	-14.56	33.03
House price growth	Annual growth rate in real house prices (deflated by CPI)	BIS	1053	1.35	10.30	-92.26	50.15
Inflation	Annual CPI inflation rate	WDI WB	1307	5.25	10.11	-4.48	168.62
Interest rate	Short-term money market interest rate	IFS IMF	1250	6.04	9.00	-2.00	125.10
Investment growth	Annual growth rate of gross fixed capital formation	WDI WB	1304	-0.08	2.05	-16.29	13.93
Trade openness	Export plus import of goods and services (in % GDP)	WDI WB	1307	96.51	71.94	15.64	442.62
Capital inflows	Total gross capital inflows (in % GDP)	IMF BoP	1285	26.68	133.76	-132.68	2079.24
Interest rate spread	Difference between lending and deposit rate	WDI WB	1257	4.94	5.17	-9.11	45.11
Financial deregulation	Credit market deregulation includes 3 components: ownership of banks, extension of credit, presence of interest rate controls/negative interest rates. Deregulation index is an average of components; it takes values from 1 to 10.	Fraser Institute's Economic Freedom Indicators	1086	8.75	1.11	4.29	10.00

Table C.2

Mortgage and business credit flows: including house prices.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	$\Delta_3 BC_{i,t-1}$	$\Delta_3 BC_{i,t}$	$\Delta_3 BC_{i,t+1}$	$\Delta_3 BC_{i,t+2}$	$\Delta_3 BC_{i,t+3}$	$\Delta_3 BC_{i,t+4}$	$\Delta_3 BC_{i,t+5}$	$\Delta_3 BC_{i,t+6}$	$\Delta_3 BC_{i,t+7}$	$\Delta_3 BC_{i,t+8}$
$\Delta_3 MC_{i,t-1}$	1.070*** (0.175)	1.083*** (0.159)	0.864*** (0.195)	0.453*** (0.167)	-0.027 (0.125)	-0.421** (0.176)	-0.648*** (0.203)	-0.714*** (0.198)	-0.671*** (0.216)	-0.554*** (0.212)
$\Delta_3 GDP_{i,t-1}$	-0.013 (0.107)	0.522*** (0.095)	0.771*** (0.125)	0.698*** (0.107)	0.482*** (0.104)	0.296** (0.125)	0.217** (0.109)	0.155 (0.099)	0.146 (0.123)	0.210 (0.167)
$\Delta_3 HP_{i,t-1}$	-0.080 (0.068)	-0.031 (0.065)	0.110* (0.059)	0.230*** (0.066)	0.223*** (0.057)	0.149*** (0.057)	0.062 (0.056)	0.004 (0.050)	-0.058 (0.045)	-0.047 (0.059)
Observations	910	911	852	792	733	675	614	557	501	444
R-squared	0.291	0.378	0.420	0.364	0.221	0.173	0.188	0.183	0.154	0.105
Countries	62	62	62	61	60	59	56	55	54	51

Notes: The table reports the estimation results from a single equation regression where 3-year business credit growth is a dependent variable. Each column leads the dependent variable by one year. Standard errors in parentheses are dually clustered on country and year. ***, **, * indicate statistical significance at 0.01, 0.05, and 0.1 levels, respectively.

Table C.3

Mortgage and business credit flows: including all control variables.

	(1) $\Delta_3 BC_{i,t-1}$	(2) $\Delta_3 BC_{i,t}$	(3) $\Delta_3 BC_{i,t+1}$	(4) $\Delta_3 BC_{i,t+2}$	(5) $\Delta_3 BC_{i,t+3}$	(6) $\Delta_3 BC_{i,t+4}$	(7) $\Delta_3 BC_{i,t+5}$	(8) $\Delta_3 BC_{i,t+6}$	(9) $\Delta_3 BC_{i,t+7}$	(10) $\Delta_3 BC_{i,t+8}$
$\Delta_3 MC_{i,t-1}$	0.780*** (0.196)	0.786*** (0.151)	0.631*** (0.171)	0.344** (0.148)	−0.018 (0.111)	−0.318** (0.151)	−0.416*** (0.153)	−0.329*** (0.127)	−0.233 (0.176)	−0.110 (0.205)
$\Delta_3 GDP_{i,t-1}$	−0.336** (0.135)	0.163* (0.096)	0.453*** (0.105)	0.499*** (0.104)	0.441*** (0.098)	0.341** (0.136)	0.370*** (0.132)	0.391*** (0.132)	0.406*** (0.155)	0.442** (0.202)
$\Delta_3 HP_{i,t-1}$	0.004 (0.066)	0.058 (0.051)	0.176*** (0.052)	0.276*** (0.052)	0.246*** (0.053)	0.189*** (0.066)	0.120** (0.060)	0.106** (0.045)	0.037 (0.043)	0.023 (0.059)
$\Delta_3 Inflation_{i,t-1}$	1.167*** (0.398)	1.222*** (0.336)	0.725*** (0.215)	0.318 (0.336)	0.022 (0.397)	0.303 (0.224)	0.340** (0.150)	0.533** (0.217)	0.229 (0.207)	−0.137 (0.240)
$\Delta_3 Interest_{i,t-1}$	0.024 (0.197)	0.154 (0.221)	0.299 (0.250)	0.241 (0.224)	0.116 (0.213)	0.003 (0.256)	0.124 (0.214)	0.238* (0.135)	0.350** (0.158)	0.526** (0.257)
$\Delta_3 Investment_{i,t-1}$	0.997*** (0.207)	1.075*** (0.220)	1.003*** (0.178)	0.521** (0.218)	−0.090 (0.227)	−0.582** (0.288)	−1.209*** (0.340)	−1.811*** (0.388)	−1.826*** (0.428)	−1.605*** (0.493)
$\Delta_3 CapFlows_{i,t-1}$	−0.017** (0.007)	−0.005 (0.004)	0.011 (0.007)	0.022** (0.010)	0.024*** (0.008)	0.007 (0.007)	−0.003 (0.009)	−0.008** (0.004)	−0.013 (.)	−0.014** (0.006)
$\Delta_3 Trade_{i,t-1}$	−0.020 (0.055)	0.036 (0.047)	0.070 (0.043)	0.066 (0.040)	0.016 (0.046)	−0.026 (0.054)	−0.057 (0.052)	−0.090** (0.044)	−0.059 (0.048)	−0.019 (0.048)
Observations	867	868	819	769	719	661	600	543	487	430
R-squared	0.373	0.464	0.488	0.417	0.259	0.192	0.242	0.317	0.300	0.236
Countries	62	62	62	61	60	59	56	55	54	51

Notes: The table reports the estimation results from a single equation regression where 3-year business credit growth is a dependent variable. Each column leads the dependent variable by one year. Standard errors in parentheses are dually clustered on country and year. ***, **, * indicate statistical significance at 0.01, 0.5, and 0.1 levels, respectively.

Table C.4

Mortgage and business credit flows: pre-crisis period.

	(1) $\Delta_3 BC_{i,t-1}$	(2) $\Delta_3 BC_{i,t}$	(3) $\Delta_3 BC_{i,t+1}$	(4) $\Delta_3 BC_{i,t+2}$	(5) $\Delta_3 BC_{i,t+3}$	(6) $\Delta_3 BC_{i,t+4}$	(7) $\Delta_3 BC_{i,t+5}$	(8) $\Delta_3 BC_{i,t+6}$	(9) $\Delta_3 BC_{i,t+7}$	(10) $\Delta_3 BC_{i,t+8}$
$\Delta_3 MC_{i,t-1}$	0.784*** (0.188)	0.815*** (0.170)	0.610*** (0.207)	0.279 (0.208)	−0.102 (0.180)	−0.340 (0.231)	−0.467* (0.240)	−0.300 (0.191)	0.094 (0.157)	0.433** (0.189)
$\Delta_3 GDP_{i,t-1}$	0.051 (0.123)	0.485*** (0.112)	0.606*** (0.138)	0.487*** (0.164)	0.282 (0.172)	−0.054 (0.124)	−0.177* (0.092)	−0.261 (0.182)	−0.469* (0.277)	−0.558** (0.221)
Observations	450	450	393	343	297	251	211	169	134	106
R-squared	0.105	0.187	0.184	0.108	0.036	0.034	0.085	0.062	0.079	0.131
Countries	52	52	47	44	42	38	36	30	25	22

Notes: The table reports the estimation results from a single equation regression where 3-year business credit growth is a dependent variable. Each column leads the dependent variable by one year. Standard errors in parentheses are dually clustered on country and year. ***, **, * indicate statistical significance at 0.01, 0.5, and 0.1 levels, respectively.

Table C.5

Mortgage and business credit flows: excluding interpolated data.

	(1) $\Delta_3 BC_{i,t-1}$	(2) $\Delta_3 BC_{i,t}$	(3) $\Delta_3 BC_{i,t+1}$	(4) $\Delta_3 BC_{i,t+2}$	(5) $\Delta_3 BC_{i,t+3}$	(6) $\Delta_3 BC_{i,t+4}$	(7) $\Delta_3 BC_{i,t+5}$	(8) $\Delta_3 BC_{i,t+6}$	(9) $\Delta_3 BC_{i,t+7}$	(10) $\Delta_3 BC_{i,t+8}$
$\Delta_3 MC_{i,t-1}$	1.081*** (0.177)	0.977*** (0.145)	0.638*** (0.120)	0.263** (0.131)	−0.093 (0.155)	−0.355** (0.179)	−0.564*** (0.206)	−0.672*** (0.213)	−0.644*** (0.222)	−0.522** (0.221)
$\Delta_3 GDP_{i,t-1}$	−0.026 (0.087)	0.445*** (0.079)	0.670*** (0.092)	0.663*** (0.113)	0.509*** (0.119)	0.381*** (0.117)	0.288*** (0.107)	0.210** (0.095)	0.124 (0.109)	0.199 (0.139)
Observations	982	983	909	835	764	693	623	554	490	431
R-squared	0.343	0.405	0.359	0.241	0.131	0.118	0.148	0.164	0.142	0.102
Countries	73	73	72	70	69	67	64	59	54	49

Notes: The table reports the estimation results from a single equation regression where 3-year business credit growth is a dependent variable. Each column leads the dependent variable by one year. Standard errors in parentheses are dually clustered on country and year. ***, **, * indicate statistical significance at 0.01, 0.5, and 0.1 levels, respectively.

Table C.6

Mortgage and business credit flows: advanced economies vs. EDEs (additional control variables).

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	$\Delta_3 BC_{i,t-1}$	$\Delta_3 BC_{i,t}$	$\Delta_3 BC_{i,t+1}$	$\Delta_3 BC_{i,t+2}$	$\Delta_3 BC_{i,t+3}$	$\Delta_3 BC_{i,t+4}$	$\Delta_3 BC_{i,t+5}$	$\Delta_3 BC_{i,t+6}$	$\Delta_3 BC_{i,t+7}$	$\Delta_3 BC_{i,t+8}$
$\Delta_3 MC_{i,t-1}$	0.858*** (0.174)	0.712*** (0.151)	0.459*** (0.103)	0.197** (0.090)	−0.043 (0.129)	−0.233 (0.147)	−0.323** (0.158)	−0.307* (0.162)	−0.262 (0.187)	−0.114 (0.215)
$\Delta_3 MC_{i,t-1} * ADV$	−0.526** (0.214)	−0.520** (0.207)	−0.142 (0.178)	0.085 (0.251)	0.257 (0.310)	−0.112 (0.261)	−0.193 (0.257)	−0.195 (0.287)	0.109 (0.258)	0.077 (0.269)
$\Delta_3 GDP_{i,t-1}$	−0.309*** (0.106)	0.110 (0.095)	0.380*** (0.099)	0.452*** (0.105)	0.438*** (0.112)	0.352** (0.145)	0.362*** (0.138)	0.363** (0.143)	0.396** (0.178)	0.452** (0.223)
$\Delta_3 Inflation_{i,t-1}$	0.815*** (0.286)	1.072*** (0.322)	0.705** (0.277)	0.447 (0.322)	0.110 (0.366)	0.335 (0.206)	0.262 (0.165)	0.457** (0.214)	0.136 (0.201)	−0.208 (0.237)
$\Delta_3 Interest_{i,t-1}$	0.048 (0.181)	0.044 (0.166)	0.110 (0.165)	0.088 (0.192)	0.093 (0.226)	0.115 (0.246)	0.265 (0.226)	0.307* (0.159)	0.356** (0.163)	0.559** (0.246)
$\Delta_3 Investment_{i,t-1}$	0.939*** (0.232)	1.059*** (0.226)	0.984*** (0.185)	0.474** (0.209)	−0.118 (0.214)	−0.576* (0.302)	−1.108*** (0.362)	−1.652*** (0.398)	−1.656*** (0.452)	−1.437*** (0.541)
$\Delta_3 CapFlows_{i,t-1}$	−0.009*** (0.002)	−0.004 (0.005)	0.007 (0.006)	0.014*** (0.005)	0.018*** (0.004)	0.001 (0.003)	−0.010 (.)	−0.012 (.)	−0.014*** (0.001)	−0.009*** (0.002)
$\Delta_3 Trade_{i,t-1}$	−0.005 (0.059)	0.052 (0.050)	0.083* (0.046)	0.070 (0.043)	0.025 (0.048)	−0.009 (0.057)	−0.025 (0.055)	−0.053 (0.043)	−0.014 (0.050)	0.008 (0.057)
$\Delta_3 HP_{i,t-1}$	0.007 (0.055)	0.060 (0.048)	0.182*** (0.048)	0.275*** (0.054)	0.254*** (0.054)	0.192*** (0.061)	0.127** (0.059)	0.105** (0.050)	0.029 (0.045)	0.024 (0.063)
Observations	836	837	790	742	694	638	577	520	469	415
R-squared	0.509	0.534	0.519	0.412	0.256	0.197	0.224	0.290	0.285	0.218
Countries	62	62	62	61	60	59	55	52	52	49

Notes: The table reports the estimation results from a single equation regression where 3-year business credit growth is a dependent variable. Each column leads the dependent variable by one year. Standard errors in parentheses are dually clustered on country and year. ***, **, * indicate statistical significance at 0.01, 0.5, and 0.1 levels, respectively.

Supplementary material

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CRedit authorship contribution statement

Dirk Bezemer: Conceptualization, Investigation, Data curation, Writing - original draft, Writing - review & editing, Supervision, Project administration, Funding acquisition. **Anna Samarina:** Investigation, Methodology, Data curation, Software, Formal analysis, Validation, Writing - original draft, Writing - review & editing, Visualization, Project administration. **Lu Zhang:** Methodology, Investigation, Formal analysis, Validation, Writing - original draft, Visualization.

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