

Finance and Business Cycles: The Credit-Driven Household Demand Channel

Atif Mian and Amir Sufi

What is the role of the financial sector in explaining business cycles? This question is as old as the field of macroeconomics, and an extensive body of research conducted since the global financial crisis of 2008 has offered new answers. The specific idea put forward in this article is that expansions in credit supply, operating primarily through household demand, have been an important driver of business cycles. We call this the credit-driven household demand channel. While this channel helps explain the recent global recession, it also describes economic cycles in many countries over the past 40 years.

Our interest in this topic began with a striking empirical regularity of the Great Recession: the larger the increase in household leverage prior to the recession, the more severe the subsequent recession. Figure 1 shows this pattern both across states within the United States and across countries in the world. Indeed, the ability of household debt expansion to predict recession severity across geographical areas during the Great Recession has been demonstrated by a number of studies (for example, Mian and Sufi 2010; Glick and Lansing 2010; IMF 2012; Martin and Philippon 2017). The ability of household debt expansion to predict a slowdown in growth is broader than the Great Recession. A rise in household debt is a robust

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rise in savings by many emerging markets (that is, the “global savings glut” as articulated by Bernanke 2005).

The discussion of fundamental causes of credit supply expansion naturally leads to consideration of longer-run factors. For example, there has been a long-term secular rise in private credit-to-GDP ratios, especially household credit-to-GDP ratios (Jordà, Schularick, and Taylor 2016). This rise has been accompanied by a decline in real long-term interest rates, and a rise in within-country inequality and across-country “savings gluts.” There may be a connection between these longer-term trends and what we uncover at the business cycle frequency. We discuss these issues in the conclusion.

Credit Supply Expansion and Business Cycles

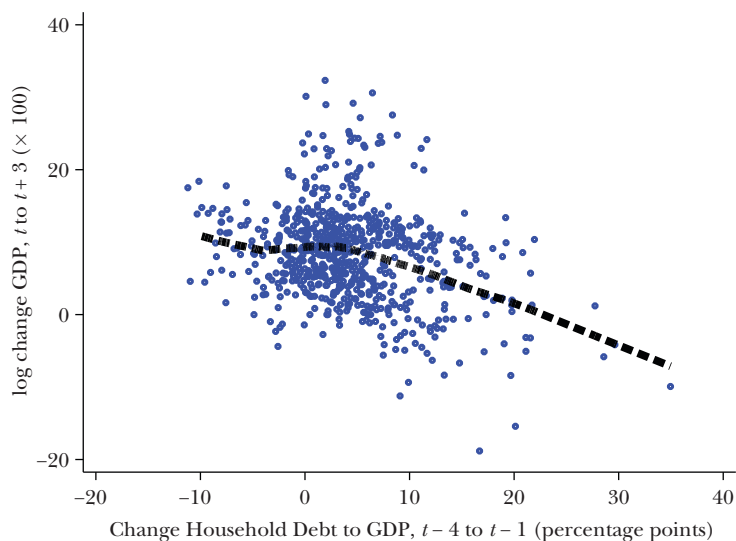
Credit Cycles and Business Cycles

A robust empirical finding is the existence of predictable credit cycles that generate fluctuations in real economic activity. López-Salido, Stein, and Zakrajšek (2017) present evidence on the predictability of the credit cycle; they use evidence from the United States since the 1920s to show that a narrowing of the spread between mid-grade corporate bonds and US Treasuries predicts a subsequent widening of credit spreads. Krishnamurthy and Muir (2017) use a sample of 19 countries (with data going back to the 19th century for 14 countries) to show that a period of low credit spreads precedes a sudden widening of credit spreads. The notion of a predictable cycle in credit is also highlighted by Borio (2014), who reviews a substantial body of research from the Bank of International Settlements supporting this view.

This predictable cycle has important effects on the household debt cycle. Using a sample of 30 mostly advanced countries over the last 40 years, in Mian, Sufi, and Verner (2017b), we estimate a vector autoregression in the level of household debt to lagged GDP, nonfinancial firm debt to lagged GDP, and log real GDP. The results show that a sudden increase in the household debt-to-GDP ratio in a given country leads to a three-year increase in the household debt-to-GDP ratio followed by a sharp fall over the subsequent seven years. There is a predictable decline in household debt following a positive shock to household debt in a country, which reflects the importance of the predictable cycle in credit spreads. The household debt cycle is closely connected to the business cycle. We show that a shock to household debt generates a boom-bust cycle in the real economy that is similar to the credit cycle. Growth increases for two to three years, and then falls significantly.

The International Monetary Fund (2017) estimates similar specifications using a significantly larger sample of 80 countries, with some data going back to the 1950s. This work confirms the boom-bust pattern associated with sudden increases in the household debt-to-GDP ratio. The report concludes that “an increase in household debt boosts growth in the short-term but may give rise to macroeconomic and financial stability risks in the medium term.” Their sample includes substantially

Figure 2

Rise in Household Debt Predicts Lower GDP Growth

Note: Figure 2 is based on a sample of 30 mostly high-income countries from 1960 to 2012 in the Mian, Sufi, and Verner (2017b) sample. Each point represents a given country and a given year. This figure plots real GDP growth from year t to $t+3$ against the rise in the household debt to GDP ratio from year $t-4$ to year $t-1$. See Mian, Sufi, and Verner (2017b) for more details.

more emerging economies, and they are able to show that the same pattern is present in emerging economies, but it is less pronounced. Drehmann, Juselius, and Korinek (2017) also confirm this pattern in a panel of 17 advanced economies from 1980 to 2015. They emphasize the importance of rising debt service burdens in explaining the subsequent drop in GDP.

In short, a boom-bust cycle of credit and housing debt is a robust pattern in the data. The pattern is strong enough that a rise in household debt systematically predicts a decline in subsequent GDP growth. Figure 2 is based on a sample of 30 mostly high-income countries from 1960 to 2012 in the Mian, Sufi, and Verner (2017b) sample. Each point represents a given country and a given year: for example, the point to the farthest right shown is for Ireland in 2007. This data point shows the change in household debt in Ireland from 2003 to 2006 (shown on the horizontal axis) is associated with a large decline GDP for Ireland from 2007 to 2010 (shown on the vertical axis). The dotted line is a nonparametric plot of the relationship in the data. Overall, there is a robust negative correlation between the growth in household debt from $t-4$ to $t-1$ and the subsequent real GDP growth from t to $t+3$.

Intriguingly, professional forecasters do not seem to take into account the connection between increases in household debt and lower subsequent growth. In

Mian, Sufi, and Verner (2017b), we examine output growth forecasts by the IMF and the OECD and find that growth is systematically over-forecasted following periods of high household debt.

Identification of Credit Supply Expansion in Aggregate Data

Why might household debt increase suddenly? Why might such a rise generate a boom-bust cycle in real economic activity? An initial approach to answer this question focuses on whether debt expansion is due to credit demand shocks or credit supply shocks. By credit demand shocks, we mean changes in household permanent income, demographics, or beliefs. By credit supply shocks, we mean an increased willingness of lenders to provide credit that is independent of the borrower's income position.¹

Two approaches have been used to distinguish credit supply shocks from credit demand shocks. In this subsection, we look at aggregate country-level analysis in datasets that cover a long time series and many macroeconomic cycles. In the next subsection, we look at studies that focus on specific macroeconomic episodes and use cross-sectional data across countries or regions.

When using longer time series datasets covering many episodes, the most direct empirical method for separating credit supply versus credit demand shocks is to examine interest rates and credit spreads during household debt expansions. Such evidence favors the credit supply expansion view. For example, using the same sample as in Figure 2, in Mian, Sufi, and Verner (2017b), we show that large three- to four-year increases in household debt are associated with low spreads between mortgage credit and sovereign credit. To isolate increases in credit supply, we use episodes in which mortgage credit spreads are low as an instrument for the rise in household debt, and we show that such credit-supply-driven increases in household debt predict subsequent economic downturns.²

In another approach, Jordà, Schularick, and Taylor (2015) use pegged currencies and monetary policy shocks to isolate variation in credit supply. Countries with fixed exchange rates see changes in short-term interest rates that are unrelated to home economic conditions when monetary policy shifts in the pegged country. They show that monetary policy shocks that lower the short-term interest rate are associated with an increase in household debt and house prices. Furthermore, the rise in household debt and house prices heightens the risk of a financial crisis.

¹We note from the outset that the negative relationship between a rise in household debt and subsequent growth shown in Mian, Sufi, and Verner (2017b) casts doubt on the role of credit demand shocks coming from changes in permanent income. A rise in household debt driven by a positive permanent income shock should predict an increase in subsequent growth, at least in models with rational expectations. The opposite pattern is found in the data.

²More specifically, we present the impulse response function of log real GDP to an increase in household debt from a proxy structural vector autoregression specification in which low credit spread episodes are used as an instrument for a credit-supply-driven increase in household debt. The proxy structural vector autoregression approach is based on Mertens and Ravn (2013); see Mian, Sufi, and Verner (2017b) for details. The impulse response function from this specification shows a similar boom and bust in real economic activity coming from a credit-supply-driven increase in household debt.

Krishnamurthy and Muir (2017) find similar results when examining growth in private sector credit. In their sample of 19 countries going back to the 19th century, they show that credit spreads between lower- and higher-grade bonds within a country tend to fall in the period of credit growth that occurs before a financial crisis. They conclude based on the evidence that the “behavior of both prices and quantities suggests that credit supply expansions are a precursor to crises.”

Identification of Credit Supply Expansion in Specific Episodes

A study of specific episodes can allow for a cleaner identification of credit supply shocks. Here, we focus on three types of episodes: US banking deregulation episodes, the introduction of the euro in the early 2000s, and US credit standards in the lead-up to the Great Recession.

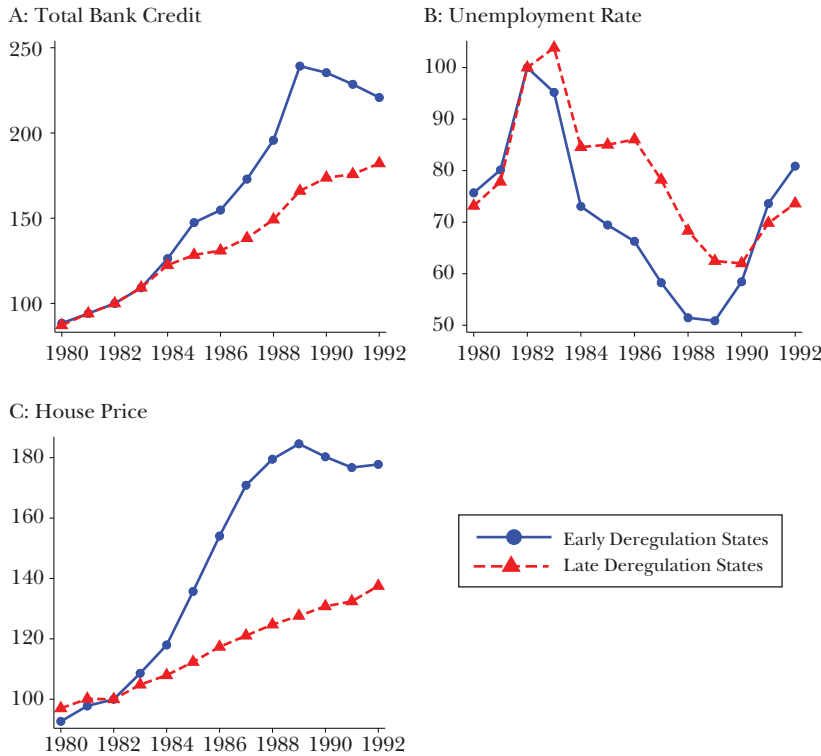
Perhaps the cleanest identification of credit supply shocks in recent literature comes from the evaluation of banking deregulation episodes. Di Maggio and Kermani (2017) focus on the federal preemption of state laws against predatory lending. As of January 1, 2004, 18 US states had anti-predatory lending rules that applied to all banks doing business in the state. However, the Office of the Comptroller of the Currency adopted regulations preempting these state laws from applying to national banks. They show that the states where anti-predatory-lending rules were preempted witnessed a surge in mortgage credit provided by national banks in 2005 and 2006, which corresponded to a sudden increase in house prices and employment in the nontradable sector. The same states then witnessed a larger decline in house prices, mortgage availability, and employment in the nontradable sector from 2006 to 2010. The preemption of anti-predatory lending laws apparently induced a credit-supply-driven boom and bust.

In a study of an earlier episode, in Mian, Sufi, and Verner (2017a), we focus on US banking deregulation in the 1980s. We classify a state as more deregulated as of 1983 if the state was early to remove restrictions on inter- and intrastate bank branching (for example, Jayaratne and Strahan 1996; Kroszner and Strahan 2014). As Figure 3A shows, states that deregulated their banking system earlier witnessed a larger rise in bank credit from 1983 to 1989 relative to states that deregulated their banking system later. During the expansion period, the unemployment rate fell by more in early deregulation states (Figure 3B) and house price growth was significantly stronger in these states (Figure 3C). After the recession hit in 1990, relative to late deregulation states, early deregulation states saw a rise in the unemployment rate and a decline in house prices. States with a stronger credit supply shock from 1983 to 1989 experienced a significantly amplified business cycle.

These two studies both build on a precise source of variation in bank regulation to generate differential credit supply expansion across states, and they find similar results: stronger credit supply expansion due to a different bank regulatory environment generates stronger growth in debt in the short run and a more severe recession in the medium run.

The introduction of the euro currency in the late 1990s can be viewed as a shock that increased credit supply by lowering currency and other risk premia,

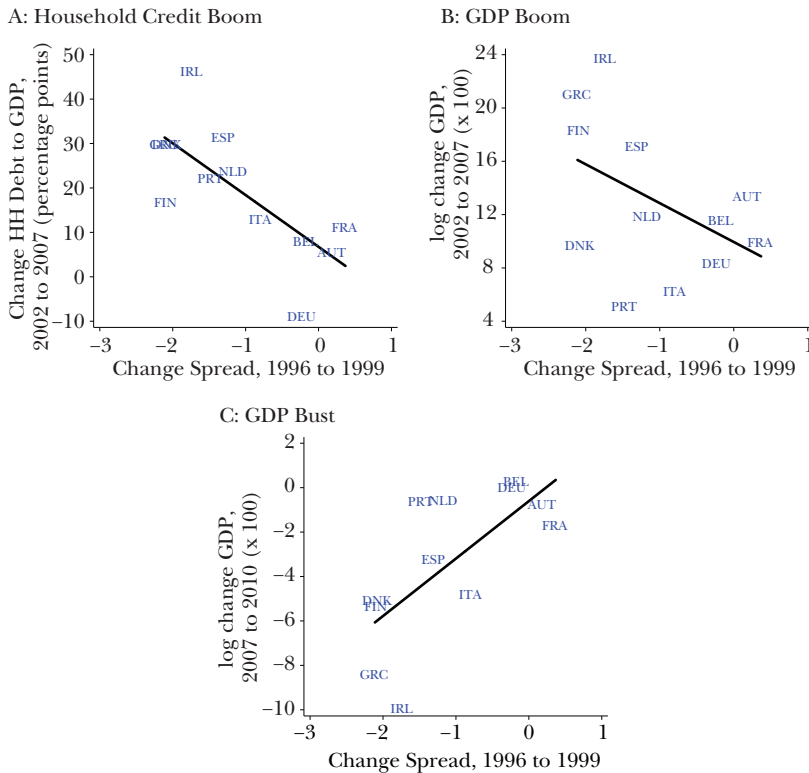
Figure 3
US Banking Deregulation Quasi-Experiment
(outcomes indexed to 100 in 1982)



Note: We focus on US banking deregulation in the 1980s and classify a state as more deregulated as of 1983 if the state was early to remove restrictions on inter- and intrastate bank branching. This figure plots outcomes for states that deregulated early versus late. For more information, see Mian, Sufi, and Verner (2017a).

especially in peripheral European countries (Mian, Sufi, and Verner 2017b). The decline in risk premia for a given country can be most easily seen in the spread between interest rates on sovereign bonds in the country versus US bonds. For example, Denmark, Finland, Ireland, and Greece all witnessed substantial declines in their borrowing costs on sovereign debt relative to US Treasury rates. Figure 4A shows that countries with the largest decline in this interest spread from 1996 to 1999 experienced the largest increase in household debt from 2002 to 2007. Figure 4B shows that countries seeing the biggest drop in this interest spread also see the strongest GDP growth from 2002 to 2007. Figure 4C shows that these same countries experienced a worse economic downturn from 2007 to 2010. We interpret this evidence as showing how a credit supply expansion induced by an institutional change led to a boom in household debt and in the real economy, followed by a more severe economic downturn.

Figure 4
Eurozone Quasi-Experiment



Note: This figure plots various outcomes against the change in the sovereign interest spread from 1996 to 1999 in countries that joined the euro currency zone. The sovereign interest spread is the interest rate on the 10-year government bond of the given country relative to the interest rate on the 10-year government bond of the United States. Please see Mian, Sufi, and Verner (2017b) for more details.

An alternative measure of shifts in European credit supply are credit standards as reported by loan officers at banks (for example, Favilukis, Kohn, Ludvigson, and Van Nieuwerburgh 2012). The European Central Bank carried out a survey of loan officers across the euro area starting in 2003, asking: “Over the past three months, how have your bank’s credit standards as applied to the approval of loans to households changed?” The survey indicates that the credit expansion period of 2003 to 2007 was associated with a substantial loosening of credit standards by loan officers on house purchase loans, especially in late 2004 and 2005.

The rapid increase in household debt in the United States from 2000 to 2007 has been studied extensively, and many factors, including credit spreads, loan surveys, and the innovation of private-label securitization, all point to an expansion in credit supply. Risk spreads on mortgage credit fell sharply from 2000 to 2005 (for

example, Pennington-Cross and Chomsisengphet 2007; Demyanyk and Van Hemert 2011). Justiniano, Primiceri, and Tambalotti (2017) point to a “mortgage rate conundrum” in the summer of 2003 when mortgage credit spreads relative to US Treasuries fell 80 basis points, and then continued to fall through 2005. Evidence on credit standards in the United States points in the same direction. According to the Federal Reserve Board Senior Loan Officer Opinion Survey, the loosening of credit standards on US mortgages is remarkably similar to the European pattern examined in Favilukis et al. (2012).

The shift in US credit supply can also be seen in the dramatic changes in mortgage markets during the late 1990s and early 2000s. Levitin and Wachter (2012) conduct a detailed analysis of the rise of the private-label securitization market, which increased from about 15 percent of all mortgage originations to almost 50 percent in 2004 and 2005. Private-label securitization refers to mortgages that were neither retained by the bank issuing the mortgage, nor issued by a government-sponsored enterprise like Fannie Mae or Freddie Mac. The rise of the private-label securitization market was accompanied by a rise in subprime mortgages, which together represented a positive credit supply shock to marginal borrowers who were previously denied credit (for example, Mayer 2011; Mian and Sufi 2009; Demyanyk and Van Hemert 2011). In particular, a rise in securitized subprime mortgages reduced the incentives of financial intermediaries to screen borrowers, thereby helping to explain why default rates on these mortgages were so high (Keys, Mukherjee, Seru, and Vig 2010). Fraud was rampant in the private-label securitization market during the height of the mortgage credit boom (Piskorski, Seru, and Witkin 2015; Griffin and Maturana 2016b; Mian and Sufi 2017a), which likely helped fuel house price growth in some areas of the country (Griffin and Maturana 2016a).

This is not to say that the subprime mortgage market alone can explain the sharp rise in household debt in the United States from 2000 to 2007. Borrowing by existing homeowners was an important driver of aggregate household debt, and such borrowing occurred even among higher credit score borrowers (for example, Mian and Sufi 2011; Mian, Sufi, and Verner 2017a). Indeed, there was an expansion in credit supply from 2001 to 2005 across the credit score distribution (Anenberg, Hizmo, Kung, and Molloy 2017).

Credit Supply Expansion and House Prices

The interaction between house prices and credit supply expansions has led to the question of whether the increase in house prices is the initial shock and the rise in household debt is a response, as argued by Laibson and Mollerstrom (2010), Foote, Girardi, and Willen (2012), and Adelino, Schoar, and Severino (2017). For example, it could have been that an “optimism” shock led to a rise in house prices, and credit merely followed the rise in house prices. There are no doubt feedback effects between the housing market and credit supply expansions. For example, an initial expansion in credit supply may lead to a rise in house prices, thereby boosting residential investment and encouraging lenders to provide even more credit because they expect house prices to rise further.

However, the weight of the empirical evidence suggests that house prices are more likely to be a *response* to credit supply expansion rather than a *cause*. A substantial body of research using careful identification strategies in microeconomic settings shows that exogenous changes in credit supply have quantitatively large effects on house prices (for example, Adelino, Schoar, and Severino 2014; Favara and Imbs 2015; Di Maggio and Kermani 2017; Mian, Sufi, and Verner 2017a). There is also a body of research using quantitative macroeconomic models to show how changes in credit affect house prices (for example, Favilukis, Ludvigson, and Nieuwerburgh 2017; Justiniano, Primiceri, and Tambalotti 2015; Landvoigt 2016).

Country-level datasets also support the view that credit supply initiates the rise in house prices. In the study mentioned earlier of survey data from loan officers, Favilukis et al. (2012) use credit standards data for the 2002 to 2010 period for 11 countries, including the United States and a panel of European economies. They conclude that “a stark shift in bank lending practices ... was at the root of the housing crisis.” Using the sample of 30 countries over the past 40 years, in Mian, Sufi, and Verner (2017b), we run a bivariate recursive vector autoregression to examine the dynamic relationship between increases in household debt and house prices. We find that a shock to household debt leads to a large and immediate increase in house prices, followed by substantial mean reversion four years after the initial shock. In contrast, a shock to house price growth leads to a gradual rise in household debt to a permanently higher level, but not to any boom and bust dynamics. For further discussion of the relative importance of credit supply expansion versus a rise in house prices, see Mian and Sufi (2017b).

The rise in house prices driven by credit supply expansion is of central importance for the aggregate economy, as it boosts construction activity, retail employment, and consumption. In addition, the rise in house prices is an amplification mechanism because households often borrow aggressively against the rising value of their home (Mian and Sufi 2011). Many of these real effects help explain the severity of the subsequent downturn, and we return to these issues later in this paper.

The Household Demand Channel

Credit supply expansions generate a boom-bust cycle in real economic activity. But what is the precise channel? An expansion in credit supply could affect the supply side of the economy by boosting firm investment or employment. Alternatively, it could boost aggregate demand by enabling households to increase consumption. There are good theoretical arguments for why credit supply could operate through the firm or household channel, and there are certainly episodes in history where credit supply boosted the economy through the firm sector. However, in recent history, the household demand channel appears dominant.

For example, over the past 40 years, the boom-bust business cycle generated by a rise in debt is unique to household debt; increases in firm debt or government debt

do not produce the same pattern (Mian, Sufi, and Verner 2017b). Furthermore, periods of rising household debt are associated with a rise in the consumption-to-GDP ratio, an increase in imports of consumption goods, and no change in the investment-to-GDP ratio. In advanced economies, a rise in household debt generates a consumption boom-bust cycle that is significantly more severe than the real GDP boom-bust cycle (IMF 2017). Household debt appears to be crucial in generating these cycles; for example, a rise in the consumption-to-GDP ratio by itself does not predict subsequently lower growth. But a rise in consumption-to-GDP ratios concurrent with a large rise in household debt does predict lower growth (Mian, Sufi, and Verner 2017b).

Household debt also appears to be important in predicting financial crises. Jordà, Schularick, and Taylor (2016) use their disaggregated bank credit dataset to estimate the relationship between bank credit and subsequent financial crises in 17 advanced economies since 1870. Since World War II, elevated mortgage credit-to-GDP ratios predict financial crises to the same degree as nonmortgage credit-to-GDP ratios. Furthermore, in predicting recession severity since World War II, the mortgage credit-to-GDP ratio at the beginning of the recession plays an especially important role.

The prominence of household debt is also found in emerging economies. Bahadir and Gumus (2016) focus on Argentina, Brazil, Chile, Korea, Mexico, South Africa, Thailand, and Turkey, and they show that household debt-to-GDP ratios in almost all of these countries have risen substantially since the early 1990s. In contrast, business credit-to-GDP ratios have been relatively stable. They also show significant comovement between household credit and real economic outcomes such as output, consumption, and investment. Increases in household credit are also associated with substantial real exchange rate appreciations. In contrast, changes in business credit have weaker correlations with other real economic outcomes. They use these stylized facts to build a model to distinguish whether shocks to household credit or business credit are driving the real economy. One insight from the model is that household credit shocks are different from business credit shocks in their tendency to simultaneously boost the real exchange rate and increase employment in the nontradable sector.

In Mian, Sufi, and Verner (2017a), we build on this model to show that a credit expansion to businesses that boosts productivity is inconsistent with a simultaneous price increase for nontradable goods and employment growth concentrated in the nontradable sector. In a sample of 36 countries with data back to 1970, we show that household debt booms are associated with a rise in the nontradable to tradable employment ratio, a rise in the nontradable to tradable output ratio, and a rise in the nontradable price to tradable price ratio. In contrast, a rise in firm debt is uncorrelated with these outcomes. This pattern suggests that the household demand channel is dominant.

In addition, in Mian, Sufi, and Verner (2017a), we test these predictions in an evaluation of bank deregulation in the 1980s. As mentioned above, states with a more deregulated banking system as of 1983 experienced a more amplified

business cycle from 1983 to 1992. We show that the relative increase in employment in early deregulation states during the expansionary period was concentrated in the nontradable and construction sectors. Furthermore, early deregulation states saw no relative increase in employment in the tradable sector, even among small firms where bank credit is particularly important. The employment patterns are more supportive of credit supply expansion operating through household demand than an expansion in productive capacity by businesses. At the same time, nominal wage growth was substantially stronger in early deregulation states, further supporting the importance of the boost in household demand.

A similar pattern is found among peripheral European countries during the credit expansion period of 2002 to 2007 (Mian, Sufi, and Verner 2017a). Countries in the eurozone with the largest decline in real interest rates experienced employment growth from 2002 to 2007 in the nontradable and construction sectors of 12 to 14 percent, while employment in the tradable sector actually fell 7 percent. Inflation rates were higher in these peripheral countries during this time period, as was nominal wage growth.

Kalantzis (2015) uses a sample of 40 countries from 1970 to 2010. The study isolates 47 episodes of large capital inflows; many are associated with well-known financial or capital account liberalizations such as in Latin America in the 1970s and 1990s, Nordic countries in the 1980s, and Asian countries in the 1990s. He finds that large capital inflows predict a shift of resources from the tradable to nontradable sector. The size of the nontradable sector relative to the tradable sector increases on average by 4 percent relative to normal times.

Explaining the Severity of the Bust

Debt and the Initial Drop in Demand

What makes the recessions that follow expansions in household debt so severe? The initial culprit appears to be a significant drop in household demand. In the Great Recession, for example, in Mian and Sufi (2010), we show that household spending fell substantially even before the heart of the financial crisis in September 2008. In international data, the IMF (2017) study finds a substantial drop in consumption in the aftermath of household debt expansions. Furthermore, both studies find that when a recession does occur, the drop in consumption is stronger in areas where household debt rose the most prior to the recession. Individual-level data also shows that those taking on the most debt during the expansion phase of the credit cycle cut spending the most during the ensuing economic downturn (for evidence from the United Kingdom, see Bunn and Rostom 2015; for Denmark, Andersen, Duus, and Jensen 2014; for a sample of European households, IMF 2017). This channel from high household leverage to a fall in demand was first articulated as the *debt deflation hypothesis* by Irving Fisher (1933), who pointed out that an economic slowdown would raise the real burden of debt, which would further slow the economy through reduced aggregate demand.

Isolating this channel is challenging because other factors that may also interact with economic shocks are often correlated with household leverage. A clear-cut case in favor of Fisher's debt-deflation hypothesis can be found in the Verner and Gyöngyösi (2017) study of Hungary. Some Hungarian households borrowed in Hungarian forint during the 2000s while others borrowed in Swiss francs. This choice of borrowing currency was partly dictated by bank branching networks and was uncorrelated with pre-2008 levels of leverage or growth in house prices, unemployment, or consumption. The sudden appreciation of the Swiss franc in 2008 by over 30 percentage points greatly increased the real burden of debt for a significant fraction of Hungarian households. This sudden rise in the real debt burden generated a sharp decline in household spending.

The drag of debt burdens on consumption during an economic downturn can also be seen in research evaluating a relief in debt payments during the Great Recession in the United States. Di Maggio et al. (2017) exploit variation in the timing of resets on adjustable rate mortgages to show that a 50 percent reduction in mortgage payments boosts spending on autos by 35 percent. They also find that households with low income and low housing wealth see the strongest consumption response to the decline in mortgage payments. In an alternative approach, Agarwal et al. (2017) use regional variation in the implementation of the Home Affordable Modification Program and the Home Affordable Refinancing Program to show that lower mortgage payments associated with the program increased spending. Some of their evidence also suggests that the response was stronger among more indebted borrowers.

Microeconomic studies reveal one reason why the drop in aggregate consumption is so large after debt expansion: debtors have a higher marginal propensity to consume out of wealth and income shocks than those without debt. For example, in Mian, Rao, and Sufi (2013), we show that during the 2006 to 2009 period, households living in zip codes with higher leverage cut back more on spending for the same decline in house prices. Similarly, Baker (forthcoming) shows that Americans with higher debt burdens cut spending by substantially more in response to the same decline in income during the Great Recession. The higher marginal propensity to consume among debtors is an important feature in explaining the severity of recessions following household debt expansions.

Subdued Growth and the Rise in Unemployment

The fact that leveraged households cut spending dramatically after a debt expansion does not, by itself, explain the decline in growth nor the increase in unemployment. For example, the decline in demand by indebted households could trigger a decline in interest rates, thereby boosting demand from less-indebted households or boosting investment by firms. An exchange rate depreciation could increase net exports. However, a variety of frictions prevent such adjustment.

Many countries find themselves at the zero lower bound on nominal interest rates in the aftermath of large expansions in household debt. As illustrated by Hall (2011) and Eggertsson and Krugman (2012), an economy that hits the zero lower

bound during the period in which leveraged households cut demand is plagued with a real interest rate that is “too high.” As a result, less-leveraged households do not boost spending sufficiently to offset the decline in demand coming from leveraged households. This friction is aggravated by the fact that consumption of less-leveraged households may in general be less-sensitive to credit conditions and interest rates (for example, Sufi 2015; Agarwal, Chomsisengphet, Mahoney, and Stroebel 2018). Households that in normal times have the highest sensitivity of consumption to interest rates and credit availability find themselves either unwilling or unable to borrow in the midst of the downturn that follows credit booms.

Price rigidities play an important role. For example, the negative effect of household debt expansion on subsequent growth is larger in countries with less-flexible exchange rate regimes (Mian, Sufi, and Verner 2017b; IMF 2017). In addition, the effect of a change in household debt on subsequent growth is nonlinear: a large decline in household debt does not predict subsequently stronger growth, but a large increase in household debt predicts subsequently weaker growth (Mian, Sufi, and Verner 2017b). Both of these results suggest that the inability of prices to fall after a debt expansion is one reason the recession is severe.

The aggregate decline in demand quickly spills over into the labor market. Downward nominal wage rigidity is an important reason. For example, Schmitt-Grohé and Uribe (2016) examine the nominal labor cost index for peripheral European countries from 2000 to 2011. Nominal labor costs rose dramatically from 2000 to 2008, but then stayed high from 2008 to 2011 as the unemployment rate jumped from 6 to 14 percent. There is also evidence of significant downward wage rigidity at the state level in the aftermath of the 1980s credit supply expansion in the United States. After the substantial relative nominal wage growth during the credit supply expansion from 1982 to 1989 in early deregulation states, unemployment rose sharply but nominal wages adjusted downward only slowly. Even by 1995, nominal wages remained relatively higher in early deregulation states (Mian, Sufi, and Verner 2017a).

County-level analysis within the United States after the Great Recession also shows the importance of such rigidities. In counties with the largest decline in housing net worth and consumer demand, job losses in the nontradable sector (like retail and restaurant jobs) were severe. However, there was no relative expansion in employment in the tradable sector in these same counties. At least some of the lack of expansion in tradable employment in these counties appears to be related to wage rigidity (Mian and Sufi 2014a).³ Verner and Gyöngyösi (2017) find similar evidence in Hungary after the depreciation of the local currency in 2008. Areas that experienced a sudden rise in debt burdens see a sharp decline

³Beraja, Hurst, and Ospina (2016) show that wages declined more in states where employment fell by the most during the Great Recession, and they argue the data are consistent with only a “modest degree of wage stickiness.”

in employment catering to local demand. But wages decline only modestly, and there is no increase in employment among firms operating in the tradable sector.

More generally, recent research suggests that any shock that leads to a large rise in unemployment in the short-term may have large and persistent effects on the labor force and large spillovers onto local economic activity (for example, Acemoglu, Autor, Dorn, Hanson, and Price 2016; Yagan 2017; Acemoglu and Restrepo 2017). If a large drop in household demand generates a substantial rise in unemployment, we should expect the consequences to be large and long-lived.

Foreclosures and a Fall in House Prices

Debt also depresses economic activity during the bust because of forced asset sales. Several studies have investigated how residential foreclosures put downward pressure on house prices and economic activity. In Mian, Sufi, and Trebbi (2015), we exploit variation across states in foreclosure judicial requirements and show that such variation has a strong effect on foreclosure propensity. However, such variation is uncorrelated with the propensity of households to default on their mortgages and uncorrelated with a number of other observable variables. The higher foreclosure propensity in non-judicial-foreclosure states is associated with a decline in house prices, residential investment, and durable goods spending. Using a different identification strategy, Ananbeg and Kung (2014) look at the timing of a listing of a foreclosed property and show that nearby sellers lower their prices in the exact week that the foreclosed property is listed.

In other approaches, Gupta (2016) isolates exogenous variation in foreclosures using shocks to interest rates resulting from details in adjustable rate mortgage contracts. He finds that a foreclosure leads to further foreclosures and lower house prices in the surrounding area. Furthermore, a foreclosure leads to difficulty in refinancing mortgages into lower rates for those living close to the foreclosed property, as banks tend to use the depressed foreclosure price as a comparison. Using a quantitative model of the housing market, Guren and McQuade (2015) find that foreclosures during the Great Recession exacerbate US aggregate house price declines by 62 percent and nonforeclosure price declines by 28 percent. Verner and Gyöngyösi (2017) find similar effects in Hungary.

Banking Crises

Another reason for the severity of the recessions following an expansion in credit supply is that the resulting crunch can involve a severe tightening of credit supply that may affect all households and businesses.

Households in the United States living in zip codes with high leverage and a decline in house prices during the Great Recession faced a particularly acute contraction in credit supply. Home equity limits and credit card limits fell significantly more in these zip codes relative to the rest of the country (Mian, Rao, and Sufi 2013). First-time home-buying contracted more severely for low credit score versus high credit score individuals, which also suggests a tightening of credit supply (Bhutta 2015).

In addition, the US banking crisis in the Great Recession led to a decline in employment and consumption that spread beyond leveraged households. Firms borrowing from banks that were most exposed to the banking crisis witnessed a larger decline in employment during the Great Recession (Chodorow-Reich 2014). Employment losses in the nontradable sector were particularly large in counties with a large drop in demand, and these employment losses were concentrated among firms with weak balance sheets that were likely most exposed to the adverse credit conditions during the Great Recession (Giroud and Mueller 2017). On the spending side, the collapse in the asset-backed commercial paper market led to a collapse in the availability of nonbank auto loan financing. As a result, counties that traditionally relied on nonbank auto loan financing witnessed a substantial decline in auto purchases (Benmelech, Meisenzahl, and Ramcharan 2017).

A banking crisis disrupts economic activity for a variety of reasons, in line with the financial accelerator view of Bernanke (1983), Bernanke and Gertler (1989), and Kiyotaki and Moore (1997). However, banking crises should not be viewed independently from the expansion in household debt that often precedes them. After all, household debt is a key asset held by banks, and so a rise in household defaults will directly affect the banking sector. As mentioned above, Jordà, Schularick, and Taylor (2016) show that a rise in mortgage credit-to-GDP ratios predicts banking crises. Additionally, they show that recessions associated with high mortgage debt growth *and* a banking crisis are the most severe.

Longer-term Distortions

A credit boom distorts the economy, which can then make the subsequent recession more severe and protracted. One such distortion is the large increase in employment in the retail and construction sectors. Areas of the United States with substantial housing booms experienced substantial improvement in labor market opportunities for young men and women. As a result, these areas witnessed lower college enrollment, especially at two-year colleges. After the bust, many of these individuals did not return to college “suggesting that reduced educational attainment is an enduring effect of the recent housing cycle” (Charles, Hurst, and Notowidigdo forthcoming).

In another study of across-sector labor reallocation during periods of rapid private credit growth, Borio, Kharroubi, Upper, and Zampolli (2016) find that workers systematically moved into low-productivity growth sectors, which in turn led to lower productivity growth after the recession. This pattern was especially prevalent in recessions associated with financial crises. Gopinath, Kalemli-Ozcan, Karabarbounis, and Villegas-Sanchez (2015) show how credit supply expansion lowered productivity growth among Spanish manufacturing firms between 1999 and 2012 by directing funds toward higher net worth firms that were not necessarily more productive.

Theoretical Foundations

What existing models help us to understand the credit-driven household demand channel? In this section, we first discuss existing theoretical research that treats credit supply expansion as exogenous, and then we turn to theoretical models that can explain how credit supply expansion leads to predictable boom-bust cycles.

Credit Supply Expansion as an Exogenous Shock

Much of the existing theoretical research treats credit supply expansion as an exogenous shock. As one example, Schmitt-Grohé and Uribe (2016) examine a small open economy with a pegged exchange rate. In one exercise, they assume an exogenous decline in the country interest rate, which subsequently reverses. As another example, in the model of Justiniano et al. (2015), total lending by savers is limited exogenously, and a credit supply expansion in their model is a relaxation of this lending constraint.

Other studies have modeled a credit shock as a relaxation of loan-to-value or payment-to-income constraints. While these are components of debt booms, there are drawbacks in treating them as the main force driving credit supply expansions. As Justiniano, Primiceri, and Tambalotti (2015) point out, a relaxation of a loan-to-value constraint by itself actually leads to an increase in mortgage interest rates, which is counterfactual for most episodes. Kiyotaki, Michaelides, and Nikolov (2011) and Kaplan et al. (2017) argue that a relaxation of loan-to-value constraints alone cannot explain the rise in house prices that is typical of these credit booms.

As a result of these issues, models that rely on relaxation of these loan constraints typically also contain a second force that is necessary to fit the facts. Favilukis, Ludvigson, and Van Nieuwerburgh (2017) consider both financial market liberalization, which consists of a loosening of a loan-to-value constraint on mortgages and lower transactions costs associated with obtaining a mortgage, along with an influx of foreign funds into the domestic risk-free bond market. The combination of these shocks is necessary to generate an increase in household debt, an increase in house prices, and a steady or declining risk-free interest rate. Similarly, Greenwald (2016) models a credit supply expansion as a simultaneous loosening of a payment-to-income constraint on mortgages and a decline in the real interest rate. Again, both forces are necessary to generate the observed patterns in housing markets during the 2000 to 2007 period in the United States. Garriga, Manuelli, and Peralta-Alva (2018) build a model where there are exogenous changes in both loan-to-value ratios and mortgage interest rates. They conclude that a decline in mortgage interest rates is the more important quantitative force leading to house price appreciation, but that the interaction of the two forces can amplify the effect of mortgage rates on home values.

Another important point is that credit supply expansions manifest themselves far beyond a higher allowed loan-to-value or price-to-income ratio. We concur with Favilukis et al. (2012) who write that “the behavior of combined

loan-to-value ratios in the boom and bust does not do full justice to several aspects of increased availability of mortgage credit.” As they point out, the 2000 to 2007 mortgage credit expansion in the United States was associated with previously rationed borrowers receiving credit, new mortgage contracts, and reduced asset and income verification by lenders. A narrow focus on loan-to-value and payment-to-income ratios misses many dimensions of credit supply expansion episodes.

Rational Expectations and Credit-Driven Externalities

What models can help to explain the predictable boom-bust episode generated by an expansion in credit supply? One class of models relies on credit-driven externalities. A temporary positive shock to credit supply occurs, but all households share a common understanding that the shock will disappear at some time in the future. However, despite rational expectations and the transient nature of credit expansion, there is “overborrowing” from a social planner’s perspective, and such overborrowing generates a boom-bust cycle in both credit and the real economy.

One such reason for overborrowing is the presence of aggregate demand externalities (for example, Eggertsson and Krugman 2012; Farhi and Werning 2016; Ríos-Rull and Huo 2016; Korinek and Simsek 2016; Schmitt-Grohé and Uribe 2016; Guerrieri and Lorenzoni 2017). In these models, there is a friction such as nominal wage rigidity or a lower bound on the real interest rate that prevents the economy from adjusting when credit contracts and there is a drop in demand from leveraged households. Households do not internalize the effect of their future decline in demand on the income of other households, and they therefore rationally take on more debt than is socially optimal.

Another reason for overborrowing is the presence of pecuniary externalities due to “fire sales” as discussed in Shleifer and Vishny (1992), Kiyotaki and Moore (1997), Caballero and Krishnamurthy (2001), Lorenzoni (2008), Bianchi (2011), Dávila (2015), and others. Suppose that an asset, such as a house, is used as collateral for borrowing. If households borrow in the present, they will tend to drive up the price of the asset. After a negative shock, households will be forced to de-lever by fire-selling the collateral, which reduces the price of collateral and hence tightens the borrowing constraint. In this way, the collateral price channel adds to the aggregate demand externality. In both cases, households may rationally decide to take on more debt during an expansion than is socially optimal because they do not internalize the effect of their actions on others during the credit contraction.

Heterogeneous Beliefs and Behavioral Biases

The rational expectations framework with a temporary, self-reverting credit shock can offer an explanation for why an expansion in credit supply leads to a boom-bust cycle. However, an explanation based on rational expectations and externalities has one major problem: it predicts that individuals during a credit boom anticipate a slowdown in the economy. This prediction is counterfactual. As noted

earlier, economic forecasters systematically over-predict future GDP growth during credit booms. In addition, market participants often fail to foresee the correction in asset prices that typically occurs in the aftermath of credit booms. For example, high levels of bank credit also seem to be associated with a predictable crash in equity prices for banks (Baron and Xiong 2017), and banks that expand credit most rapidly have predictably worse returns in the subsequent years (Fahlenbrach, Prilmeier, and Stulz 2017). For these reasons, the rational expectations model with common beliefs is unlikely to explain the predictable boom-bust cycles we witness in the data.

One alternative is to move away from the assumption of common beliefs. Geanakoplos (2010) builds a theory of endogenous leverage cycles in which households differ in their level of optimism about the economy. Burnside, Eichenbaum, and Rebelo (2016) also build a model in which belief heterogeneity plays an important role in explaining boom-bust cycles in the housing market. Greater availability of credit in such an environment enables optimists to increase leverage, to buy more of the collateralized asset, and therefore to raise asset prices. A positive credit supply shock results in giving the optimists' expectations greater weight in market prices. As a result, credit, asset prices, and market expectations rise collectively.

However, even a small negative shock bankrupts the optimists who are highly leveraged because of their exuberant beliefs. Consequently, these optimists must dump assets in the market, and the only households with positive net worth who can buy these assets are the pessimists. Asset prices fall, which further reinforces the original wave of fire sales and credit contraction. This endogenous boom-bust leverage cycle may interact with frictions in the macroeconomy discussed earlier, thereby generating a boom-bust cycle in the real economy.

Another approach, relying on behavioral biases, has been emphasized at least since Minsky (2008) and Kindleberger (1978). This approach is consistent with empirically observed errors in expectations and can also generate credit cycles. For example, in Gennaioli, Shleifer, and Vishny (2012), investors neglect tail risks, which leads to aggressive lending by the financial sector via debt contracts. In Landvoigt (2016), the lending boom is instigated when creditors underestimate the true default risk of mortgages. In Greenwood, Hanson, and Jin (2016), exuberant credit market sentiment boosts lending because lenders mistakenly extrapolate previously low defaults when granting new loans. Bordalo, Gennaioli, and Shleifer (2017) provide micro-foundations for such mistakes by lenders, which they refer to as "diagnostic expectations."

These behavioral biases can be viewed as part of a process that leads to credit supply expansions. For example, perhaps lenders begin lending to lower-credit-quality borrowers because they mistakenly believe that the probability of default for such borrowers is lower than it is. Or perhaps mortgage credit spreads fall because lenders become more optimistic about house price growth, as in Kaplan, Mitman, and Violante (2017).

A further advantage of the behavioral models is that they may be able to generate endogenously a reversal in credit supply after an expansion driven by behavioral

biases. For example, Bordalo, Gennaioli, and Shleifer (2017) generate predictable reversals in credit supply given the biased expectations formed by investors. As they note, “following this period of narrow credit spreads, these spreads predictably rise on average ... while investment and output decline ...” While the exact timing of the reversal is not known, a rise in credit supply driven by lender optimism eventually reverts as lenders become pessimistic.

What Drives Credit Supply Expansion

Much of the work on the credit-driven household demand channel takes the credit supply expansion as given. But what kind of shock leads to an expansion in credit supply? We should admit that we have now entered a more speculative part of this essay. The evidence currently available is less conclusive on this question.

In our view, the most likely initial shock is one that creates an excess of savings relative to investment demand in some part of the global financial system, what we call a “financial excess.” This initial shock can be amplified by behavioral biases, financial innovation, and even by malfeasance within the financial sector.

Perhaps the most popular version of such a financial excess is the “global savings glut” hypothesis articulated in Bernanke (2005), which focuses on the “metamorphosis of the developing world from a net user to a net supplier of funds to international capital markets.” In response to financial crises in the late 1990s and early 2000s, governments in emerging markets began to accumulate foreign reserves, typically in the form of US-dollar denominated assets. In turn, this shift led to declining global interest rates, the rise of dollar-denominated assets, and current account deficits in many advanced economies. Alpert (2013) and Wolf (2014) both place high importance on the global savings glut as a reason for the boom and bust in economic activity from 2000 to 2010 in many advanced economies.

The combination of OPEC price increases in the 1970s and the Latin American debt crisis of the early 1980s offers another example. Pettis (2017) points to financial excesses created by OPEC countries: “[I]n the early 1970s, for example, as a newly assertive OPEC drove up oil prices and deposited their massive surplus earnings in international banks, these banks were forced to find borrowers to whom they could recycle these flows. They turned to a group of middle-income developing countries, including much of Latin America.” Devlin (1989) also points to the dramatic increase in oil prices in 1973 and 1974 as a source of credit supply expansion. As he points out, a large fraction of the surplus dollars earned by oil-producing countries entered the international private banking system. In response, “banks become much more active lenders, and the scope of their operations expanded enormously.” Similarly, Folkerts-Landau (1985) writes that “the international payments imbalances generated by the oil price increase of 1973 provided an unprecedented opportunity for the international credit markets to expand.”

External debt of non-oil developing countries increased from \$97 billion in 1973 to \$505 billion in 1982 (Bernal 1982). During this credit expansion, syndicated

bank loan interest spreads over LIBOR on loans to these countries fell from 1.6 to 0.7 percent. Similarly, Devlin (1989) writes: “By 1977 not only did loan volume [to Latin America] continue to rise but the terms of lending softened as the situation moved back into a so-called borrowers’ market. ... [B]eginning in 1977 spreads came down sharply and maturities were commonly awarded in excess of five years. The trend toward lower spreads and longer maturities became sharply accentuated in 1978 to 1980.”

In both of these examples, a set of countries experienced an expansion in credit supply because of financial excesses created in international markets. Examples of a shock leading to financial excesses in a closed-economy setting are also available, if less common.

One example proposed by Kumhof, Rancière, and Winant (2015) is the rise in income inequality. They look at rising inequality prior to both the Great Depression and Great Recession. In both episodes, there was a simultaneous large increase in debt-to-income ratios among lower- and middle-income households. In their model, a rise in income inequality leads to more funds entering the financial system as high-income households have a preference for wealth accumulation and therefore a high marginal propensity to save. Thus a rise in income inequality acts as a credit supply expansion to middle- and lower-income households. The model also predicts a decline in the interest rate on household borrowing, which is consistent with the empirical evidence.

Other possible domestic sources of credit supply expansions include financial liberalization and financial deregulation, especially for smaller open economies. For example, Kindleberger and Aliber (2005) write that “a particular recent form of displacement that shocks the system has been financial liberalization or deregulation in Japan, the Scandinavian countries, some of the Asian countries, Mexico, and Russia. Deregulation has led to monetary expansion, foreign borrowing, and speculative investment.” Two studies mentioned above exploit variation across the United States in banking deregulation: Di Maggio and Kermani (2017) and Mian, Sufi, and Verner (2017a). Both show that states that experience more deregulation see a bigger increase in credit supply during aggregate credit expansion episodes.

The Latin American debt crisis of the early 1980s was also preceded by a round of deregulation that scholars have pointed to as a source of the rapid expansion in debt (for example, Diaz-Alejandro 1985). As McKinnon (1984) notes, “[T]he case of the Southern Cone in the 1970s and early 1980s is hardly very pure; in this period virtually all less-developed countries overborrowed, and then got themselves into a debt crisis. This era was complicated by a recycling from the oil shock on the one hand and then what I consider to be a major breakdown in the public regulation of risk-taking Western banks on the other. The result was gross overlending by banks in the world economy at large and to the Third World in particular.”

The Scandinavian banking crises of the late 1980s and early 1990s also followed a financial deregulation. In his overview of the banking crises in Norway, Finland, and Sweden, Englund (1999) concludes that “newly deregulated credit markets after 1985 stimulated a competitive process between financial institutions where

expansion was given priority.” Jonung, Kiander, and Vartia (2008) focus on the banking crises in Sweden and Finland. They write, “the boom-bust process starts with a deregulation of financial markets leading to a rapid inflow of capital to finance domestic investments and consumption.”

From the perspective of a given country or state, deregulation of the financial sector may lead to capital inflows and a credit supply expansion. In this sense, deregulation is the shock that leads to an expansion in credit supply from the perspective of the country or state. This narrative tells us where credit lands, but it still leaves open the question of why so much credit is looking for a place to land in the first place. For this reason, we give more importance to the view that financial excess is the initial shock starting the expansion process. But the level of regulation or efforts at deregulation will help determine where credit lands during credit supply expansions.

Directions for Future Research

The credit-driven household demand channel is the idea that credit supply expansions operating through household demand are an important source of business cycles. The Great Recession is the most prominent example, but this phenomenon is present in many episodes the world has witnessed over the past 50 years.

In this article, we have presented evidence supporting the three main pillars of the credit-driven household demand channel. First, credit supply expansions lead to a boom-bust cycle in household debt and real economic activity. Second, expansions tend to affect the real economy through a boost to household demand as opposed to an increase in productive capacity of firms. Third, the downturn is driven initially by a decline in aggregate demand which is further amplified by nominal rigidities, constraints on monetary policy, banking sector disruptions, and legacy distortions from the boom.

The credit-driven household demand channel is distinct from traditional financial accelerator models (Bernanke and Gertler 1989; Kiyotaki and Moore 1997; Bernanke, Gertler, and Gilchrist 1999), primarily due to the centrality of households as opposed to firms in explaining the real effects of credit supply expansions. In addition, while there are examples of financial accelerator models that focus on the expansion phase of the credit cycle and explore the importance of behavioral biases (Bernanke and Gertler 2000), these factors play a more central role in the credit-driven household demand channel.

There remain a number of open questions related to the credit-driven household demand channel. For example, what is the fundamental source that causes lenders to increase credit availability? Why do some credit booms end in a crash while others may not (for example, Gorton and Ordonez 2016)? What is the sequence of events that initiates the crisis stage?

The policy implications of this idea need more exploration, too. Should regulators impose macroprudential limits on household debt? Should monetary policymakers “lean against the wind” during credit supply expansions? Should

the government encourage the use of debt contracts? During the bust, what is the most effective policy at limiting the damage coming from the collapse in aggregate demand? We have offered preliminary answers to these questions elsewhere (Mian and Sufi 2014b, 2017c), but definitive answers require more investigation on both the theoretical and empirical fronts.

Finally, while we have emphasized the business cycle implications of the credit-driven household demand channel, the analysis presented here may prove relevant for longer-run growth considerations. Since 1980, advanced economies of the world have experienced four key trends: 1) Most advanced economies have seen a substantial rise in wealth and income inequality. 2) Borrowing costs have fallen dramatically, especially on risk-free debt. 3) Household debt-to-GDP ratios have increased substantially, and most of bank lending is now done via mortgages (Jordà, Schularick, and Taylor 2016). 4) Finally, the financial sector has grown as a fraction of GDP. Are these four patterns linked? Can they help explain why global growth for advanced economies has been so weak since the onset of the Great Recession in 2007 (for example, Summers 2014)? One preliminary idea is that there is a global excess supply of savings coming from both the rise in income inequality in advanced economies and the tendency of some emerging economies to export capital to advanced economies. This excess savings leads to growth in the financial sector, a decline in interest rates, and a rise in household debt burdens of households in advanced economies outside the very top of the income distribution. But at this stage, the connection of these patterns to growth remains a more open question.

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