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Abstract

After a steady increase following the global financial crisis, private nonfinancial sector leverage rose further during the COVID-19 on the back of easy financial conditions induced by unprecedented policy support. We investigate the empirical relationships between increased leverage, financial conditions, and macro-financial stability in a sample of major advanced and emerging market economies. We find that loose financial conditions contribute to leverage buildups and generate an intertemporal tradeoff: financial stability risk is lessened in the near term but exacerbated in the medium term. The tradeoff is amplified during credit booms, when debt service burdens are particularly high, or when the share of foreign currency debt is high in emerging markets. Selected macroprudential tools can arrest leverage buildups and mitigate the tradeoff.

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I. INTRODUCTION

The nonfinancial sector came into the COVID-19 (henceforth COVID) pandemic crisis with historically high levels of leverage, defined as the reliance on debt in relation to income.[2] On the back of highly accommodative monetary policies pursued by major central banks that have eased financial conditions since the global financial crisis, nonfinancial sector debt worldwide increased from 138 percent of GDP to 152 percent of GDP over the decade leading up to the end of 2019 (Figure 1, Panels 1 and 2).[3] Nonfinancial corporate sector debt increased in both advanced economies (AEs) and emerging market economies (EMs), reaching a historical high of 91 percent of GDP at the end of 2019 (Figure 1, Panel 1).[4,5] Household debt, by contrast, rose sharply among EMs but fell in AEs as a group, reaching 60 percent of GDP worldwide at the end of 2019 (Figure 1, Panel 2).

The COVID shock has further increased nonfinancial sector leverage across economies, albeit for different reasons. The crisis has squeezed cash flows for the corporate sector and, through its adverse impact on employment, increased the financing needs of households. The unprecedented and warranted monetary, fiscal, and financial sector policy support launched during the containment phase of the pandemic has eased market dysfunction, helped loosen financial conditions after a sharp tightening in the first quarter of 2020, and maintained the flow of credit to households and firms (IMF 2020b; IMF 2020c). Policy support has also enhanced their ability to repay, thus allowing them to avoid having liquidity pressures morph into solvency issues on a significant scale. However, coping with the COVID shock has accompanied increased private sector debt levels for most economies.[6] Global nonfinancial corporate and household debt increased by 8 and 4 percentage points of GDP, respectively, between the end of 2019 and the fourth quarter of 2020 (Figure 1, Panels 3 and 4).[7] While sharp declines in output have contributed to this increase during 2020, by the fourth quarter incipient recoveries have gotten underway in some AEs, thus about 80 percent of the full-

[2] We use the debt-to-GDP ratio as the metric of leverage, where GDP is the scaling factor representing economy size and proxying for the capacity to repay.

[3] The global nonfinancial sector debt-to-GDP ratio is computed here as the sum of nonfinancial sector debt for 52 economies reporting to the Institute of International Finance divided by the sum of GDP for those economies (all expressed in US dollars). These economies together account for about 80 percent of global GDP. The corresponding ratios for nonfinancial firms and households, as well as for AEs and EMs, are calculated in a similar fashion. While country-specific structural factors (such as continued financial liberalization and financial development, as well as demographic shifts) may have contributed to the rise in nonfinancial sector debt in some cases, studies note the predominant role of loose global financial conditions in driving nonfinancial sector debt since the global financial crisis (e.g., Alter and Elekdag 2020).

[4] Nonfinancial corporate debt includes that of state-owned enterprises, defined as firms in which the state owns positive equity. For some EMs in the sample, the share of state-owned enterprises in nonfinancial corporate debt is quite substantial (exceeding 60 percent). The nonfinancial corporate data shown in Figure 1 are for nonconsolidated debt, as presented by the Institute of International Finance. Data on consolidated debt are less widely available. In countries for which both consolidated and unconsolidated data are available, the consolidated figures are often noticeably lower but have followed trends similar to the unconsolidated figures.

[5] In many systemically important economies, the rise in nonfinancial corporate debt over the past decade was accompanied by weaker credit quality of borrowers, looser underwriting standards, and increased interconnectedness (IMF 2020a).

[6] Together with the increase in private sector debt, the COVID crisis has led to a global increase in public sector debt to unprecedented levels (IMF 2021a).

[7] As noted in IMF (2021b), the increase in nonfinancial corporate leverage during the pandemic shock has been across the board, though firms in the sectors most affected by the pandemic crisis—such as energy, consumer services, and commercial real estate—have experienced the greatest increase. Across regions, the highest levels of leverage have been registered in the Asia-Pacific and European regions, and the largest increases in leverage during the COVID crisis have been in the Middle East and Central Asia.

year increase in debt-GDP ratios is explained by increases in debt rather than declines in output.

Against this backdrop, and in light of an extensive literature that explores the adverse repercussions of increases in private sector leverage, in this paper we take a detailed look at the empirical relationships between financial conditions, changes in leverage, and risks to macro-financial stability. The aim is to better understand the challenges faced by policymakers as economies emerge from the COVID pandemic crisis, weighing the need for accommodative policies to support nascent recoveries, while at the same time preventing excessive buildups in leverage that could amplify the effects of future negative shocks, and thereby increase financial fragility. We ask three key empirical questions. What is the role of financial conditions in leverage buildups? What are the macro-financial implications of high and rising leverage? And what role can macroprudential policies play in arresting the possible macro-financial impact of financial conditions and leverage?

Our empirical analysis is based on a simple conceptual framework in which leverage, financial conditions, and macro-financial stability are tightly intertwined, as depicted in Figure 2. Financial conditions, which reflect the price of risk in an economy, constitute a key driver of leverage buildups. Loose financial conditions provide intermediaries and markets with a greater incentive to take on more risk and a greater capacity to lend. At the same time, borrowers (firms and households) have a greater incentive to take on debt and, through heightened net worth associated with higher asset values, a greater capacity to borrow. During episodes of particularly rapid increases in debt, leverage buildups would tend to be even more sensitive to financial conditions due to a financial accelerator mechanism, whereby financial frictions can amplify the effects of shocks through their effect on net worth (Bernanke, Gertler, and Gilchrist 1999). The stronger sensitivity would also be consistent with a risk-taking channel, through which the effects of shocks on macro-financial outcomes are amplified in times of high credit growth.

Macro-financial policies (monetary, macroprudential, and fiscal) also affect leverage buildups, either through financial conditions and the availability of credit or through the effects of policies on factors such as income, unemployment, inflation, and debt service costs.[8] Macroprudential policies in particular can help to lean against the wind—that is, tighten preemptively to lessen risks to future financial stability. These policies can accomplish this objective by taming leverage buildups or by strengthening borrower and lender resilience.

Leverage buildups can represent a financial vulnerability, as high levels of indebtedness cause households and firms to become more susceptible to adverse shocks. When these shocks arise and financial conditions tighten, financial stability risks may arise from an abrupt correction of asset prices and rapid deleveraging by firms and households. The

[8] While monetary policy is generally considered to be the main policy-related driver of financial conditions, thereby affecting nonfinancial sector leverage, fiscal policy can also influence leverage through several channels. Fiscal measures such as grants to households or subsidies to nonfinancial firms, by reducing financing needs, can help dampen leverage buildups. At the same time, measures such as loan guarantee programs for nonfinancial firms, favorable tax treatment of interest expenses, and accelerated depreciation for tax purposes could all incentivize nonfinancial sector borrowing. More broadly, public spending can "crowd out" private borrowing by raising interest rates (see, for example, Furceri and Sousa 2011), though a "crowding-in" effect is also possible if public spending stimulates aggregate demand, particularly during recessions (Auerbach and Gorodnichenko 2012).

combination of a repricing of risk and elevated leverage can generate pernicious nonlinearities, whereby tighter financial conditions interact with deleveraging, which in turn causes additional repricing of risk. The higher the level of indebtedness before the shock, the greater the likelihood of such deleveraging becoming highly disruptive. Thus, leverage can act as an amplifier of adverse shocks, as shown by Kiyotaki and Moore (1997), Bernanke, Gertler, and Gilchrist (1999), and Brunnermeier and Sannikov (2014). In addition to the level of leverage, the growth of leverage may matter as well—possibly magnifying the effect of a shock if, for example, the composition of credit deteriorates as new lending is extended to riskier borrowers.[9]

Our analysis yields results consistent with previous literature on several fronts, but also provides new evidence that pushes forward our understanding of leverage buildups and their macroeconomic consequences. On the drivers of leverage, we find that, consistent with previous empirical studies, easing financial conditions leads to an acceleration in leverage growth in both the nonfinancial corporate and household sectors. However, we also find that this relationship intensifies during periods of rapid buildups in leverage, that is, credit booms.

As in other studies, we find evidence of an intertemporal tradeoff from easing financial conditions, as well as one originating from increases in private nonfinancial sector leverage. In contrast to previous work, our results give stronger support for a corporate-sector-led intertemporal tradeoff, by focusing our attention on the lower percentiles rather than on median growth (as opposed to Mian, Sufi, and Verner, 2017), and by including non-AE countries in our sample (in contrast to Jordà and others, 2020), where resolution processes might be deficient and accelerations in corporate leverage are more disruptive. While our results are consistent with previous findings on the amplification effect of credit booms, we find that this effect occurs primarily when the boom occurs in conjunction with a positive output gap, and also uncover amplifications stemming from high debt service burdens or high foreign currency shares in emerging economies. Finally, we find that tightening of specific macroprudential tools is associated with slower buildups in leverage, itself having critical financial stability consequences, and with mitigation of the inter-temporal tradeoff.

These findings suggest that policymakers grappling with the adverse economic effects of the current COVID crisis are increasingly facing a tradeoff associated with their choices. While an accommodative policy stance may be appropriate for many countries to ease financial conditions and stimulate aggregate demand, continued extraordinary policy support once the recovery takes hold risks adding to the already elevated leverage vulnerabilities. Furthermore, such extraordinary support could induce excessive risk taking arising from moral hazard under an expectation of continued central bank interventions.[10] Thus, the intertemporal tradeoff becomes highly relevant, in the sense that policy support for near-term economic activity may lead to increasing downside risks in the medium term. This tradeoff

[9] For instance, Brandao-Marques and others (2019) find that credit expansions under loose financial conditions are more likely to involve increased riskiness of credit allocation, which is associated with greater downside risks to future growth.

[10] As noted by Borio and Zhu (2012), leverage and risk in the financial sector tend to increase with lower policy rates. Adrian and Liang (2018) discuss in detail how accommodative monetary policy can loosen current financial conditions, but at the cost of increasing future financial vulnerabilities. Hanson and others (2020) point out a potential moral hazard, in that the private sector may misperceive government support actions, believing that they will be repeated in the future under different situations.

may be amplified by high or increasing leverage, for example, if new credit is allocated to riskier borrowers—and could be mitigated by the use of selected macroprudential policies.

The rest of the paper is organized as follows. Section II describes the relevant literature on leverage and financial stability and our paper's contributions. Section III describes the main data sources and definitions, and presents stylized facts on leverage, financial conditions, and output growth. Section IV addresses the first question, related to the drivers of private nonfinancial sector leverage. Section V focuses on the second question, the macro-financial stability implications of leverage. Section VI addresses the third question, assessing the impact of macroprudential policy on leverage buildups and financial stability. Section VII presents additional robustness exercises, and Section VIII concludes and presents policy implications of the analysis.

II. Literature Review and Main Contributions

A large body of literature has studied the implications of rapid accumulations or high levels of private nonfinancial sector leverage, which have often preceded sharp financial and economic downturns. High levels or rapid increases in nonfinancial sector leverage have often been identified as key predictors of downside risks to economic growth and financial stress (e.g., Bank for International Settlements 2014; Gilchrist, Siemer, and Zakrajsek 2018; Gertler and Gilchrist 2018; IMF 2017a; and IMF 2018b). Verner (2019) discusses the crucial distinction between beneficial episodes of credit deepening and more disruptive episodes of booms in private credit, which tend to precede growth slowdowns and lead to a series of macroeconomic imbalances. In a similar vein, Schularick and Taylor (2012) find that, while not all booms in private credit result in financial instability, most instances of financial distress are preceded by credit booms. Jordà and others (2016) show that high levels of leverage are associated with dampened business cycle volatility, but more pronounced crashes—implying that business cycles are more asymmetric in high-debt economies.

Related studies analyze leverage in the corporate and household sectors separately. High corporate leverage is also associated with weaker post-crisis recovery, as investment is held back by debt overhang (Kalemli-Ozcan and others 2020), which could generate a self-reinforcing cycle. Mian, Sufi, and Verner (2017) find that it is household debt accumulation that is particularly related to financial stability risk. Positive shocks to household debt tend to precede a near-term upswing in economic activity which is then followed by a medium-term downturn, that is, a boom-bust cycle. However, shocks to nonfinancial corporate leverage do not produce the same short-term boost, presumably because corporate debt overhang limits firm investment and future growth.[11] In a sample of 38 countries, Kirti (2018) finds that, on their own, neither increasing leverage nor declining lending standards—measured as a rising share of high-yield issuance—predict declining economic performance. However, the combination of the two is indeed followed by poor subsequent performance, which in addition is unexpected for forecasters.

[11] Existing studies show that household debt tends to be concentrated in low-wealth quantiles, which could amplify the effects of the COVID shock on the financial vulnerabilities of the household sector (Institute of International Finance 2020).

A recent strand of the literature examines the implications of leverage buildups using a Growth-at-Risk (GaR) approach (IMF 2017b; and Adrian and others -2019a, 2019b), whereby the financial stability effects are analyzed through the lens of downside risk to future output growth. Thus, studies rely on quantile regression methods to assess the impact of leverage on lower percentiles of the distribution of conditional output growth in the future. Adrian and others (forthcoming) focus on a sample of 11 AEs and find that loose financial conditions have a larger impact on downside risk (the 5th percentile of future growth) than on the median, and identify an intertemporal tradeoff; the combination of loose financial conditions and rapid increase in aggregate credit tends to reduce downside risk to economic activity in the near term but increases it in the medium run. Jordà and others (2020) also focus on an AE sample and find that, while rapid expansions in nonfinancial corporate leverage do not generally lead to depressive effects on output and investment, they do so in countries where firm resolution processes are inefficient, which facilitate the survival of "zombie" firms when credit is expanding rapidly.

Another recent literature considers the role of macroprudential regulations. Several studies find evidence that tighter macroprudential policy is associated with lower future growth in domestic credit, particularly household credit (Cerutti, Claessens, and Laeven 2017; and Forbes 2020). Alam and others (2019) find that two types of measures targeting households—loan-to-value (LTV) and debt-service-to-income (DSTI) ceilings—slow down their debt accumulation. Peydró and others (2020) find that limits on the proportion of high loan-to-income ratios in mortgage lending can lead to less severe house price declines and mortgage defaults during an episode of price correction. Araujo and others (2020) find from a meta-analysis of 58 empirical studies at the macro and micro levels that tightening of certain instruments has a significant effect on credit, less so on house prices, and some near-term negative effects on economic activity. There is also evidence of asymmetry—tightening having stronger impacts than loosening—and of leakages and spillovers.

Brandao-Marques and others (2020) introduce a cost-benefit approach to evaluate to what extent different policies, such as macroprudential and monetary policies, can bolster financial stability by mitigating the intertemporal tradeoff. For a broad sample of AEs and EMs they find that macroprudential policies are indeed effective in counteracting the downside risks to future economic activity, particularly when debt is high. Furthermore, combining macroprudential tightening with monetary policy loosening can provide additional benefits. Along similar lines, Duprey and Ueberfeldt (2020) focus on Canada, where there is a long history of implementing changes in household-related macroprudential measures, such as loan-to-value (LTV) and debt service ratio ceilings. They show that credit growth is a main driver for downside risk to economic activity, and that macroprudential tightening can be coordinated with loose monetary policy to mitigate these risks.

Our study contributes to both strands relating to GaR and to assessing the impact of macroprudential policies, and draws policy implications that are particularly relevant to policymakers contemplating a post-COVID recovery. We focus on the drivers of leverage and its implications for financial stability—primarily as an amplifier of shocks—as reflected in GaR. We analyze a country panel that includes both AEs and EMs, and distinguish between nonfinancial corporate and household sectors since, as some of the reviewed studies suggest, the two can have very different implications for financial stability. We also test for

the effectiveness of a wide range of macroprudential policy instruments, both in slowing leverage buildups directly and in mitigating the intertemporal tradeoff that arises when financial conditions ease. Finally, we test whether an alternative measure of leverage is equally predictive of economic downturns, and critically for many EMs, whether the foreign currency share of debt exacerbates the risk of sharp economic downturns.

III. Data Definitions, Sources, and Stylized Facts

Our empirical analysis focuses on 29 economies, of which 19 are AEs and 10 are EMs, selected primarily for their globally systemic importance and availability of data—in particular, of disaggregated nonfinancial sector leverage and financial conditions indices.[12] The sample period is from 1996:Q1 to 2020:Q4, also limited by the availability of data on private sector leverage and financial conditions. The analysis does not cover low-income countries, and it is not entirely obvious that its implications would apply to most low-income countries, where financial development is relatively low, and episodes of rapid credit growth may reflect financial deepening rather than disruptive credit expansion.[13] However, as financial sectors in these economies continue to develop, the potential for loose financial conditions and nonfinancial sector leverage to have financial stability implications will increase as well.

Country-level private nonfinancial sector leverage is measured as the ratio of the stock of debt as reported to the IIF—which includes bank loans and bond issuance—to GDP. In robustness exercises explored in Section VII, we also analyze the implications of two other measures of leverage also constructed from IIF, the ratio of debt service to income and the foreign currency share of private nonfinancial sector debt.[14] Drehmann and Juselius (2014) and Du and Schreger (2016) show that these other dimensions of debt—such as its currency composition and maturity, as well as the borrowers' debt servicing capacity—may also be relevant in assessing the effects on macro-financial stability. Available data suggest that despite loose financial conditions, debt servicing capacity has declined for many countries since the global financial crisis, while the share of foreign currency debt in total nonfinancial corporate debt has increased for many emerging markets.

Financial conditions are measured by the Financial Conditions Index (FCI), constructed by the IMF and periodically reported in Chapter 1 of the IMF's *Global Financial Stability Report* (GFSR). It is a Principal Components aggregate measure based on a set of price-related indicators, such as interest rates and spreads, equity prices and volatility, and real house price growth. It is often referred to as the "price of risk," such that a decrease in its value can be interpreted as a fall in the price of risk—or a loosening of financial conditions (see, for further details, Online Annex 1.1 of IMF, 2018a).

[12] The economies are: Australia, Austria, Belgium, Brazil, Canada, Chile, China, Colombia, Denmark, Finland, France, Germany, Hong Kong SAR, India, Italy, Japan, Korea, Malaysia, Mexico, The Netherlands, Norway, Russia, South Africa, Spain, Sweden, Switzerland, Turkey, the United Kingdom, and the United States.

[13] For example, Eberhardt and Presbitero (2018) show that commodity price shocks, rather than surges in credit or capital flows, tend to predict banking crises in low-income countries.

[14] For the ratio of debt service to income, the IIF constructs a measure of income of the private nonfinancial sector and of households.

We construct measures of macroprudential policy actions from the IMF's Integrated Macroprudential Policy (iMaPP) database over the 1990–2018 period (see, for details, Alam and others, 2019). The database classifies 17 different macroprudential policies into six broad categories: (1) borrower-based measures (LTV and DSTI limits); (2) bank capital measures (capital requirements, leverage limits, loan-loss provision requirements, countercyclical capital buffers, capital conservation buffer requirements, measures targeting systemically important banks); (3) banks' foreign currency exposure measures (limits on foreign currency lending, limits on gross open foreign currency positions, reserve requirements on foreign currency assets); (4) bank liquidity measures (reserve requirements, liquidity requirements, limits to the loan-deposit ratio); (5) credit measures (limits on credit growth, loan restrictions); and (6) other measures (stress testing, restrictions on profit distribution, limits on exposures between financial institutions). One limitation of the database is that it contains mostly qualitative information, showing if a certain measure has been tightened or loosened during a given period, but does not indicate its intensity. It must also be noted that the bulk of macroprudential policy tools that have been deployed so far apply to banks, with almost no tools directed specifically at nonbank financial institutions (NBFIs), which have become increasingly important actors in financial markets and therefore pose additional challenges for financial stability.

We also rely on standard sources for country-level macroeconomic controls: the IMF World Economic Outlook (WEO) database for real GDP, the output gap, and consumer price indices (from which we calculate inflation rates); and Haver Analytics for short-term interest rates (3-month treasury bill rates and 3-month money market rates). For monetary policy rates, we use the central bank policy rates from the BIS for most countries, and the Shadow Short Rates (SSR) constructed by Leo Krippner for the U.S., Euro Area, Japan, and the U.K.[15] Finally, in some regressions we include additional controls: the government balance-GDP ratio (IMF WEO), the unemployment rate (Haver Analytics), and the population speed of aging (UN Population Division's World Population Prospects).

A simple look at the data supports the two relationships that are central to the intertemporal tradeoff. First, loose financial conditions are associated with substantial buildups in leverage. As Panels 1 and 2 of Figure 3 show, for most countries there is a positive correlation between loose financial conditions and changes in leverage over the subsequent 12 months.[16] Second, Panels 3 and 4 show a visible negative correlation between change in leverage and future economic activity, as stronger buildups of leverage tend to be followed by more subdued economic activity over the subsequent 12 quarters, in both AEs and EMs.[17] These observations suggest that the intertemporal tradeoff posed by easy financial conditions may be highly relevant as the economic recovery from the pandemic gains momentum, with sharply increasing levels of leverage.

[15] The SSR estimates measures seek to capture nonconventional monetary policy during zero lower bound (ZLB) episodes (see https://www.ljkmfa.com/test-test/international-ssrs/).

[16] To facilitate interpretation, Figure 3 shows the negative of the FCI (that is, higher values indicate looser financial conditions).

[17] These relationships are similar when computed for different horizons.

IV. FINANCIAL CONDITIONS AND LEVERAGE BUILDUPS

Having established a positive unconditional correlation between current financial conditions and future changes in leverage, in this section we analyze this relationship more rigorously, with an econometric specification that controls for other relevant drivers of the change in private nonfinancial sector leverage, while considering the dynamics of nonfinancial firm and household leverage separately. Specifically, we estimate the following model:

$$\Delta LEV_{i,t,h} = \alpha_{i,h} + \beta_h FCI_{i,t} + \gamma_h X_{i,t} + \theta_h Z_t + e_{i,t,h}\,, \tag{1a}$$

where subscripts *i* and *t* denote country and time, respectively, and *h* is the time horizon. The dependent variable, $\Delta LEV_{i,t,h}$, is the change in leverage between periods *t* and *t+h,* that is, the *h*-quarter change in the sector-specific debt-to-GDP ratios. The variable $FCI_{i,t}$ is the country-specific financial conditions index. The control variables included are country-fixed effects, $\alpha_{i,h}$, a set of baseline country-specific controls $X_{i,t}$ (quarter-on-quarter annualized growth of output and CPI, and the change in policy rates), and other relevant macroeconomic and structural variables $Z_{i,t}$ (government balance as a percentage of GDP, population aging speed, and unemployment rates). Equation (1a) is estimated using the local projections approach (Jordà 2005).

One important question in estimating (1a) is whether the effect of financial conditions is nonlinear such that an easing of financial conditions has different implications for future leverage buildup depending on the current *pace* of leverage growth. To explore this question, we examine the response of leverage to financial conditions across different regimes of domestic credit growth by enriching equation (1a) as follows:

$$\begin{aligned}\Delta LEV_{i,t,h} = \alpha_{i,h} &+ \Theta_{i,t}\left(\beta_{1,h}^{Boom} FCI_{i,t} + \gamma_{1,h}^{Boom} X_{i,t}\right) \\ &+\left(1-\Theta_{i,t}\right)\left(\beta_{2,h}^{No\ Boom} FCI_{i,t} + \gamma_{2,h}^{No\ Boom} X_{i,t}\right) + e_{i,t,h}\,,\end{aligned} \tag{1b}$$

where $\Theta_{i,t}$ is a credit-boom dummy defined as equal to 1 if country i is experiencing a credit boom in period *t*. We define a credit boom as a period during which the eight-quarter change in the private nonfinancial sector debt-to-GDP ratio is in the top three deciles of its distribution and the country-specific FCI is below the median of its distribution (a lower FCI represents looser financial conditions).

A word of caution in interpreting the estimated relationships in the equations above: these should be considered as associations between variables rather than causal relationships since potential reverse causality cannot be ruled out, given that prospects of future changes in leverage could affect current values of the regressors. To mitigate this endogeneity concern, we estimate equations (1a) and (1b) by the instrumental variable (IV) method in addition to using ordinary least squares (LS). In particular, to control for the endogeneity of policy rate changes, we include as instruments changes in the two-year Treasury yield and changes in

the ten-year Treasury yield purged by the former.[18] Standard errors of LS estimates are calculated following the Driscoll-Kraay (1998) approach, and for the IV estimates robust standard errors are calculated.

A. Key Results

Our empirical analysis shows that, controlling for other drivers, looser financial conditions are indeed associated with an increase in nonfinancial sector leverage in the near and medium terms. Across all economies in the sample, an easing in financial conditions by one unit is followed by an increase in nonfinancial corporate debt by 4 percentage points of GDP over three years in the least squares estimation result. The IV estimation, carried out to control for the endogeneity of policy rate change (as forward-looking monetary policy could respond to prospective credit movements for financial stability), yields a significant but smaller impact on leverage, of 3 percentage points (Figure 4, Panel 1). The easing of financial conditions also boosts household leverage, although the association is smaller than for nonfinancial firms: a one-unit easing of financial conditions implies an increase in household leverage by about 1½ percentage points of GDP over a three-year horizon in both the LS and IV estimation results (Figure 4, Panel 2). Overall, these results suggest that financial condition easing is associated with faster leverage buildup (or slower deleveraging), robust to controlling for other country-specific drivers of leverage.

The results for country-specific controls are largely consistent with the literature. The estimated impacts of country-specific controls as well as those of financial conditions are summarized in Tables 1 and 2—along with Figures A1 and A2 in the appendix. First, the effect of output growth on the change in leverage is significantly negative up to one year ahead for firms and for the first two years for households, as increased income flows reduce the need for external financing. Second, inflation has a mixed effect on leverage buildups: it becomes positive and significant after one year for households (especially in AEs), possibly because inflation—if not fully reflected in debt contracts—produces gains for debtors and thus motivates households to increase borrowing. For firms, access to hedging instruments and equity market funding can weaken their incentives to increase borrowing in response to the negative effect of inflation on the real burden of existing debt. Third, a policy rate hike is associated with an initial increase in corporate leverage, given that policy rate changes tend to be gradual, in part due to concerns about financial market stability and uncertainty.[19] In contrast, it reduces leverage for households, presumably because of higher debt financing costs. Lastly, the key findings largely remain intact when regression (1a) includes additional controls including government balance, unemployment rates, and population aging speed—see the Appendix for details of the regressions with the broader set of controls.

[18] Gilchrist and others (2015) suggest that monetary policy surprises are well reflected in changes in the two-year Treasury yield and changes in the ten-year Treasury yield orthogonal to those in the two-year yield. We employ these variables as instruments to control for the endogeneity of policy rate changes to prospective leverage buildups. See also the notes to Figure 4 for a description of the instruments used, which are supported by the Sargan-Hansen instrument validity test.

[19] Tighter monetary policy, as reflected in a positive policy rate change, could prompt firms to increase their leverage, for example, using loan commitments or issuing bonds for financing investment (Bernanke and Blinder 1992; Christiano and others 1996), or to stockpile liquidity to fend off financial distress (Opler and others 1999).

B. Amplification Effects of Credit Booms

The results of regression (1b) suggest that the response of leverage buildups to financial conditions indeed varies across regimes of credit growth. An easing of financial conditions during a credit boom is followed by stronger leverage buildups than in other periods (Figure 4, Panels 3-6). [20] Across all economies in the sample, an easing in financial conditions by one unit is followed by an increase in nonfinancial corporate debt by 10 (12) percentage points of GDP over three years in the LS (IV) estimations under the credit boom regime, whereas in no credit boom periods it is followed by about 5 percent over three years in both the LS and IV estimates. Both the LS and IV estimates show significantly positive leverage responses for all horizons under the credit boom regime (only from the second or third year under the no credit boom regime), while the IV estimates have somewhat wider confidence intervals.

Overall, these results suggest that a loosening of financial conditions is associated with faster leverage buildups, and that this association becomes much stronger in times of high credit growth and already loose financial conditions.

V. Macro-Financial Stability Implications of Leverage

In this section, we investigate the intertemporal tradeoff that arises when financial conditions loosen, boosting growth in the near term but possibly at the cost of greater risk to macro-financial stability, as reflected in the downside risk future economic activity. We use the quantile local projection approach to estimate the term structure of the impact of financial conditions on the lower percentiles of future GDP growth outcomes. In addition, we explore the possible role played by financial vulnerabilities—private nonfinancial sector leverage, in particular—in amplifying the intertemporal tradeoff. Specifically, we empirically construct the term-structure of GaR with the fixed-effects panel quantile local projection model:

$$y_{i,t,h}^{\tau} = \alpha_{i,h}^{\tau} + \beta_{1,h}^{\tau} FCI_{i,t} + \beta_{2,h}^{\tau} \Delta Lev_{i,t}^{NFC} + \beta_{3,h}^{\tau} \Delta Lev_{i,t}^{HH} + \gamma_{h}^{\tau} X_{i,t} + \varepsilon_{i,t,h}^{\tau}, \quad (2a)$$

where $y_{i,t,h}$ is the year-on-year growth rate of real GDP of country i in quarter $t+h$, and $\alpha_{i,h}$ denotes country-fixed effects. The key explanatory variables in the equation, $FCI_{i,t}$, $\Delta Lev_{i,t}^{NFC}$, $\Delta Lev_{i,t}^{HH}$, are respectively, country i's financial condition index, and the changes in nonfinancial corporate and household leverage ratios over the eight-quarter period up to t. Finally, $X_{i,t}$ is a set of control variables for country i in quarter t that include lagged year-on-year real GDP growth, lagged year-on-year inflation, and a lagged year-on-year policy rate change. The regression is estimated at the 10th percentile ($\tau = 0.1$) and the median ($\tau = 0.5$).[21] The estimation method for panel quantile models follows Machado and Silva (2019). Bootstrapped standard errors are based on 100 replications.

[20] The choice of the specific thresholds draws on the literature (see, e.g., Adrian and others, forthcoming) but also reflects data specificities such as including a sufficient number of credit boom cases in the estimations for meaningful analysis. Notably, with this definition, about 25 percent of the economies in the sample are in the credit boom regime in 2020:Q3. These results are robust to alternative definitions of credit booms (such as using the bottom three deciles for the FCI and the upper three deciles for the change in leverage).

[21] For comparison, Figure 5 and Table 3 also present the term structure at the median ($\tau = 50^{th}$).

In a second exercise, the baseline specification is enriched through interactions with a credit growth regime-dependent dummy variable $\Theta_{i,t}$, as well as with an output gap variable, to study different left-tail responses of future real GDP growth to FCI and leverage buildups across various macro-financial regimes:

$$y_{i,t,h}^{\tau} = \alpha_{i,h}^{\tau} + \Theta_{i,t}\left[\beta_{1,h}^{\tau,Boom} FCI_{i,t} + \beta_{2,h}^{\tau,Boom} \Delta Lev_{i,t}^{NFC} + \beta_{3,h}^{\tau,Boom} \Delta Lev_{i,t}^{HH} + \gamma_h^{\tau,Boom} X_{i,t}\right] + \left(1 - \Theta_{i,t}\right)\left[\beta_h^{\tau,No\ Boom} FCI_{i,t} + \beta_{2,h}^{\tau,No\ Boom} \Delta Lev_{i,t}^{NFC} + \beta_{3,h}^{\tau,No\ Boom} \Delta Lev_{i,t}^{HH} + \gamma_h^{\tau,No\ Boom} X_{i,t}\right] + \varepsilon_{i,t,h}^{\tau}, \quad (2b)$$

where $\Theta_{i,t}$ is a credit boom dummy variable, as defined in the previous section. Thus, we discuss a set of coefficient estimates for each of "Boom" and "No Boom" regimes below.

A. Baseline Results

As shown in Panel 1 of Figure 5, a one-standard-deviation easing in financial conditions (i.e., a one-unit decrease in the FCI) generates an intertemporal tradeoff that is more pronounced at the 10th percentile (GaR) than at the median: greater short-term boost, but also greater downside in the medium term, particularly starting eight quarters after the loosening. As Table 3 reports, 10 quarters after a one-standard-deviation increase in FCI, the adverse impact on GaR is ½ percentage point, more than three times that of the median.

Panels 2 and 3 of Figure 5 present the impact on the 10th percentile and median of future growth of an increase of one percentage point of GDP in household and nonfinancial corporate leverage (measured over the past eight quarters). The term structure of the impact highlights the disruptive effect of sustained buildups in private nonfinancial sector leverage. For nonfinancial corporate leverage, the adverse impact on the 10th percentile becomes significant quickly and peaks at about 1 percentage point after four quarters, whereas for households it takes longer to materialize, about 9 quarters. For both sectors, the estimated impact is greater for the 10th percentile than for the median, although this difference is rarely statistically significant, consistent with a parallel downward shift in the lower tail of the distribution of future growth.

A closer investigation into AE and EM subsamples suggests several striking differences. First, as Panel 1 of Figure 6 shows, a one-standard-deviation easing in financial conditions leads to a significant negative impact in EMs after about 4 quarters, whereas AEs experience a more subdued growth-at-risk impact in the first 6 quarters, before this left-tail impact becomes significantly negative. Second, the disruptive left-tail impact following increased household leverage is significant and persistent only in AEs, highlighting the importance of macro-finance linkages of households in economies with higher levels of financial development. Finally, increases in nonfinancial corporate leverage have an impact on downside risk mainly in EMs. This is consistent with Jordà and others (2020), who find that, within AEs, the downside impact of nonfinancial corporate leverage is concentrated among countries with weaker debt resolution frameworks.

B. Amplification Effects of Credit Booms

The next piece of the GaR analysis studies how the intertemporal tradeoff could be amplified during episodes of credit booms, which are often associated with increasing asset valuations and deteriorating lending standards, both of which contribute to elevated financial vulnerabilities. When risks materialize, these vulnerabilities can amplify the bust of the real economy through rapid deleveraging by the private sector and fire sales of assets.

The empirical results based on the regime-dependent specification (2b) confirm this hypothesis. As Panel 1 of Figure 7 shows, credit booms amplify the intertemporal tradeoff. Panel 2 shows that a similar amplification occurs when comparing periods with positive versus negative output gaps. In fact, the intertemporal tradeoff all but disappears when the output gap is negative.

Finally, we combine credit boom and output gap indicators to distinguish three regimes: credit boom with a positive output gap, credit boom with a negative output gap, and no credit boom. Panel 3 shows the frequency of these regimes, highlighting that the third regime is relatively common; credit booms have tended to coincide with positive output gaps, most notably in the runup to the global financial crisis, and also early on in the COVID crisis. The salient exception is the second regime experienced during the latter part of 2020; output collapsed in many countries while private nonfinancial sector leverage continued to be high. As Panel 4 shows, the intertemporal tradeoff is much more pronounced in the first regime, oscillating between an improvement of downside risk by 4 percentage points after 4 quarters to a worsening of downside risk by 4 percentage points at nine quarters. By contrast, a credit boom coinciding with a negative output gap entails a much milder intertemporal tradeoff, with downside risk worsening much later than in other regimes. The last regime, with no credit boom, also features a mild intertemporal tradeoff, with an impact oscillating between +1 and -1 percentage points.

Thus, for countries currently in the second regime, easing financial conditions does not appear to involve an intertemporal tradeoff. However, as the recovery proceeds and output gaps begin to close and even become positive, the financial stability implications of easy financial conditions together with elevated nonfinancial sector leverage will intensify.

VI. Macroprudential Policy and the Intertemporal Tradeoff between a Short-Term Boost and a Medium-Term Downturn

In this section, we examine whether macroprudential policy can be effective in containing buildups in private nonfinancial sector leverage and/or mitigating the intertemporal tradeoff documented in the previous section.

Macroprudential policy is generally aimed at mitigating the materialization of systemic risk to achieve financial stability (ESRB 2014). Various types of tools can be deployed to curb credit growth and alter its composition (by, e.g., maturity and currency denomination), as well as affect default and losses, and financial resilience associated with nonfinancial corporate and household leverage. Borrower-based tools (LTV and DSTI) constrain borrowing eligibility from the demand side—preventing borrowers from stretching their

borrowing capacity too far above their budgets or collateral values—and provide affordability buffers to improve resiliency of banks. Supply-based tools, aimed at altering lenders' incentives and taming credit supply, include credit growth limits, capital- (capital adequacy and loan loss provisions), and liquidity-oriented tools (liquidity coverage, net stable funding, and loan-to-deposit ratios). Sector-based tools include FX exposure limits and sector-specific loan restrictions, while broad-based ones include countercyclical capital buffers to lean against the buildup phase of the credit cycle. For the characteristics of these tools, see ESRB (2014), IMF (2014), and Alam and others (2019).

A. Macroprudential Policy and Private Nonfinancial Sector Leverage Buildup

To assess the effectiveness of macroprudential measures in containing sector-specific leverage buildups and mitigating downside risks to growth, our analysis considers a range of measures, including various borrower-based measures, as well as others aimed at banks, such as capital adequacy and liquidity, and foreign currency (FX) exposure measures.

Panel 1 of Figure 8 shows that macroprudential instruments were more often tightened than loosened, particularly after the global financial crisis and leading up to the COVID crisis. After experiencing net loosening prior to 2000, a strong upward trend followed, reaching close to 300 net tightening actions during the 2016-18 period for the economies in the sample. Tightening measures related to bank capital and liquidity were the most prevalent, as banking sector regulatory reforms took root in the aftermath of the global financial crisis. Panel 2 compares actions across country groups, showing that measures related to the foreign currency exposure of banks have played a larger role in EMs than in AEs (Figure 8, Panel 2).

To examine the relationship between macroprudential policies and leverage buildup, we used a specification similar to that of equation (1a), now including the *Macropru* variable:

$$\Delta LEV_{i,t,h} = \alpha_{i,h} + \beta_h Macropru_{i,t} + \gamma_h X_{i,t} + \theta_h Time_t + e_{i,t,h}\,, \qquad (3)$$

where $\alpha_{i,h}$ are country fixed effects, and $Macropru_{i,t}$ is one of several measures of macroprudential policies. $X_{i,t}$ is a set of country-specific controls: lagged values of (year-on-year) inflation, (quarter-on-quarter) real GDP growth, FCI, and policy rate change, as well as lagged one-quarter change in the sector-specific debt-to-GDP ratio. Global time effects are represented by $Time_t$, which is a dummy variable for the global financial crisis that takes a value of 1 between 2008:Q4 and 2009:Q4 (or time fixed effects). Standard errors are calculated following the Driscoll-Kraay (1998) approach.

There are potentially several concerns regarding the specification of equation (3). First, reverse causality could arise if the financial supervisor chooses to tighten macroprudential policies to address excessively strong leverage buildups. Second, the effectiveness of macroprudential policies may be weakened by substitutability between financing that is subject to macroprudential regulation and financing from other sources, such as unregulated NBFIs, cross-border bank lending and issuance of securities (e.g., corporate bonds or

equity).[22] Yet both concerns—reverse causality and macroprudential leakages—would bias upward the estimates of β_h in equation (3), in the direction of finding either a positive association between macroprudential tightening and change in leverage, or weakening the negative relationship. Thus, the true impact of macroprudential tightening on leverage growth is likely to be stronger than our estimates.

Our empirical findings confirm that a tightening of certain macroprudential measures has a measurable negative impact on leverage buildups. Taking the net number of tightening actions during a quarter and within a category—that is, the sum of total number of tightening actions minus loosening actions, without distinguishing across the specific measures nor considering their intensity—our analysis shows that tightening a borrower-based measure (LTV or DSTI, for instance) is followed by a reduction in the household debt-to-GDP ratio by up to 1 percentage point over a two-year horizon (Figure 8, Panel 1).[23] Panel 1 of Table 4 shows that borrower-based measures are the only macroprudential tools associated with a statistically significant decline in household leverage over both the two- and three-year horizons.

A net tightening of banks' liquidity requirements is also associated with a reduction in corporate leverage by up to 1 percentage point of GDP over a two-year horizon (Figure 9, Panel 2; and Table 4, Panel 2). Notably, for EMs, where both domestic and external borrowing by firms is often denominated in foreign currency, a tightening of FX–related measures for banks is significantly associated with lower future nonfinancial corporate leverage. Specifically, a net tightening of such measures is followed by a decline in nonfinancial corporate leverage by about 2½ percentage points over three years (Figure 9, Panel 3). Panel 2 of Table 4 shows that, on average across all economies in our sample, banks' liquidity requirements deliver the most consistent results to reduce the nonfinancial corporate debt-to-GDP ratio. Other tools either do not significantly affect corporate leverage, do so only at a specific horizon only (FX measures) or, as in the case of credit measures, even present a puzzling positive and significant association with corporate leverage.[24]

Overall, our findings on the ability of macroprudential tools to rein in leverage growth are comparable to those reported in earlier literature. For example, there is extensive evidence showing that tightening limits on LTV or DSTI ratios is effective in reducing household credit (Araujo and others 2020). Moreover, the results regarding measures on foreign currency exposure are in line with Ostry and others (2012) and Cerutti, Claessens, and Laeven (2017), who find that foreign-exchange–related macroprudential regulations (e.g., limits on foreign currency lending) reduce nonfinancial sector credit growth in EMs.

[22] See Aiyar et al. (2014), who find that macroprudential leakages are substantial in the United Kingdom and amount to about a third of the initial impulse from the regulatory change. However, macroprudential leakages are likely to be less severe in other economies given the predominant role of London as a global financial center where foreign branches of banks not subject to U.K. regulation are abundant.

[23] For a given category of measures, net tightening is computed as the sum of the total number of tightening minus loosening of measures in a country in a given quarter. For each measure, a tightening is assigned a value of 1, no policy change takes a value of 0, and a loosening is assigned a value of -1. The analysis focuses on the number of tightening episodes, rather than the intensity of applied measures, as the latter is difficult to quantify consistently across different measures and economies.

[24] Credit measures are relatively rare and are predominantly targeted at the household sector, which might explain this puzzling result.

B. Macroprudential Policy and the Intertemporal Tradeoff

Next, we analyze the role of macroprudential tools in shaping downside risks to growth and affecting the intertemporal tradeoff. First, the downside-risk-mitigation effect of macroprudential measures is analyzed using the GaR framework based on the following specification, similar to that of equation (2):

$$y_{i,t,h}^{\tau} = \alpha_{i,h}^{\tau} + \beta_{1,h}^{\tau} FCI_{i,t} + \beta_{2,h}^{\tau} \Delta Lev_{i,t}^{NFC} + \beta_{3,h}^{\tau} \Delta Lev_{i,t}^{HH} + \beta_{4,h}^{\tau} SUM17_{i,t} + \gamma_h^{\tau} X_{i,t} + \varepsilon_{i,t,h}^{\tau}, \quad (4a)$$

where $SUM17_{i,t}$ is a discrete variable which indicates the net number of macroprudential tightening actions across all measures undertaken in quarter t.[25] The estimated quantile coefficient for $SUM17_{i,t}$, denoted as $\beta_{4,h}^{\tau}$, indicates the direct impact of one additional net macroprudential tightening on the given percentile of the future GDP growth distribution.

Furthermore, we explore how macroprudential policy can affect the intertemporal tradeoff by estimating the following:

$$\begin{aligned} y_{i,t,h}^{\tau} = \alpha_{i,h}^{\tau} &+ \Theta_{i,t}\left[\beta_{1,h}^{\tau,Tight} FCI_{i,t} + \beta_{2,h}^{\tau,Tight} \Delta Lev_{i,t}^{PNF} + \gamma_h^{\tau,Tight} X_{i,t}\right] \\ &+ \left(1 - \Theta_{i,t}\right)\left[\beta_{1,h}^{\tau,No\ Tight} FCI_{i,t} + \beta_{2,h}^{\tau,No\ Tight} \Delta Lev_{i,t}^{PNF} + \gamma_h^{\tau,No\ Tight} X_{i,t}\right] + \varepsilon_{i,t,h}^{\tau}, \quad (4b) \end{aligned}$$

where $\Theta_{i,t}$ is a regime variable defined as a dummy that takes a value of 1 if the sum of $SUM17_{i,t}$ in the past 4 quarters is positive and is equal to 0 otherwise, and $\Delta Lev_{i,t}^{PNF}$ is the 8-quarter change in the debt-to-GDP ratio for the private nonfinancial (PNF) sector, which covers both nonfinancial corporates and households. The coefficients of interest are $\{\beta_{1,h}^{\tau,Tight}, \beta_{1,h}^{\tau,No\ Tight}\}$ and $\{\beta_{2,h}^{\tau,Tight}, \beta_{2,h}^{\tau,No\ Tight}\}$ which capture the extent to which the links between financial conditions or PNF sector debt and GaR differ across periods with and without macroprudential tightening.

The results for equation (4a) indicate that macroprudential policies appear to be effective in containing downside risks to future growth. On average, a macroprudential tightening measure is associated with a reduction in downside risk to future growth by about half a percentage point in the medium run (Figure 10, Panel 1, where, again, a higher value is to be interpreted as lower downside risk).

Results for equation (4b) imply that macroprudential tightening can also help to offset the increase in medium-term downside risks associated with easing financial conditions. When a loosening of financial conditions coincides with macroprudential tightening, the deteriorated medium-term downside risks inherent in the intertemporal tradeoff are almost entirely mitigated (Figure 10, Panel 2), particularly after 9 quarters. This result is consistent with the findings of Brandao-Marques and others (2020).

[25] Net tightening is defined in a way similar to individual categories, with the difference between the total number of actions of tightening and loosening of measures in a country in a given quarter considered as 1 if the difference is positive, 0 if there is no difference, and -1 if the difference is negative. For instance, if country i tightened the LTV ratio twice in quarter t but loosened the reserve requirement once in the same quarter, the discrete variable $SUM17_{i,t}$ takes the value of 1.

In sum, the analysis shows that macroprudential policies can play two important roles for the management of financial stability risks. First, the tightening of targeted measures helps to lean against the wind, tempering or even reversing leverage buildups. Second, overall tightening contributes to mitigating the intertemporal tradeoff, either reducing downside risk directly or counteracting the risk inherent in loose financial conditions when leverage has been growing rapidly.[26]

VII. ROBUSTNESS

A. Examining the Relationship between Financial Conditions, Leverage, and Economic Activity in a System

In our main analysis, the relationships between financial conditions and leverage, and between financial conditions and economic activity, are analyzed separately. A case can be made, however, for estimating relationships between all variables of interest in a single system of equations. Arguably, causality between financial conditions, leverage and economic activity can go in all directions, and prior assumptions which restrict these dynamics may lead to biased estimates. To give way to these considerations, we conduct a panel vector autoregressive (PVAR) analysis that imposes minimal restrictions or prior assumptions about the overall relationship of variables, treating all variables as endogenous, and thus giving the data the ability to speak for themselves.

Using the same dataset as the analysis in the rest of the paper, the (recursively identified) PVAR results presented below model the relationship between economic activity, household leverage, nonfinancial corporate leverage, and the financial conditions index. To separate movements in national from global leverage, quarter (time) dummies are added to the model. Note that, in contrast to the GaR analysis in Section V, the impulse response functions derived from the PVAR relate to mean responses, rather than low quantiles. That is, they do not provide a measure of downside risk to output.

The estimated results, depicted in Figure 11, support the findings of the main analysis of this paper.[27] As in Section IV, the PVAR shows that a loosening in financial conditions leads to a significant increase in both household and nonfinancial corporate leverage, where the increase in household leverage is about half the size of the increase in nonfinancial corporate leverage (Panels 1-2). An unexpected loosening of financial conditions by one standard deviation leads to an increase in household leverage by about 0.2 percentage point after 4 years, while the increase in nonfinancial corporate leverage is about 0.4 percentage point. Also, supporting the Section V findings on downside risks to growth, the PVAR results suggest that economic activity expands after a loosening in financial conditions (Panel 3). A one-standard-deviation loosening in financial conditions leads to an increase in real GDP by about 0.2 to 0.3 percent in the 4 years after the shock, with most of the boost frontloaded in

[26] From a growth-at-risk perspective, the role of macroprudential policy in mitigating downside risks to future growth is consistent with its objective of limiting systemic risk.

[27] In contrast to the analyses in sections IV- VI, the PVAR is run in levels. For this reason, a comparison of results across methodologies has to remain at a qualitative level.

the first year. These results mirror our finding from the GaR analysis that the positive effect of looser financial conditions on output growth tends to fade after about 6 quarters.

In addition, the PVAR results display negative consequences following an increase in leverage. A one-standard-deviation shock to household leverage leads, on average, to a fall in real GDP of about 0.2 percent after 4 years (Panel 4). The drag on GDP is immediate and continues to build across all horizons. This contrasts with previous findings that suggest a short-run boost to GDP following a shock to household leverage (as in Mian, Sufi and Verner, 2017). The difference in results is partly explained by the inclusion of quarter dummies, which filter out global leverage dynamics. Excluding the dummies leads to a marginally significant boost to output in the first year after the shock.[28] Lastly, a shock to nonfinancial corporate leverage also acts as a drag on GDP, albeit smaller in size than a household leverage shock, reducing GDP by about 0.1 percent within the first 4 years after the shock (Panel 5). Again, these results support prior findings that the impact on output of nonfinancial corporate leverage is smaller compared to that of household leverage.

B. Additional Amplifiers of the Intertemporal Tradeoff

In addition to testing for changes in the intertemporal tradeoff under different regimes for credit booms and output gaps, we also test for two additional possible amplifiers. First, we recognize a key limitation of debt-to-GDP ratios as a measure of leverage: if financing costs change, the same debt-GDP ratio would not necessarily reflect the same debt burden for borrowers. In particular, with interest rates lowered and maintained at low levels during much of the decade preceding the COVID crisis, it is possible that higher debt-to-GDP ratios could be sustainable—and therefore not constitute as severe a financial vulnerability—compared to the past. Therefore, we define a regime of high debt service as periods during which the ratio of private nonfinancial sector debt-service-to-income is above the country-specific median and the FCI is looser than the country-specific median as well. Panel 1 of Figure 12 shows that, just as a credit boom amplifies the intertemporal tradeoff, so does a situation in which the debt-service ratio is relatively high by historical standards.

We also explore whether a high FX share of debt could be an amplifier, given the balance sheet vulnerabilities that can materialize when an external sector shock results in a sharp currency depreciation, ultimately raising the probability of a financial crisis.[29] We define a regime in which the FX-denominated share of debt in the nonfinancial corporate or household sector is higher than the country-specific median and the FCI is looser than the country-specific median.

For a subsample of mostly EMs, Panels 2 and 3 of Figure 12 provide supporting evidence from a GaR perspective. Following an easing in financial conditions, economies with a high

[28] The PVAR as specified in Mian, Sufi and Verner (2017) does not include time dummies. However, these authors examine the inclusion of time dummies in a local projections setup and find that the inclusion weakens the expansionary effect of higher household leverage on output.

[29] Krugman (1999), and Caballero and Krishnamurthy (2003) document the causes and consequences of firms' foreign currency exposure in emerging market crises. Calvo and others (2008), Rancière and others (2010), and Rancière and Tornell (2016) use cross-country studies to find that country-level FX share or debt mismatch increases the probability and severity of a sudden stop crisis. In addition, Verner and Gyöngyösi (2020) find that higher household FX share also contributes to the severity of a currency crisis.

FX share in either nonfinancial corporate debt or household debt have deteriorated medium-term downside risks.[30] It is noteworthy that the severity of downside risks is equally strong for the regimes based on FX debt of nonfinancial corporate and household sectors, suggesting a substantial presence of unhedged borrowers—those lacking incomes in foreign currency and/or financial hedging instruments for foreign currency risk—in both sectors.

VIII. Conclusions and Policy Implications

In the decade or so following the global financial crisis, leverage increased steadily in the nonfinancial corporate and household sectors across many economies in the world, largely buoyed by relaxed financial conditions. Global nonfinancial sector leverage reached a historically high level by the end of 2019, just before the onset of the COVID pandemic.

As a result of the pandemic, central banks around the world have pursued highly expansionary monetary policy to ease financial conditions in order to maintain the flow of credit to households and firms. Liquidity needs by firms and households have been met by additional debt, which has for the time being cushioned the devastating effects of the pandemic crisis.

However, a large and expanding literature has highlighted the dangers posed by high and rising leverage to financial stability, in terms of increasing the vulnerability of the economy and making more likely sudden drops in activity such as those experienced during a financial crisis. We build on this literature and investigate the empirical relationships between nonfinancial sector leverage, financial conditions, and financial stability risk, relationships which will be particularly crucial to policymakers as they chart a course for their post-COVID recoveries.

Our analysis of quarterly data for 29 advanced and emerging market economies during the 1996-2020 period yields three major results. First, controlling for a rich set of drivers, we find that a loosening of financial conditions is associated with a stronger buildup in nonfinancial corporate and household leverage, particularly over the medium term. Second, looser financial conditions also lead to an intertemporal tradeoff, as downside risk to economic activity diminishes in the near term but is accentuated in the medium term. This tradeoff is amplified when the economy is experiencing a credit boom—a rapid increase in leverage coupled with relatively loose financial conditions—that is, the near-term lessening of downside risk is more pronounced, as is its medium-term accentuating. Furthermore, this amplification is greatest when a credit boom is experienced together with a positive output gap. We also find amplification effects when the debt service burden is relatively high and, critically for EMs, when the foreign currency share of debt is relatively large. Third, selected macroprudential policies can tame buildups in either nonfinancial corporate or

[30] The subsample includes the 10 EMs and Korea.

household leverage and mitigate the intertemporal tradeoff stemming from loose financial conditions, albeit with a lag from implementation to full impact.

Furthermore, we find the results to be robust to different estimation methods, specifications, and variable definitions. The key median relationships between leverage, financial conditions, and financial stability when using a system estimation approach (PVAR) are consistent with those obtained using a single-equation local projections methodology. We show that the estimated impact of financial conditions on leverage is robust to inclusion of broader sets of controls, and to various alternative measures of financial conditions, while also showing that domestic, rather than international, financial conditions tend to be more informative about the future path of leverage.

Our results imply that, in the post-COVID context, policymakers will likely face a policy tradeoff. Accommodative policy support to firms and households in the near term will continue to be crucial for economies where recovery has not yet taken hold, or remains fragile. However, loosening of financial conditions comes at the cost of a potentially greater downside risk to growth in the medium term as a result of increased nonfinancial sector leverage. Our results imply that macroprudential tools targeted at the eligibility of borrowers or at liquidity-related limits on banks can help to slow buildups in leverage of either households or nonfinancial firms, and measures aimed at curbing foreign currency exposures of banks are effective at reining in buildups of nonfinancial corporate leverage in emerging markets. General macroprudential tightening can also improve the intertemporal tradeoff, reducing downside risk in the medium term and thereby mitigating the effects of loosening financial conditions.

The risks of high leverage will continue to pose policy challenges into the foreseeable future. In particular, swift implementation of macroprudential tightening depending on country-specific circumstances (the pace of recovery, postcrisis vulnerabilities, and the set of available macroprudential policy tools) will be needed as soon as macroeconomic conditions permit.[31] This underscores the need to limit potential leakages which have been documented in previous studies and to expand the perimeter covered by macroprudential instruments, particularly as intermediation activity increasingly migrates away from banks to NBFIs.[32]

[31] See IMF (2021b) IMF (2021c). In a few economies where recovery has gained momentum (such as China and New Zealand), macroprudential measures pertaining to the real estate sector have been tightened in recent months.

[32] Claessens and others (2021) provide cross-country evidence that macroprudential tightening increases NBFI activities and spills over across borders. A recent example of the application of macroprudential tools to NBFIs is Korea, which extended limits on household lending at high debt service ratios to some NBFIs. In addition, policy measures to contain foreign exchange risks also apply to some NBFIs in Korea (IMF 2020).

REFERENCES

Adrian, Tobias, Federico Grinberg, Nellie Liang, and Sheheryar Malik, forthcoming, "The Term Structure of Growth-at-Risk," *American Economic Journal: Macroeconomics*, forthcoming.

Adrian, Tobias, and Nellie Liang, 2018, "Monetary Policy, Financial Conditions, and Financial Stability," *International Journal of Central Banking*, Vol. 14 (January), pp. 73-131.

Adrian, Tobias, Nina Boyarchenko, and Domenico Giannone, 2019a, "Vulnerable Growth," *American Economic Review*, Vol. 109 (April), pp. 1263-89.

Adrian, Tobias, Dong He, Nellie Liang, and Fabio Natalucci, 2019b, "A Monitoring Framework for Global Financial Stability," IMF Staff Discussion Note 19/06 (Washington, D.C.: International Monetary Fund).

Aiyar, Shekhar, Charles W Calomiris, and Tomasz Wieladek, 2014, "Does Macro-prudential Regulation Leak? Evidence from a UK Policy Experiment," *Journal of Money, Credit and Banking*, Vol. 46 (January), pp. 181–214.

Alam, Zohair, Adrian Alter, Jesse Eiseman, Gaston Gelos, Heedon Kang, Machiko Narita, Erlend Nier, and Naixi Wang, 2019, "Digging Deeper—Evidence on the Effects of Macroprudential Policies from a New Database." IMF Working Paper 19/66 (Washington D.C.: International Monetary Fund).

Alter, Adrian, and Selim Ali Elekdag, 2020, "Emerging Market Corporate Leverage and Global Financial Conditions," *Journal of Corporate Finance*, Vol. 62 (June), pp. 1-18.

Araujo, Juliana, Manasa Patnam, Adina Popescu, Fabian Valencia, and Weijia Yao, 2020, "Effects of Macroprudential Policy: Evidence from Over 6,000 Estimates," IMF Working Paper 20/67 (Washington D.C.: International Monetary Fund).

Auerbach, Alan and Yuriy Gorodnichenko, 2012, "Measuring the Output Responses to Fiscal Policy," *American Economic Journal: Economic Policy*, Vol. 4 (May), pp. 1-27.

Bank for International Settlements, 2014, "Debt and the Financial Cycle: Domestic and Global," Chapter IV in the BIS Annual Report (Basel: Bank for International Settlements).

Bernanke, Ben S., and Alan S. Blinder, 1992, "The Federal Funds Rate and the Channels of Monetary Transmission," *American Economic Review*, Vol. 82 (September), pp. 901-21.

Bernanke, Ben S., Mark Gertler, and Simon Gilchrist,1999, "The Financial Accelerator in a Quantitative Business Cycle Framework," Chapter 21 in John B. Taylor and Michael Woodford (eds), *Handbook of Macroeconomics* (Amsterdam: Elsevier Science B.V.).

Brandao-Marques, Luis, Qianying Chen, Claudio Raddatz, Jérôme Vandenbussche, and Peichu Xie, 2019, "The Riskiness of Credit Allocation and Financial Stability," IMF Working Paper 19/207 (Washington, D.C.: International Monetary Fund).

Brandao-Marques, Luis, Gaston Gelos, Machiko Narita, and Erlend Nier, 2020, "Leaning Against the Wind: A Cost-Benefit Analysis for an Integrated Policy Framework," IMF Working Paper 20/123 (Washington D.C.: International Monetary Fund).

Brunnermeier, Markus K., and Yuliy Sannikov, 2014, "A Macroeconomic Model with a Financial Sector," *American Economic Review*, Vol. 104 (February), pp. 379-421.

Caballero, Ricardo J., and Arvind Krishnamurthy, 2003, "Excessive Dollar Debt: Financial Development and Underinsurance," *Journal of Finance*, Vol. 58 (March), pp. 867-93.

Calvo, Guillermo A., Alejandro Izquierdo, and Luis-Fernando Mejia, 2008, "Systemic Sudden Stops: The Relevance of Balance-Sheet Effects and Financial Integration," Working Paper 14026 (National Bureau of Economic Research).

Cerutti, Eugenio, Stijn Claessens, and Luc Laeven, 2017, "The Use and Effectiveness of Macroprudential Policies: New Evidence," *Journal of Financial Stability*, Vol. 28 (February), pp. 203–24.

Christiano, Lawrence J., Martin Eichenbaum, and Charles Evans, 1996, "The Effects of Monetary Policy Shocks: Evidence from the Flow of Funds," *Review of Economics and Statistics*, Vol. 78 (February), pp. 16-34.

Christiano, Lawrence J., Mathias Trabandt and Karl Walentin, 2011, "DSGE Models for Monetary Policy Analysis," in Benjamin M. Friedman, and Michael Woodford (eds), *Handbook of Monetary Economics*, Vol. 3A (Amsterdam: Elsevier Science B.V.).

Claessens, Stijn, Giulio Cornelli, Leonardo Gambacorta, Francesco Manaresi, and Yasushi Shiina, 2021, "Do Macroprudential Policies Affect Nonbank Financial Intermediation?" BIS Working Paper 927 (Basel: Bank for International Settlements).

Drehmann, Mathias, and Mikael Juselius, 2014, "Evaluating Early Warning Indicators of Banking Crises: Satisfying Policy Requirements," *International Journal of Forecasting,* Vol. 30 (July-September), pp. 759-80.

Driscoll, John C., and Aart C. Kraay, 1998, "Consistent Covariance Matrix Estimation with Spatially Dependent Panel Data," *Review of Economics and Statistics,* Vol. 80 (November), pp. 549-60.

Du, Wenxin, and Jesse Schreger, 2016, "Local Currency Sovereign Risk," *Journal of Finance*, Vol. 71 (February), pp. 1027-70.

Duprey, Thibault, and Alexander Ueberfeldt, 2020, "Managing GDP Tail Risk," Bank of Canada Staff Working Paper 2020-03 (Ottawa: Bank of Canada).

Eberhardt, Markus, and Andrea Presbitero, 2018, "Commodity Price Movements and Banking Crises." IMF Working Paper 18/153 (Washington D.C.: International Monetary Fund).

ESRB, 2014, "Flagship Report on Macro-prudential Policy in the Banking Sector," European System of Financial Supervision, European Systemic Risk Board.

Forbes, Kirstin, 2020, "The International Aspects of Macroprudential Policies," MIT Sloan School Working Paper 6167-20.

Furceri, Davide, and Ricardo M. Sousa, 2011, "Does Government Spending Crowd Out Private Consumption and Investment?" *World Economics*, Vol. 12 (October), pp. 153-170.

Gertler, Mark, and Simon Gilchrist, 2018, "What Happened: Financial Factors in the Great Recession," *Journal of Economic Perspectives*, Vol. 32 (Summer), pp. 3-30.

Gilchrist, Simon, David López-Salido, and Egon Zakrajšek, 2015, "Monetary Policy and Real Borrowing Costs at the Zero Lower Bound," *American Economic Journal: Macroeconomics,* Vol. 7 (January), pp. 77-109.

Gilchrist, Simon, Michael Siemer, and Egon Zakrajsek, 2018, "The Real Effects of Credit Booms and Busts: A County-Level Analysis," Meeting Papers 99, Society for Economic Dynamics.

Gilchrist, Simon, and Egon Zakrajšek, 2012, "Credit Spreads and Business Cycle Fluctuations," *American Economic Review*, Vol. 102 (June), pp. 1692-720.

Gross, Marco, Thierry Tressel, Xiaodan Ding, and Eugen Tereanu, forthcoming, "Structural Risk Drivers of Household Default in a Micro-Macro Simulation Model for 21 EU Countries and the US," IMF Working Papers forthcoming (Washington D.C.: International Monetary Fund).

Hanson, Samuel G., Jeremy C. Stein, Adi Sunderman, and Eric Zwick, 2020, "Business Credit Programs in the Pandemic Era," BPEA Article, September (Washington D.C.: Brookings Institution).

Institute of International Finance, 2020, "COVID-19 Exacerbates Household Debt Burdens," IIF Weekly Insight, March 26.

International Monetary Fund, 2014, "Staff Guidance Note on Macroprudential Policy" (Washington D.C.: International Monetary Fund).

International Monetary Fund, 2017a, "Household Debt and Financial Stability," Global Financial Stability Report, (October), Chapter 2, pp. 53-89 (Washington D.C.: International Monetary Fund).

International Monetary Fund, 2017b, "Is Growth At Risk?" Global Financial Stability Report, (October), Chapter 1, pp. 1-52 (Washington D.C.: International Monetary Fund).

International Monetary Fund, 2018a, "Online Annex 1.1 Technical Note," Global Financial Stability Report, (April), Chapter 1, pp. 57-92 (Washington D.C.: International Monetary Fund).

International Monetary Fund, 2018b, "The Riskiness of Credit Allocation: A Source of Financial Vulnerability?" Global Financial Stability Report, (April), Chapter 2, pp. 57-92 (Washington D.C.: International Monetary Fund).

International Monetary Fund, 2020a, "Risky Credit Markets," Global Financial Stability Report," (April), Chapter 2, pp. 29-46.

International Monetary Fund, 2020b, "Liquidity Strains Cushioned by a Powerful Set of Policies," Global Financial Stability Report, (October), Chapter 3, pp. 53-69.

International Monetary Fund, 2020c, "Fiscal Policies to Address the COVID-19 Pandemic," Fiscal Monitor, (October), Chapter 1, pp. 1-29.

International Monetary Fund, 2021a, "Tailoring Fiscal Responses," Fiscal Monitor (April), Chapter 1, pp. 1-26.

International Monetary Fund, 2021b, "An Asynchronous and Divergent Recovery May Put Financial Stability at Risk, Global Financial Stability Report, (April), Chapter 1, pp. 1-33.

International Monetary Fund, 2021c, "Global Prospects and Policies," World Economic Outlook, (April), pp. 1-41.

Jordà, Òscar, 2005, "Estimation and Inference of Impulse Responses by Local Projections," *American Economic Review*, Vol. 95 (March), pp. 161-82.

Jordà, Òscar, Martin Kornejew, Moritz Schularick, and Alan M. Taylor, 2020, "Zombies at Large? Corporate Debt Overhang and the Macroeconomy," NBER Working Paper 28197 (National Bureau of Economic Research).

Jordà, Òscar, Moritz Schularick, and Alan M. Taylor, 2016, "Macrofinancial History and The New Business Cycle Facts." *NBER Macroeconomic Annuals,* Vol. 31, pp. 213-63.

Kalemli-Ozcan, Sebnem, Luc Laeven, and David Moreno, 2020, "Debt Overhang, Rollover Risk, and Corporate Investment: Evidence from the European Crisis," NBER Working Paper 24555 (National Bureau of Economic Research).

Kirti, Divya, 2018, "Lending Standards and Output Growth," IMF Working Paper 18/023 (Washington D.C.: International Monetary Fund).

Kiyotaki, Nobuhiro, and John Moore, 1997, "Credit Cycles," *Journal of Political Economy*, Vol. 105 (April), pp. 211-48.

Krugman, Paul, 1999, "Balance Sheets, the Transfer Problem, and Financial Crises," *International Tax and Public Finance*, Vol. 6 (November), pp. 459-72.

Machado, José A.F., and J.M.C. Santos Silva, 2019, "Quantiles Via Moments," *Journal of Econometrics,* Vol. 213 (November), pp. 145-73.

Mian, Atif, Amir Sufi, and Emil Verner, 2017, "Household Debt and Business Cycles Worldwide," *Quarterly Journal of Economics,* Vol. 132 (November), pp. 1755-817.

Opler, Tim C., Lee Pinkowitz, Rene Stultz, and Rohan Williamson, 1999, "The Determinants and Implications of Corporate Cash Holdings," *Journal of Financial Economics*, Vol. 52 (April), pp. 3-46.

Ostry, Jonathan, Atish Ghosh, Marcos Chamon, and Mahvash Qureshi, 2012, "Tools for Managing Financial-Stability Risks from Capital Inflows," *Journal of International Economics*, Vol. 88 (November), pp. 407–21.

Peydró, José-Luis, Francesc Rodriguez-Tous, Jagdish Tripathy, and Arzu Uluc, 2020, "Macroprudential Policy, Mortgage Cycles and Distributional Effects: Evidence from the UK," Staff Working Paper 866 (London: Bank of England).

Rancière, Romain, Aaron Tornell, and Athanasios Vamvakidis, 2010, "Currency Mismatch, Systemic Risk and Growth in Emerging Europe," *Economic Policy*, Vol. 25 (October), pp. 597-658.

Rancière, Romain, and Aaron Tornell, 2016, "Financial Liberalization, Debt Mismatch, Allocative Efficiency, and Growth," *American Economic Journal: Macroeconomics,* Vol. 8 (April), pp.1-44.

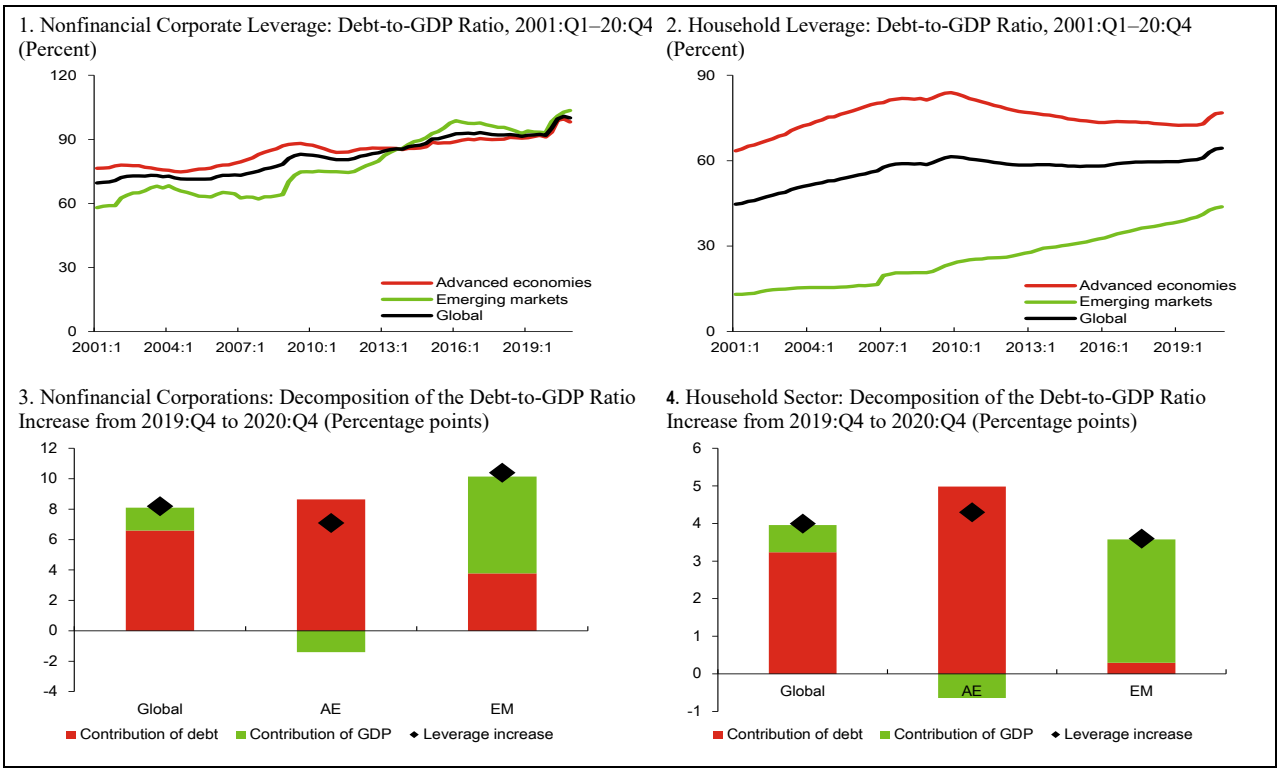
Schularick, Moritz, and Alan M. Taylor, 2012, "Credit Booms Gone Bust: Monetary Policy, Leverage Cycles, and Financial Crises, 1870-2008," *American Economic Review*, Vol. 102 (April), pp. 1029-61.

Verner, Emil, 2019, "Private Debt Booms and the Real Economy: Do the Benefits Outweigh the Costs?" Working Paper, MIT, Sloan School of Management.

Verner, Emil, and Győző Gyöngyösi, 2020, "Household Debt Revaluation and the Real Economy: Evidence from a Foreign Currency Debt Crisis," *American Economic Review*, Vol. 110 (September), pp. 2667-702.

FIGURES

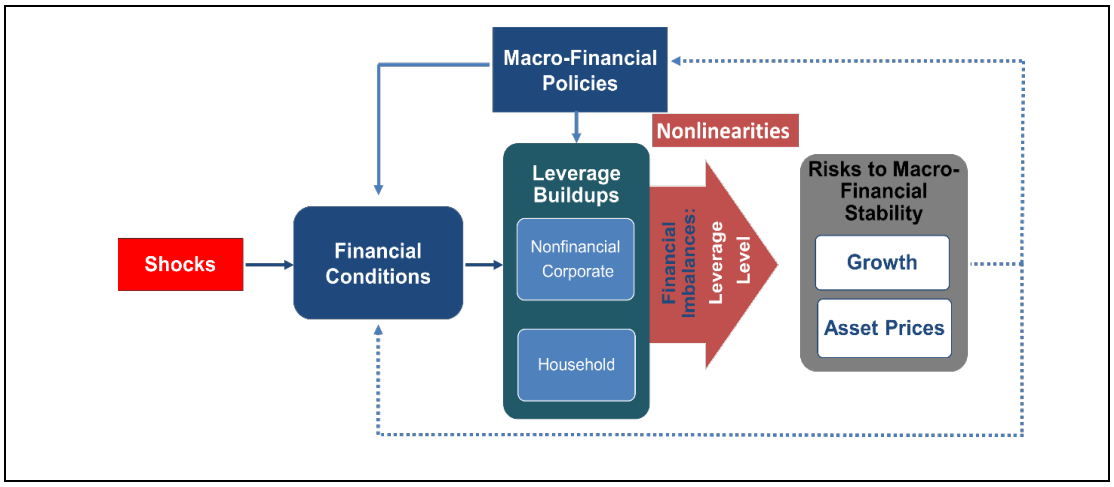
Figure 1. Private nonfinancial Sector Leverage, by Country Group



Sources: Institute of International Finance; and authors' calculations.

Notes: The figure includes 27 advanced economies (AEs) and 25 emerging markets (EMs). Leverage is measured as the ratio of debt to GDP. Global, AE, and EM leverage are measured as the ratio of aggregate debt to aggregate GDP across different country groups. Nonfinancial corporate debt figures are nonconsolidated.

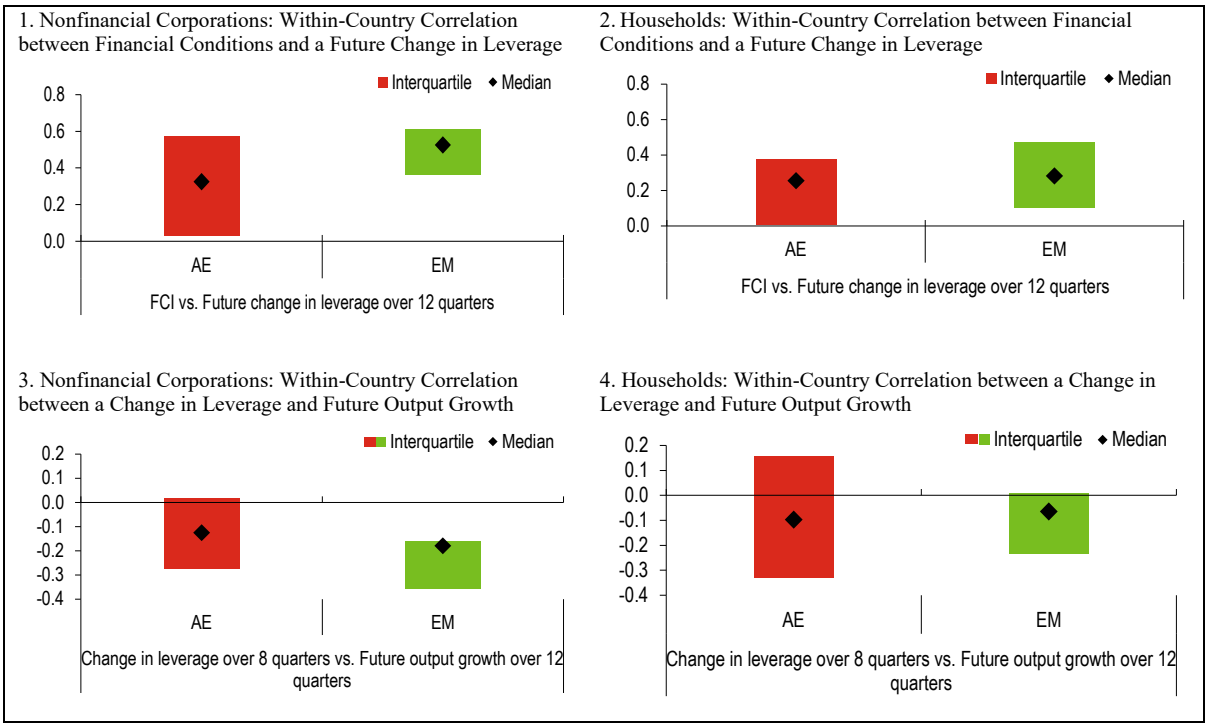
Figure 2. Leverage as an Amplifier of Shocks



Source: IMF staff, based on Adrian and others 2019b.

Note: "Nonlinearities" indicates that the impact of financial conditions on macro-financial stability may be amplified in the presence of elevated financial vulnerabilities, such as a high level of leverage.

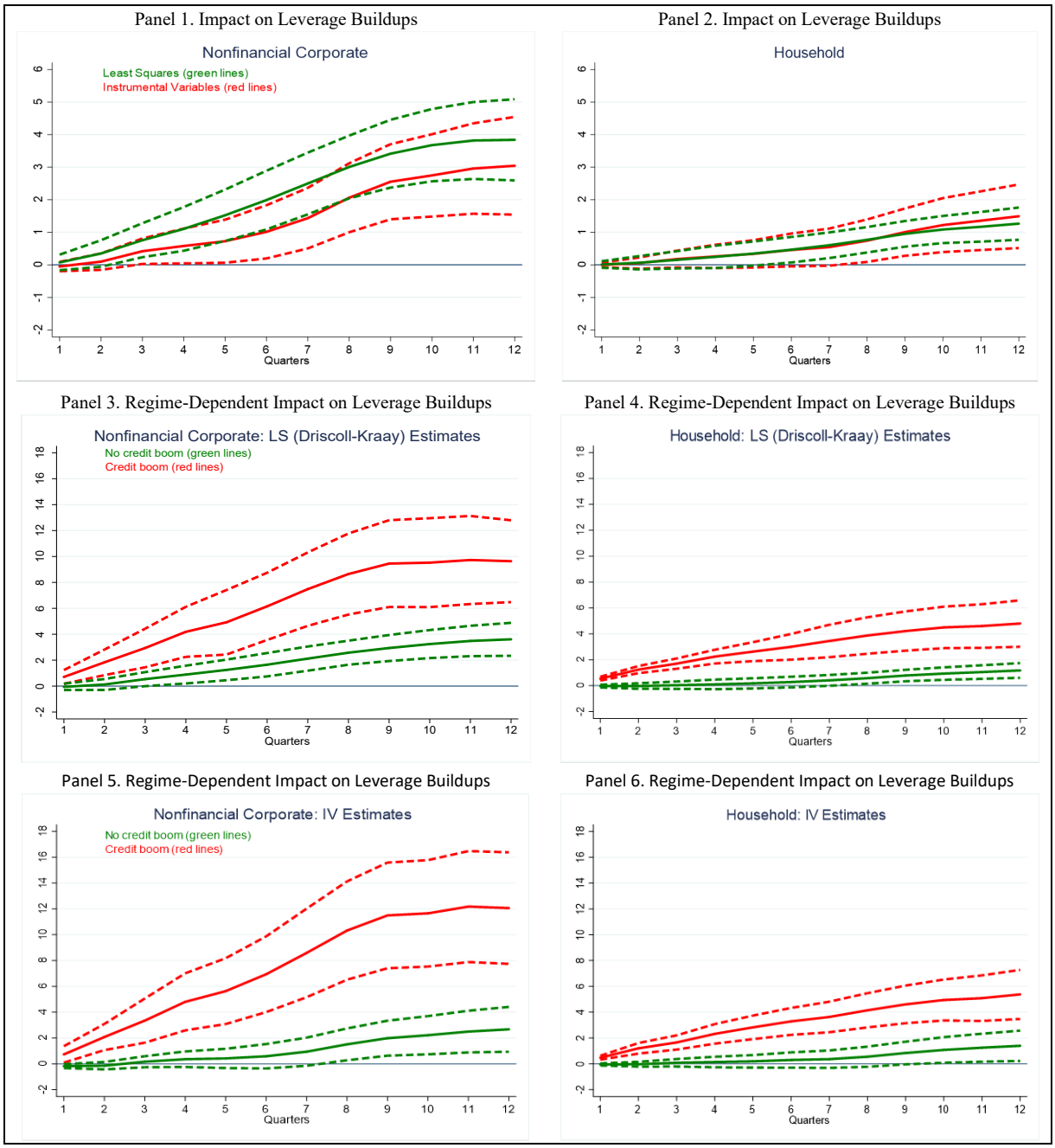
Figure 3. Leverage, Financial Conditions, and Output Growth



Sources: Institute of International Finance; and authors' calculations.

Notes: The sample includes 19 advanced economies (AE) and 10 emerging markets (EMs) over the period 1996:Q1 – 2020:Q4. Panels 1 and 2 show the correlation of the negative of the Financial Conditions Index (FCI) (that is, higher values indicate looser financial conditions) and changes in the debt-to-GDP ratio over the subsequent 12 quarters. Panels 3 and 4 show the correlation of a change in the nonfinancial corporate sector and household debt-to-GDP ratio, respectively, over eight quarters and a change in output growth over the subsequent 12 quarters.

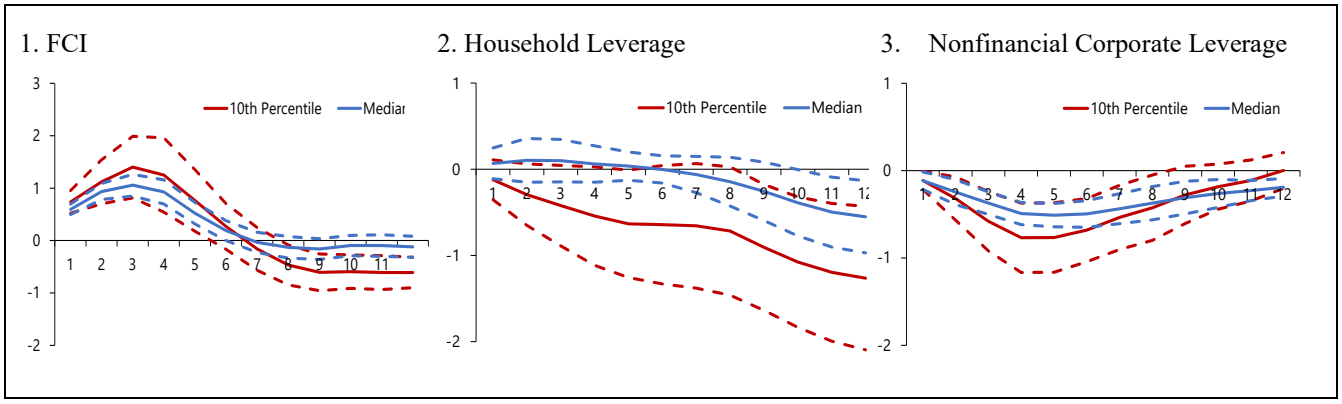
Figure 4. Financial Conditions Easing and Nonfinancial Sector Leverage Buildups: All Countries



Source: Authors' calculations.

Notes: (a) Panel regressions with country-fixed effects are estimated for 1996:Q1-20:Q4 for Panels 1-2 (1997:Q1-20:Q4 for Panels 3-6). The dependent variable is the cumulative h-quarter-ahead change in the nonfinancial corporate or household debt-to-GDP ratio over horizons of 1–12 quarters. The shock is scaled as a one-unit decrease in the Financial Conditions Index (FCI) to reflect the effect of financial condition easing. (b) The estimated responses based on panel least square (instrumental variable, IV) regressions are depicted by green (red) lines, along with 90% confidence intervals based on the Driscoll-Kraay (robust) standard errors in the same color. (c) Regressors in Panels 1 and 2 (regression 1a) comprise one-period-lagged variables of the core covariates (FCI, output growth, inflation, and policy rate change) as well as lagged one-quarter changes in the sector-specific debt-to-GDP ratio; and those in Panels 3-6 (regression 1b) additionally include credit-boom and no-credit boom dummies interacting with these regressors as well. (d) To control for the possible endogeneity of policy rate change, IV regressions include a set of instruments: two lags of commodity price inflation, policy rate change, 2-year government bond yield change, and 10-year government bond yield change purged by 2-year bond yield change in addition to the regressors in Panels 1 and 2; and these variables interacting with credit-boom and no-credit-boom dummies in Panels 3-4. (e) The credit-boom dummy is defined to indicate a credit boom regime: it equals one when, for a given country, the country-specific FCI is below the median of its distribution and the eight-quarter change in the credit-to-GDP ratio is in the top three deciles of its distribution.

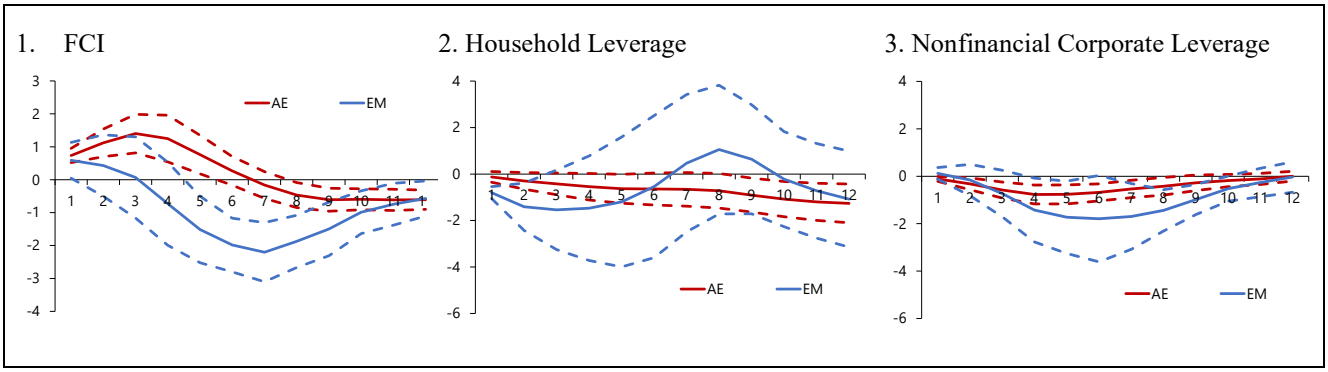
Figure 5. Impact of Financial Conditions, Household Leverage, and Nonfinancial Corporate Leverage on Future GDP Growth (10th percentile and median, percentage points)



Sources: International Institute of Finance; and authors' calculations.

Notes: The panels show the 10th percentile (red) and median (blue) impact of a one-standard-deviation easing in the FCI, one-percentage-point increase in household leverage, one-percentage-point increase in nonfinancial corporate leverage, respectively, on future year-on-year real GDP growth. The control variables in all regressions include year-on-year real GDP growth, inflation, policy rate change (all one-period lagged), and country fixed effects. Dashed lines indicate 90 percent confidence intervals based on standard errors computed from bootstrapping.

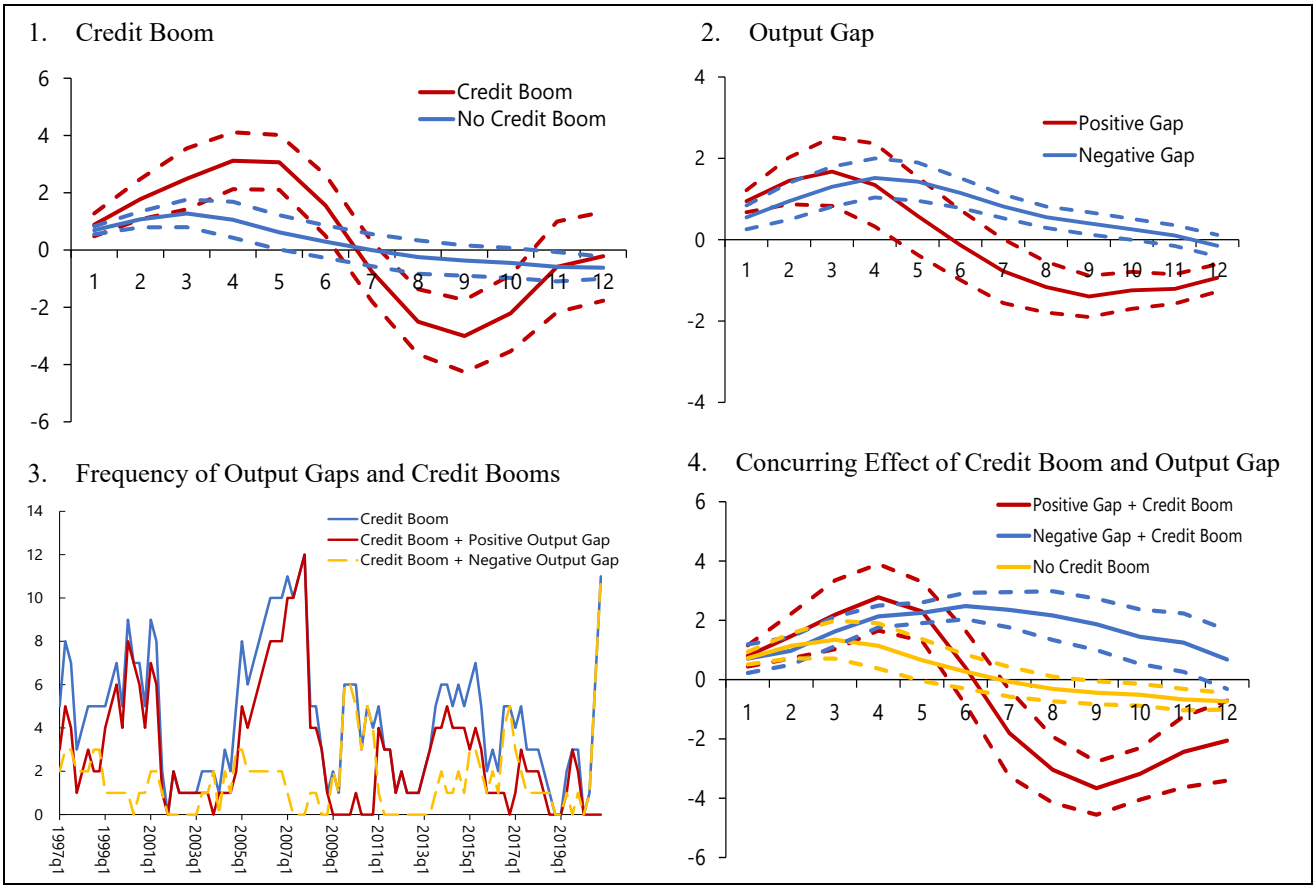
Figure 6. Impact of Financial Conditions, Household Leverage, and Nonfinancial Corporate Leverage on the 10th Percentile of Future GDP Growth: by Country Groups (AEs vs. EMs)



Sources: International Institute of Finance; and authors' calculations.

Notes: The panels show impact on the 10th percentile of the future growth distribution of a one-standard-deviation easing in the FCI, one-percentage-point increase in household leverage, one-percentage-point increase in nonfinancial corporate leverage, respectively, on future year-on-year real GDP growth in advanced economies (red) and emerging market economies (blue). The control variables in all regressions include year-on-year real GDP growth, inflation, policy rate change (all one-period lagged), and country fixed effects. Dashed lines indicate 90 percent confidence intervals based on standard errors computed from bootstrapping.

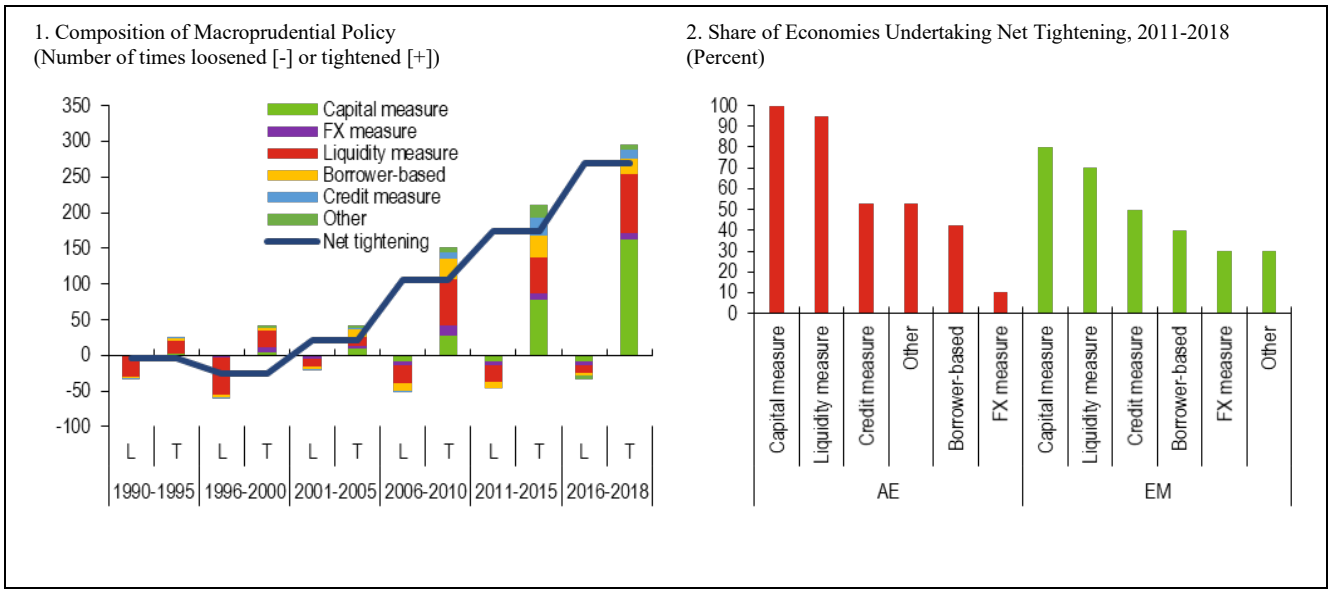
Figure 7. Amplification Effects of Credit Booms and Output Gaps: Impact of Loosening Financial Conditions on the 10th Percentile of Output Growth under Different Regimes



Sources: International Institute of Finance; Bank for International Settlements; and authors' calculations.

Notes: The panels show the 10th percentile impact of a one-standard-deviation easing in the FCI on future year-on-year real GDP growth under different regimes. The regime in Panel 1 is credit boom in which the 8-quarter change in private nonfinancial sector leverage is higher than the top 3rd decile and financial conditions are looser than median in a country. The regime in Panel 2 is defined as the episodes where the quarterly output gap is positive or negative. Panel 3 shows the frequency of credit boom regimes and the concurring credit boom and positive (or negative) output gap regimes across 29 sample countries during 1997-2020. Panel 4 shows the impacts on output growth under the regimes defined by interactions between output gaps and credit boom. The control variables in all regressions include year-on-year real GDP growth, inflation, and policy rate change (all one-period lagged), and country fixed effects. Dashed lines indicate 90 percent confidence intervals based on standard errors computed from bootstrapping.

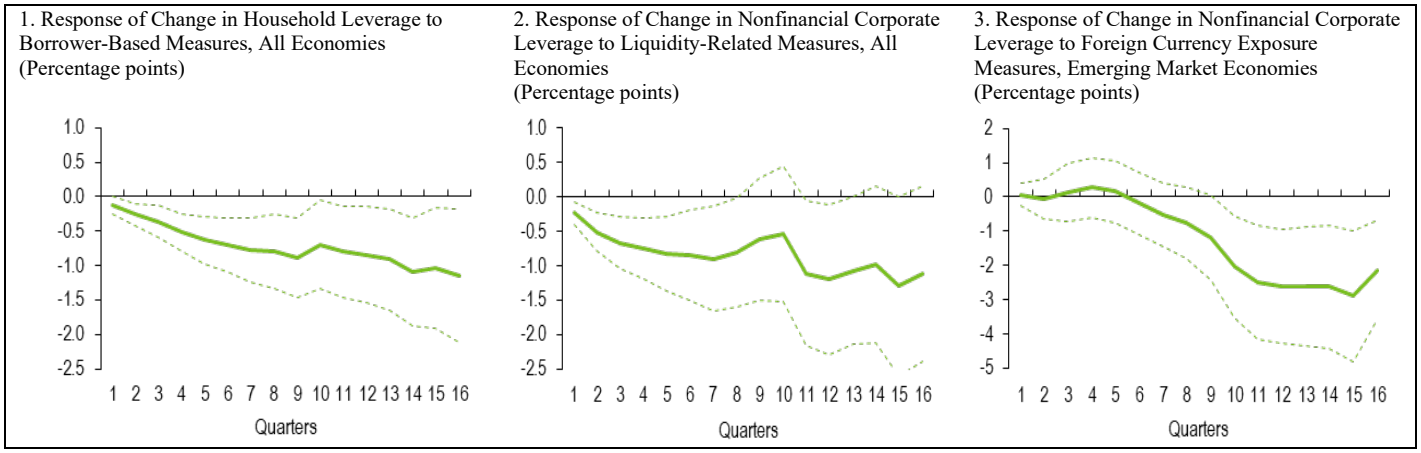
Figure 8. Macroprudential Policy Actions, by Category



Source: IMF, Integrated Macroprudential Policy database.

Notes: The sample includes 19 advanced economies (AEs) and 10 emerging markets (EMs). Panel 1 shows the number of times during which a given category of macroprudential measures was either tightened (positive) or loosened (negative) during each five-year subperiod during 1990–2018. The solid line indicates net tightening; that is, the difference between the number of measures tightened and loosened. Panel 2 shows the net tightening over the 2011–18 period for each category and by country group. FX = foreign exchange; L = loosened; T = tightened.

Figure 9. Macroprudential Tightening and Change in Leverage

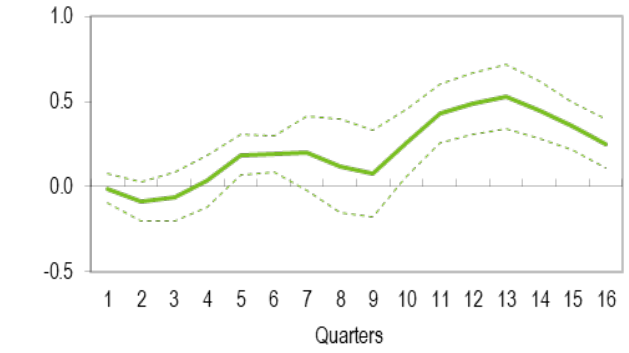


Sources: International Institute of Finance; and authors' calculations.

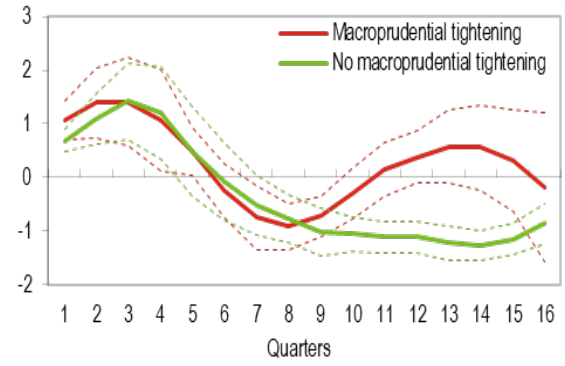
Notes: The panels show the association between a one-unit net tightening in the respective category of macroprudential measures and the subsequent change in the household or nonfinancial corporate-debt-to-GDP ratios over horizons of 1–16 quarters. The control variables in all regressions include a one-quarter change in the sector-specific debt-to-GDP ratio, GDP growth, FCI, inflation, policy rate change (all one-period lagged), and a dummy variable for the global financial crisis. Dashed lines indicate 90 percent confidence intervals.

Figure 10. Macroprudential Measures and Downside Risks to Future Growth

1. Impact of Macroprudential Tightening on the 10th Percentile of GDP Growth (Percentage points)



2. Impact of Loosening Financial Conditions on 10th Percentile of GDP Growth (with vs. without Macroprudential Tightening) (Percentage points)

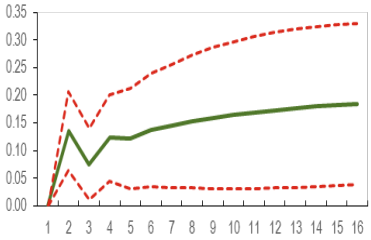


Sources: International Institute of Finance; and authors' calculations.

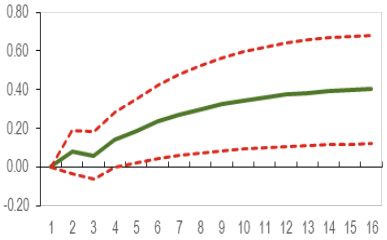
Notes: Panel 1 shows the effects of a net tightening event across the 17 types of macroprudential measures found in the IMF Integrated Macroprudential Policy database. Panel 2 shows the effect of a one-unit loosening in the FCI. The "macroprudential tightening" regime contains all quarters with net macroprudential tightening in the past year. The dependent variable is the year-over-year growth of real GDP over horizons of 1–16 quarters ahead. The control variables in all regressions are the change in the private nonfinancial sector leverage over the past eight quarters, year-over-year GDP growth, and inflation. All the responses are estimated with county fixed effects using quantile local projections at the 10th percentile of the growth distributions. Dashed lines indicate 90 percent confidence intervals.

Figure 11. PVAR-Estimated Responses to Loosening Financial Conditions and to Increasing Leverage

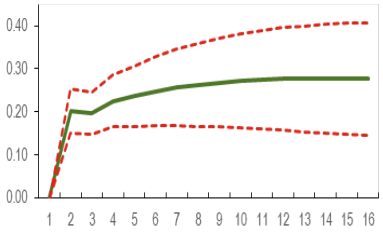
1. Household Leverage Responses to a Surprise Loosening of Financial Conditions (Percentage points, Quarters)



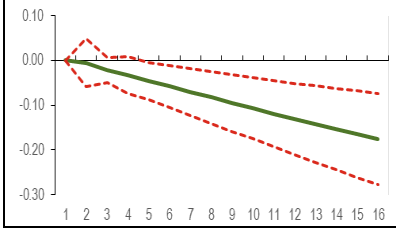
2. Nonfinancial Corporate Leverage Responses to a Surprise Loosening of Financial Conditions (Percentage points, Quarters)



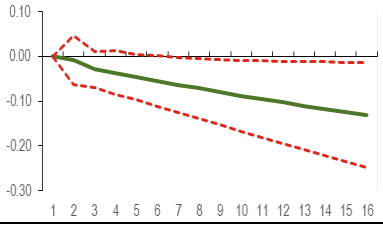
3. Real GDP Responses to a Surprise Loosening of Financial Conditions (Percent, Quarters)



4. Real GDP Responses to a Surprise Increase in Household Leverage (Percent, Quarters)



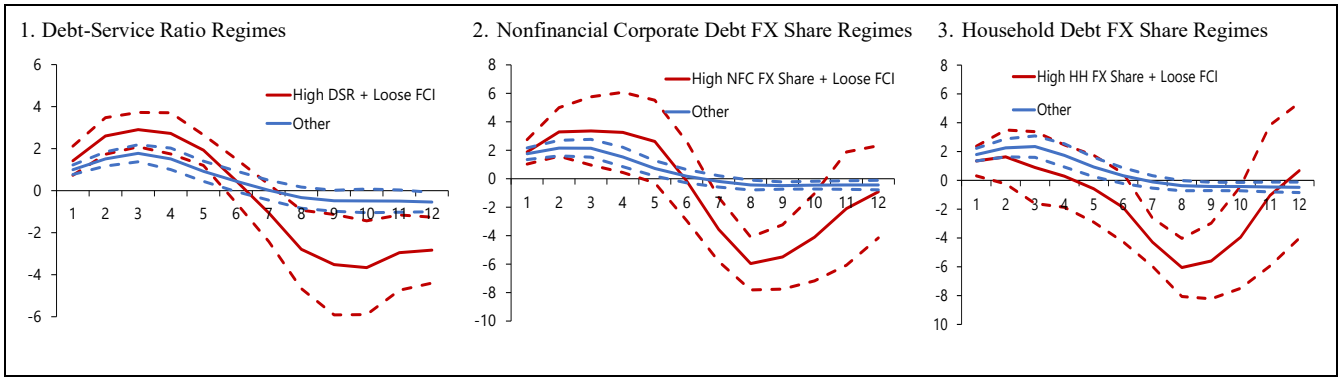
5. Real GDP Responses to a Surprise Increase in Nonfinancial Corporate Leverage (Percent, Quarters)



Source: Authors' calculations.

Notes: Panels 1-3 show the responses to a one-standard-deviation loosening in financial conditions. Panels 4 and 5 show the responses to a one-standard-deviation increase in private nonfinancial sector leverage. Dotted lines show +/- two-standard-deviation-error bands.

Figure 12. Amplification Effects of High Debt Service or FX Share of Debt: Impact of Loosening Financial Conditions on the 10th Percentile of Output Growth under Different Regimes



Sources: International Institute of Finance; Bank for International Settlements; and authors' calculations.

Notes: The panels show the 10th percentile impact of one standard deviation easing in financial condition index on future year-on-year real GDP growth in different regimes. Panel 1 compares the regimes with above-median private sector debt-service ratio and looser financial conditions with all other time periods. Finally, Panels 2 and 3 compare regimes with above-median nonfinancial corporate or household debt foreign currency share and loose financial conditions with all other time periods. The control variables in all regressions include year-on-year real GDP growth, inflation, and policy rate change (all one-period lagged), and country fixed effects. Dashed lines indicate 90 percent confidence intervals based on standard errors computed from bootstrapping.

TABLES

Table 1. Drivers of Future Changes in Nonfinancial Corporate Sector Leverage: All Economies (horizons = 2, 4, 6, 8, and 12 quarters ahead)

Panel 1. Least Square Regressions (with Driscoll and Kraay Standard Errors)

Variables	(1) h=2	(2) h=4	(3) h=6	(4) h=8	(5) h=10	(6) h=12
FCI	0.348	1.104***	1.989***	3.006***	3.677***	3.840***
	(0.248)	(0.408)	(0.548)	(0.586)	(0.675)	(0.758)
Output Growth	-0.060**	-0.109**	-0.064	-0.044	-0.039	-0.018
	(0.023)	(0.042)	(0.051)	(0.063)	(0.074)	(0.084)
Inflation	-0.026***	-0.052***	-0.056***	-0.072***	-0.082***	-0.102***
	(0.006)	(0.010)	(0.014)	(0.018)	(0.024)	(0.031)
Policy Rate Change	0.084***	0.111***	0.101**	0.075	0.050	0.053
	(0.028)	(0.027)	(0.039)	(0.048)	(0.049)	(0.057)
Observations	2,816	2,758	2,700	2,642	2,584	2,526
Country Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes

Panel 2. Instrumental Variable Regressions (with Robust Standard Errors)

Variables	(1) h=2	(2) h=4	(3) h=6	(4) h=8	(5) h=10	(6) h=12
FCI	0.097	0.578*	1.013**	2.060***	2.747***	3.043***
	(0.154)	(0.325)	(0.497)	(0.645)	(0.769)	(0.913)
Output Growth	-0.054***	-0.113**	-0.026	-0.000	-0.000	0.030
	(0.015)	(0.049)	(0.048)	(0.059)	(0.077)	(0.083)
Inflation	0.041	0.016	0.006	-0.048	-0.046	-0.105
	(0.053)	(0.032)	(0.062)	(0.055)	(0.089)	(0.101)
Policy Rate Change	-0.100	0.311	1.581***	1.720**	1.669***	1.214*
	(0.444)	(0.707)	(0.597)	(0.463)	(0.593)	(0.643)
Observations	2,277	2,219	2,161	2,103	2,045	1,987
Country Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes

Source: Authors' calculations.

Notes: Standard errors in parentheses. *, **, *** indicate significance at the 0.1, 0.05, 0.01 levels, respectively. (a) Panel regressions with country-fixed effects are estimated for 19 AEs and 10 EMs for 1996:Q1-2020:Q4. (b) The cumulative h-quarter-ahead response estimates are obtained by panel least square (instrumental variable, IV) regressions based on Driscoll and Kraay (1998) standard errors (robust standard errors). (c) Regressors comprise one-period-lagged variables of the core covariates (FCI, output gap, inflation, and policy rate change) as well as lagged one-quarter change in the sector-specific debt-to-GDP ratio and country fixed effects. (d) To control for the possible endogeneity of policy rate change, IV regressions include two lags of commodity price inflation, policy rate change, 2-year government bond yield change, and 10-year bond yield change purged by 2-year bond yield change in addition to the regressors.

Table 2. Drivers of Future Changes in Household Sector Leverage: All Economies (horizons = 2, 4, 6, 8, and 12 quarters ahead)

Panel 1. Least Square Regressions (with Driscoll and Kraay Standard Errors)

Variables	(1) h=2	(2) h=4	(3) h=6	(4) h=8	(5) h=10	(6) h=12
FCI	0.065	0.244	0.464*	0.769***	1.085***	1.265***
	(0.125)	(0.209)	(0.238)	(0.237)	(0.254)	(0.301)
Output Growth	-0.040***	-0.076***	-0.068***	-0.055**	-0.039	-0.023
	(0.007)	(0.016)	(0.022)	(0.028)	(0.034)	(0.039)
Inflation	-0.006**	-0.007	-0.005	-0.003	-0.001	-0.001
	(0.003)	(0.004)	(0.006)	(0.007)	(0.009)	(0.011)
Policy Rate Change	0.007	-0.009	-0.001	0.005	0.000	0.003
	(0.010)	(0.016)	(0.021)	(0.029)	(0.032)	(0.036)
Observations	2,816	2,758	2,700	2,642	2,584	2,526
Country Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes

Panel 2. Instrumental Variable Regressions (with Robust Standard Errors)

Variables	(1) h=2	(2) h=4	(3) h=6	(4) h=8	(5) h=10	(6) h=12
FCI	0.054	0.259	0.456	0.741*	1.221**	1.492**
	(0.105)	(0.223)	(0.307)	(0.397)	(0.504)	(0.594)
Output Growth	-0.042***	-0.108***	-0.104***	-0.100***	-0.081**	-0.052*
	(0.009)	(0.025)	(0.028)	(0.035)	(0.036)	(0.040)
Inflation	- 0.005	0.026	0.091**	0.110*	0.137**	0.129
	(0.013)	(0.031)	(0.040)	(0.056)	(0.070)	(0.081)
Policy Rate Change	-0.435***	-0.700***	-0.841***	-0.504	-0.909**	-0.984**
	(0.089)	(0.206)	(0.245)	(0.331)	(0.380)	(0.415)
Observations	2,277	2,219	2,161	2,103	2,045	1,987
Country Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes

Source: Authors' calculations.

Notes: Standard errors in parentheses. *, **, *** indicate significance at the 0.1, 0.05, 0.01 levels, respectively. (a) Panel regressions with country-fixed effects are estimated 19 AEs and 10 EMs for 1996:Q1-2020:Q4. (b) The cumulative h-quarter-ahead response estimates are obtained by panel least square (instrumental variable, IV) regressions based on Driscoll and Kraay (1998) standard errors (robust standard errors). (c) Regressors comprise one-period-lagged variables of the core covariates (FCI, output gap, inflation, and policy rate change) as well as lagged one-quarter change in the sector-specific debt-to-GDP ratio and country fixed effects. (d) To control for the possible endogeneity of policy rate change, IV regressions include two lags of commodity price inflation, policy rate change, 2-year government bond yield change, and 10-year bond yield change purged by 2-year bond yield change in addition to the regressors.

Table 3. Impact of Financial Conditions and Changes in Household and Nonfinancial Corporate Leverage on Future GDP Growth

Panel 1. 10th percentile impact on future GDP growth (in percentage points)

Variables	(1) h=2	(2) h=4	(3) h=6	(4) h=8	(5) h=10	(6) h=12
FCI	-1.121***	-1.250***	-0.269	0.467**	0.593***	0.609***
	(0.262)	(0.443)	(0.273)	(0.238)	(0.199)	(0.182)
Change in HH Leverage	-0.295	-0.543	-0.644	-0.718	-1.078**	-1.263**
	(0.223)	(0.357)	(0.429)	(0.465)	(0.473)	(0.520)
Change in NFC Leverage	-0.319**	-0.768***	-0.681***	-0.424*	-0.184	0.003
	(0.155)	(0.248)	(0.226)	(0.233)	(0.161)	(0.127)
Observations	2,257	2,257	2,257	2,257	2,257	2,257
Country Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes

Panel 2. Median Impact on future GDP growth (in percentage points)

Variables	(1) h=2	(2) h=4	(3) h=6	(4) h=8	(5) h=10	(6) h=12
FCI	-0.935***	-0.928***	-0.189	0.130	0.097	0.120
	(0.096)	(0.144)	(0.119)	(0.128)	(0.122)	(0.125)
Change in HH Leverage	0.104	0.061	-0.002	-0.144	-0.389	-0.553**
	(0.158)	(0.132)	(0.099)	(0.177)	(0.241)	(0.262)
Change in NFC Leverage	-0.246***	-0.491***	-0.496***	-0.373***	-0.262***	-0.191***
	(0.089)	(0.080)	(0.095)	(0.119)	(0.100)	(0.063)
Observations	2,257	2,257	2,257	2,257	2,257	2,257
Country Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes

Sources: International Institute of Finance; and authors' calculations.

Notes: Standard errors in parentheses. *, **, *** indicate significance at the 0.1, 0.05, 0.01 levels, respectively. The table shows the 10th percentile (Panel 1) and median (Panel 2) impact of a one-standard-deviation easing in financial conditions, one percentage point increase in household leverage, one percentage point increase in nonfinancial corporate leverage, respectively, on future year-on-year real GDP growth. The table reports future quarters where h is equal to 2, 4, 6, 8, 10, and 12. The control variables in all regressions include year-on-year real GDP growth, inflation, policy rate change (all one-period lagged), and country fixed effects.

Table 4. Macroprudential Tightening and Change in Leverage: Linear Regression Results

Panel 1: Nonfinancial Corporate Leverage and Macroprudential Policy, All Economies

Macroprudential Policy	Capital	Liquidity	Borrower-based	Credit Measure	FX Measure	Sum17	Capital	Liquidity	Borrower-based	Credit Measure	FX Measure	Sum17
(horizon: h)	h=8						h=12					
	-0.563	-0.825*	1.254	2.547*	-0.363	-0.145	-0.718	-1.172*	2.110*	3.432***	-2.242**	-0.162
	(0.394)	(0.483)	(1.155)	(1.436)	(0.592)	(0.306)	(0.507)	(0.661)	(1.164)	(1.288)	(1.042)	(0.335)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R^2	0.100	0.101	0.101	0.101	0.099	0.099	0.115	0.116	0.117	0.116	0.115	0.114
Observations	2557	2557	2557	2557	2557	2557	2441	2441	2441	2441	2441	2441
Fixed effects	Country, Time	Country, Time	Country, Time	Country, Time	Country, Time	Country, Time	Country, Time	Country, Time	Country, Time	Country, Time	Country, Time	Country, Time

Panel 2: Household Leverage and Macroprudential Policy, All Economies

Macroprudential Policy	Capital	Liquidity	Borrower-based	Credit Measure	FX Measure	Sum 17	Capital	Liquidity	Borrower-based	Credit Measure	FX Measure	Sum 17
(horizon: h)	h=8						h=12					
	-0.049	-0.146	-0.637**	0.276	-0.235	-0.128	-0.078	-0.133	-0.680**	0.190	-0.522*	-0.146
	(0.213)	(0.215)	(0.312)	(0.560)	(0.180)	(0.117)	(0.326)	(0.276)	(0.453)	(0.649)	(0.295)	(0.170)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R^2	0.028	0.028	0.030	0.028	0.028	0.028	0.046	0.046	0.047	0.046	0.046	0.046
Observations	2557	2557	2557	2557	2557	2557	2441	2441	2441	2441	2441	2441
Fixed effects	Country, Time	Country, Time	Country, Time	Country, Time	Country, Time	Country, Time	Country, Time	Country, Time	Country, Time	Country, Time	Country, Time	Country, Time

Source: Authors' estimates.

Notes: Standard errors in parentheses are calculated according to the Driscoll-Kraay (1998) approach. *, **, *** indicate significance at the 0.1, 0.05, 0.01 levels, respectively. The table shows the association between a one-unit net tightening in the respective category of macroprudential measures and the subsequent change in the debt-to-GDP ratio of the household (Panel 1) and nonfinancial corporate (Panel 2) sectors for horizons of 8 and 12 quarters. The control variables in all regressions include a one-quarter change in the sector-specific debt-to-GDP ratio, GDP growth, Financial Conditions Index, inflation, and policy rate change (all one-period lagged). A dummy variable for the global financial crisis represents time fixed effects.

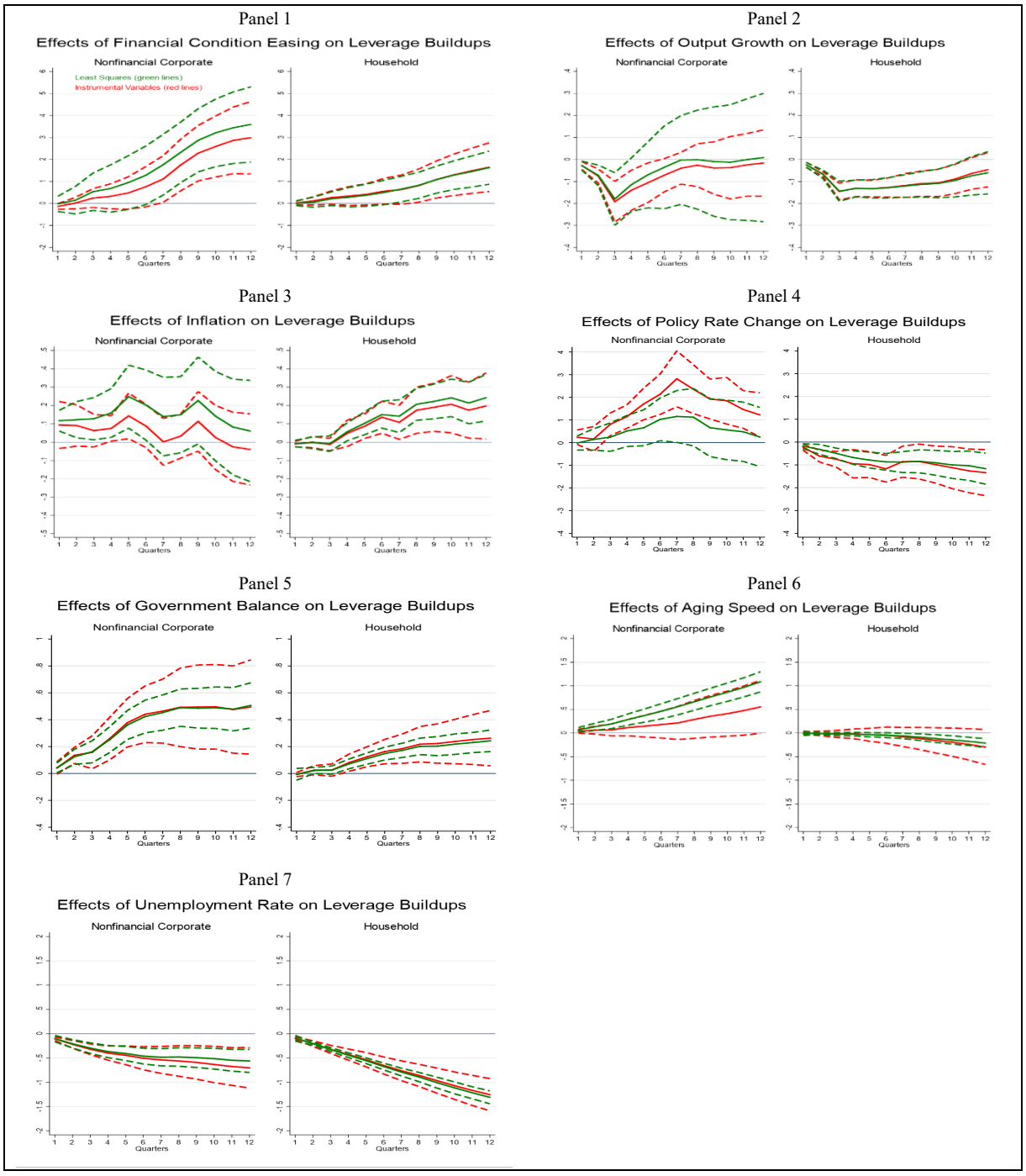
APPENDIX

This appendix summarizes the estimated impact on leverage buildup (based on equation 1a) of key drivers, additional country-specific controls, and alternative measures of financial conditions to support the robustness of the key findings.

First, focusing on the AE sample, an increase in unemployment rates lowers leverage for corporates and more strongly for households (Figure A1, Panel 7). This could reflect that unemployment increases household default risk (e.g., Gross and others, forthcoming) which lowers borrowing capacity, and reduces corporate demand for financing labor inputs as implied by the so-called working capital channel (e.g., Christiano and others, 2011). Second, the government balance has a positive effect on leverage because tighter fiscal policy reduces disposable income and savings and thus increases financing needs in the private sector; the positive effect is significant in the near and medium terms (after a lag) for firms (households), as seen Figures A1 and A2, Panel 5. Last, aging speed—measured as the future-40-quarter change in the ratio of elderly population (65 years and above) to population between 15 and 64 years (using the data of UN World Population Prospects)—increases somewhat leverage buildups for firms but not for households (Figures A1 and A2, Panel 6).[33]

[33] A more rapid aging would have an ambiguous effect on leverage. Firms may increase foreign (rather than domestic) investment as domestic returns on capital declines with reducing labor inputs (see, e.g., IMF 2019). With rises in life expectancy, households increase not only their savings for lifetime consumption smoothing but also possibly financial liabilities against assets (primarily houses, which are illiquid) to alleviate the impact of declining income on their liquidity position, rendering the net effect on leverage ambiguous.

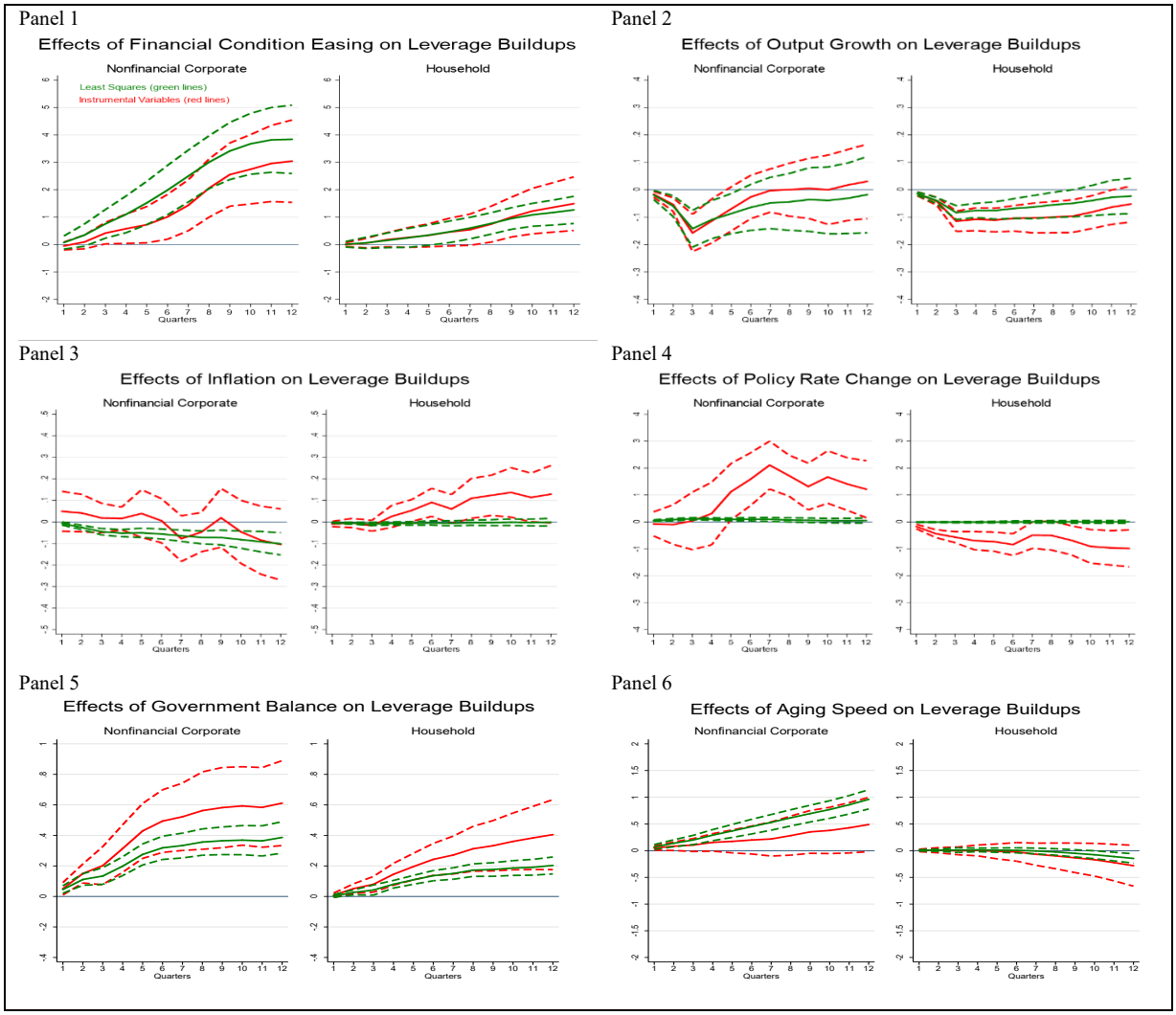
Figure A1. Effects of Key Variables on Leverage Buildups: 19 Advanced Economies



Source: Authors' calculations.

Notes: (a) Panel regressions with country-fixed effects are estimated for 1996:Q1-20:Q4. The dependent variable is the cumulative h-quarter-ahead change in the nonfinancial corporate or household debt-to-GDP ratio over horizons of 1–12 quarters. The shock is scaled as a one-unit decrease in the Financial Conditions Index (FCI) to reflect the effect of financial condition easing. (b) The estimated responses based on panel least square (instrumental variable, IV) regressions are depicted by green (red) lines, along with 90% confidence intervals based on the Driscoll-Kraay (robust) standard errors in the same color. (c) Regressors in Panels 1-4 comprise one-period-lagged variables of the core covariates (FCI, output growth, inflation, and policy rate change) as well as lagged one-quarter change in the sector-specific debt-to-GDP ratio; and in addition to these regressors, Panels 5-7 include one-period-lagged variables of the core covariates, unemployment rate, government balance, and the current value of aging speed. (d) To control for the possible endogeneity of policy rate change, IV regressions include two lags of commodity price inflation, policy rate change, 2-year government bond yield change, and 10-year government bond yield change purged by 2-year bond yield change in addition to the regressors.

Figure A2. Effects of Key Variables on Leverage Buildups: All Economies



Source: Authors' calculations.

Notes: (a) Panel regressions with country-fixed effects are estimated for all economies (19 AEs and 10 EMs) for 1996:Q1-20:Q4. The dependent variable is the cumulative h-quarter-ahead change in the nonfinancial corporate or household debt-to-GDP ratio over horizons of 1–12 quarters. The shock is scaled as a one-unit decrease in the Financial Conditions Index (FCI) to reflect the effect of financial condition easing. (b) The estimated responses based on panel least square (instrumental variable, IV) regressions are depicted by green (red) lines, along with 90% confidence intervals based on the Driscoll-Kraay (robust) standard errors in the same color. (c) Regressors in Panels 1-4 comprise one-period-lagged variables of the core covariates (FCI, output growth, inflation, and policy rate change) as well as lagged one-quarter change in the sector-specific debt-to-GDP ratio; and in addition to these regressors, Panels 5-6 include one-period-lagged variables of the core covariates and government balance, and the current value of aging speed. (d) To control for the possible endogeneity of policy rate change, IV regressions include two lags of commodity price inflation, policy rate change, 2-year government bond yield change, and 10-year government bond yield change purged by 2-year bond yield change in addition to the regressors.

We also investigate to what extent alternative measures of financial conditions yield different results using equation (1a). As reported in Table A1, the estimated results overall suggest that domestic financial conditions outweigh alternative measures in explaining the dynamics of private nonfinancial sector leverage. First, purging financial conditions from domestic macroeconomic factors delivers qualitatively similar results compared with our original results. Second, global measures of financial conditions, calculated as in IMF (2018a), are not significantly related to household leverage—either when included alone or in conjunction with domestic measures of financial conditions. Last, the VIX, commonly used as a proxy for global financial conditions in the literature, is significantly related to leverage buildups in the nonfinancial corporate sector but not in the household sector.

Table A1. Financial Conditions and Change in Leverage:
Alternative Financial Conditions Measures

Panel 1. Nonfinancial Corporate Leverage and Alternative Measures of Financial Conditions, All Economies

Financial Conditions										
(horizon:h)	h=8					h=12				
FCI	3.006***				3.428***	3.840***				4.320***
	(0.586)				(0.550)	(0.758)				(0.663)
Purged FCI		2.783***					3.725***			
		(0.620)					(0.732)			
Global FCI			0.783		-0.582			1.075		-0.653
			(0.521)		(0.485)			(0.765)		(0.734)
VIX				0.143**					0.218**	
				(0.061)					(0.089)	
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R^2	0.080	0.062	0.024	0.032	0.083	0.096	0.08	0.032	0.049	0.099
Country Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Panel 2. Household Leverage and Alternative Measures of Financial Conditions, All Economies

Financial Conditions										
(horizon:h)	h=8					h=12				
FCI	0.769***				0.887***	1.265***				1.196***
	(0.237)				(0.175)	(0.223)				(0.337)
Purged FCI		0.892***					1.376***			
		(0.261)					(0.334)			
Global FCI			0.186		-0.161			0.563*		0.093
			(0.233)		(0.244)			(0.296)		(0.335)
VIX				-0.020					0.002	
				(0.025)					(0.032)	
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R^2	0.133	0.135	0.118	0.118	0.134	0.133	0.133	0.117	0.107	0.133
Country Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Source: Authors' estimates.

Notes: Standard errors in parentheses are calculated according to the Driscoll-Kraay (1998) approach. *, **, *** indicate significance at the 0.1, 0.05, 0.01 levels, respectively. The table shows the association between a one-standard-deviation loosening in financial conditions and the subsequent change in the debt-to-GDP ratio of the household (Panel 1) and nonfinancial corporate (Panel 2) sectors for horizons of 8 and 12 quarters, using different proxies for financial conditions. The control variables in all regressions include a one-quarter change in the sector-specific debt-to-GDP ratio, GDP growth, inflation, and policy rate change (all one-period lagged).