Lending standards and output growth

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Abstract

What drives macro-financial vulnerabilities? Inspired by Minsky-Kindleberger narratives, one prominent view emphasizes that lending standards repeatedly deteriorate in good times, creating exposure to widespread reassessments of risk. Another emphasizes that leverage amplifies negative shocks. This paper constructs panel data on lending standards and uses it to show that Minsky-Kindleberger dynamics interact with leverage. Standards erode with improving economic performance, but do not always co-move with aggregate leverage. The combination of deteriorating standards and leverage—above and beyond leverage alone—signals poor subsequent macroeconomic performance. Inconsistent with models incorporating rational expectations, this poor subsequent performance is systematically reflected in forecast errors.

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1 Introduction

> "Current views about financing ... reflect the past and, in particular, the recent past. A history of success will tend to diminish the margin of safety that business and bankers require ... [while] a history of failure will do the opposite." — Minsky (1986)

What drives macro-financial vulnerabilities? One prominent view, inspired by the narratives of Minsky (1986) and Kindleberger (1978), emphasizes that lending standards repeatedly erode in good times, only to be followed by unexpected reversals in risk appetite that trigger painful adjustments. Indeed, López-Salido, Stein & Zakrajšek (2017) find that aggressive risk taking by credit investors in quiescent periods forecasts not only low returns for these investors (Greenwood & Hanson 2013, Baron & Xiong 2017), but poor macroeconomic outcomes as well. Moreover, market participants underestimate future credit risk when credit spreads are low (Bordalo, Gennaioli & Shleifer 2018).

Another prominent line of work, building on seminal work by Bernanke & Gertler (1989) and Kiyotaki & Moore (1997), highlights that leverage amplifies negative shocks, with financial frictions leaving borrowers no alternative but to deleverage. Initial shocks need not be large to matter at a macroeconomic level as the resulting impact can be highly non-linear (Brunnermeier & Sannikov 2014). Theoretical work in this area typically assumes expectations are rational and points to externalities to explain why economic agents use excessive leverage despite understanding the risks involved (Shleifer & Vishny 1992, Lorenzoni 2008, Stein 2012). Motivated by this set of theories, a large body of empirical work flags the risks associated with high credit growth (Jordà, Schularick & Taylor 2011, Schularick & Taylor 2012, Jordà, Schularick & Taylor 2013, Jordà, Schularick & Taylor 2017, Mian, Sufi & Verner 2017, Bordo, Eichengreen, Klingebiel & Martinez-Peria 2001).

Prior work has largely examined these two explanations in isolation. This paper shows that their interaction is important. The combination of deteriorating lending standards and leverage tends to be followed by poor macroeconomic performance. Departures from rational expectations have some role to play: this poor performance is systematically reflected in forecast errors.

To make this analysis possible, I construct panel data on a quantity-based measure of lending standards, the high-yield (HY) share of issuance, for 38 countries.[1] The cross-country coverage this data-collection effort provides is important, as strong credit growth is a low frequency phenomenon (López-Salido et al. 2017). Time series for individual countries begin in the 1980s in many cases. In line with Minsky-Kindleberger narratives, lending standards worsen in good times—when short-term macroeconomic performance unexpectedly improves—and subsequently mean revert. While lending standards are closely tied to contemporaneous economic performance, they do not systematically co-move with aggregate leverage.[2] In other words, there is room for the interaction between lending standards and leverage to matter, both conceptually and empirically.

The combination of eroding lending standards and leverage is followed by poor subsequent medium-term macroeconomic outcomes. Economic growth is persistently lower, investment contracts even relative to slowing overall output, unemployment rises, and economy-wide financial distress is more likely. The associated economic magnitudes are large. Following strong credit growth (a 30 percent increase in credit scaled by GDP over a five-year period), economic growth in the subsequent three years is roughly 110 basis points a year slower; if this increase in leverage is accompanied by a marked deterioration in lending standards (a two standard deviation increase in the HY share), growth over the subsequent three years slips by a further 80 basis points per year. Following strong credit growth alone, unemployment rises by about 1.3 percentage points; if lending standards also deteriorate sharply, unemployment rises by an additional 0.6 percentage points. Deteriorating standards alone are not followed by worse economic performance.

While the interaction between leverage and lending standards has not been emphasized in models focused on either individually, it is natural to expect this interaction to matter. Leverage amplifies the effect of negative shocks on borrowers' financial health. In leverage-based models, even if debt limit schedules—driven by financial frictions—tied to financial health remain fixed,

[1]Evidence from loan officer surveys and dispersion in credit spreads helps validate this measure of lending standards (see Section 2). Showing that measures drawing on capital markets can help capture lending standards, even when these capital markets are somewhat small, is a contribution of this paper.

[2]The lack of systematic co-movement between lending standards and leverage is consistent with the possibility that some, but not all, credit booms are driven by improving fundamentals (Gorton & Ordonez 2020, Gertler, Kiyotaki & Prestipino 2020).

borrowers must deleverage as financial health deteriorates. Minsky-Kindleberger dynamics in lending standards can be interpreted as temporary outward shifts in debt limit schedules in good times. Subsequent reversals in risk appetite then tighten debt limit schedules.[3] The joint presence of aggregate leverage and worsening standards raises the possibility that tightening debt limit schedules bind sharply for many borrowers, triggering particularly steep deleveraging. Relatedly, Baron, Verner & Xiong (forthcoming) argue that panics amplify the impact of distress in the financial sector. Indeed, I find that poor subsequent performance follows the combination of leverage and reversals in the HY share.

Both behavioral and rational models can generate erosion in credit standards in good times. Behavioral explanations point to partially self-fulfilling over-extrapolation that can endogenously reverse and amplify externalities (Bordalo et al. 2018, Greenwood et al. 2019, Farhi & Werning 2020).[4] Diamond, Hu & Rajan (2020) present a model with rational expectations in which high anticipated liquidity dims incentives to maintain standards.[5] The key testable difference between these theories relates to expectations: in behavioral models risk taking is driven by unrealistically optimistic views about the future; in rational models risk taking occurs despite accurate anticipation of potential downside scenarios.

The poor subsequent macroeconomic performance that follows when standards erode together with rising leverage is unexpected for forecasters. It is not anticipated in medium-term real GDP growth forecasts and appears in forecast errors instead. The systematic forecast errors I document are not consistent with fully rational expectations.[6] Behavioral dynamics seem to play at least some role in driving macro-financial cycles.

While there is little prior work on the interaction between Minsky-Kindleberger dynamics

[3]This discussion emphasizes credit supply. Sentiment in credit demand (Minsky 1986, Greenwood, Hanson & Jin 2019, Ivashina & Vallee 2020, Gennaioli, Ma & Shleifer 2016) could increase the likelihood that even expanded debt limits are exhausted, adding further amplification.

[4]Another class of behavioral models emphasizes belief heterogeneity (Geanakoplos 2010, Simsek 2013).

[5]See Bhattacharya, Goodhart, Tsomocos & Vardoulakis (2015), Martin & Ventura (2011), Farboodi & Kondor (2020), and Fishman, Parker, & Straub (2020) for other examples of rational models.

[6]Related work documents errors in lenders' expectations (Greenwood & Hanson 2013, Fahlenbrach & Stulz 2011, Cheng, Raina & Xiong 2014, Baron & Xiong 2017, Murfin & Pratt 2018, Richter & Zimmermann 2019) as well as over-extrapolation more broadly (Greenwood & Shleifer 2014, Coibion & Gorodnichenko 2015, Gennaioli et al. 2016, Bordalo, Gennaioli, Ma & Shleifer 2020).

and leverage, Krishnamurthy & Muir (2017) and Greenwood, Hanson, Shleifer & Sørensen (2020) present important exceptions with complementary findings. These authors show that the combination of leverage and various prices helps predict the incidence and severity of financial crises and also point to the relevance of behavioral dynamics.[7] Credit spreads seem to be too low prior to crises (Krishnamurthy & Muir 2017). The strong predictability of crises (Greenwood et al. 2020) makes it difficult to believe they are accurately anticipated by market participants. A key contribution of this paper is to directly tie the combination of eroding standards and leverage to systematic errors in macroeconomic forecasts, cleanly demonstrating departures from rational expectations. This requires working with outcomes for which expectations are available, like GDP growth. Focusing on more continuous outcomes also helps capture the role of Minsky-Kindleberger dynamics in driving "garden variety recessions" (Stein 2019).

Next, Sections 2 and 3 summarize the data and empirical methodology. Section 4 turns to the empirical results. Section 5 concludes with a discussion of implications for policy.

2 Data and HY share

I draw on three main sources of data: (i) bond-level data on issuance from Dealogic from 1980-2018, (ii) data on credit to GDP ratios from the BIS, and (iii) macroeconomic data, including realized real GDP growth, investment to GDP ratios, and unemployment rates as well as historical real GDP growth forecasts from the IMF World Economic Outlook (WEO) database. Both short- and medium-term real GDP growth forecasts are available, permitting construction of forecast errors at different horizons.

I construct a panel of 38 countries with sufficient bond issuance and data on aggregate credit. I associate issuers with countries based on their reported country of operations. I exclude financial issuers, money-market instruments, and floating-rate bonds.[8] After filters, the sample consists of

[7]Prior work has examined the role of prices in isolation (Mishkin 1990, Friedman & Kuttner 1992, Bordo & Haubrich 2010, Gilchrist & Zakrajšek 2012). One strand of this literature builds financial condition indices—that can capture behavioral shifts in risk appetite—but does not focus on leverage (Stock & Watson 2003, Hatzius, Hooper, Mishkin, Schoenholtz & Watson 2010, Adrian, Boyarchenko & Giannone 2019).

[8]I include non-financial corporate and government bond issuance. I exclude countries with more than five years

134,000 bond issues. Dealogic reports whether these are rated as investment grade or high yield at issuance. France and the US enter the panel in 1980; coverage begins by 1985 for 17 countries.[9]

The HY share is the fraction of proceeds from high-yield issues in each country-year, in percentage points. Intuitively, when the HY share rises, lenders are willing to allocate a larger share of credit to less credit-worthy borrowers, suggested that lending standards have loosened.

The HY share seems to capture lending standards at large even when bond markets are relatively small. While surveys of senior bank loan officers may seem to be a natural source of information on lending standards (Favilukis, Kohn, Ludvigson & Van Nieuwerburgh 2012, Bassett, Chosak, Driscoll & Zakrajšek 2014), they are available only for a third of the countries in my sample, and generally begin in the early 2000s. In principle, banks may become more cautious even when bond market investors' risk appetite increases. However, when the HY share and loan officer surveys are available together, they move in line with each other: the HY share tends to be falling when loan officers report tightening standards.[10]

Quantity-based measures of lending standards are valuable in part because the mapping between standards and prices is complex. Movements in spreads reflect a combination of changes at the intensive and extensive margins. As standards worsen, lenders may begin to lend to borrowers previously viewed as too risky even as spreads compress for risky borrowers previously able to access credit. Indeed, dispersion in yields observed in equilibrium increases when the HY share rises together with credit growth, consistent with the entry of riskier borrowers as standards deteriorate.[11]

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in which no bonds were issued after the first year of reported issuance. I require at least ten years with at least ten issues and at least one non-financial corporate issue, starting the sample in the first such year.

[9] See Appendix Figure A.1 and Appendix Table A.1 for further details on sample coverage.

[10] The average correlation for the 14 countries where both the HY share and loan officer surveys are available, scaled to be positive, is about 0.3. See Appendix Figure A.2 and Appendix Tables A.2 and A.3.

[11] See Appendix Table A.4.

3 Empirical methodology

This paper seeks to examine the interaction between leverage and lending standards. As credit evolves slowly (López-Salido et al. 2017, Borio 2014), a single time series will contain few episodes of rapid credit growth. Pooling time-series data across countries is therefore important, even though establishing causality when working with cross-country panel data is challenging.

My baseline regressions control for cross-country differences with country fixed effects but fully utilize time-series variation. Driscoll & Kraay (1998) standard errors correct for time-series and cross-country dependence in errors. I focus on medium-term changes in quantities of interest. Changes over the last k years are denoted $\Delta x_{it,t-k}$ (average changes are denoted $\Delta \bar{x}_{it,t-k}$). Forecasts made at year t are denoted $\hat{x}^t$.

I use the following regression structure to study subsequent macroeconomic performance following the combination of growing leverage and deteriorating lending standards:

$$\begin{aligned}\Delta x_{it+h,t} =& \alpha_i + \beta \, \Delta ln \, Credit/GDP_{it,t-5} + \gamma \, \Delta \overline{HY}_{it,t-5} \\ &+ \delta \, \Delta ln \, Credit/GDP_{it,t-5} \times \Delta \overline{HY}_{it,t-5} + \epsilon_{i,t+h} \qquad (1)\end{aligned}$$

All baseline specifications include country fixed effects (α_i). Credit to GDP ratios and the HY share are winsorized at the 5th and 95th percentiles within country. I control for two lags of real GDP growth (not shown in Equation 1). To capture potential non-linearities associated with sharp increases in leverage, in some specifications I include squared credit growth and its interaction with the change in the HY share (also not shown in Equation 1). Dependent variables include real GDP growth ($\Delta ln \, y_{t+h,t}$), forecasted real GDP growth ($\Delta ln \, \hat{y}^t_{t+h,t}$), forecast errors, the investment to GDP ratio, and the unemployment rate. Varying the horizon h across specifications allows me to construct Jordà (2005) local-projection impulse responses.

4 Empirical results

4.1 Dynamics of HY share

I begin by examining whether the dynamics of lending standards, as measured by the HY share, are consistent with the narratives of Minsky and Kindleberger. For example, Minsky (1986) argues that a "history of success will tend to diminish the margin of safety" while "a history of failure will do the opposite." Table 1 presents regressions where the dependent variable is the average change in the HY share over the previous five years. These regressions show the relationship between the HY share and macroeconomic performance over these five years, while controlling for credit to GDP growth and country fixed effects.

Lending standards do tend to worsen in good times—when macroeconomic performance is improving.[12] The first specification in Table 1 shows that the HY share tends to be rising when GDP growth is consistently picking up. To be more precise, the HY share rises with sequences of surprising improvements in economic performance: the second specification shows that stronger improvements in realized short-term economic performance than forecasted are strongly related to increases in the HY share.[13] In contrast, the third specification shows that changes in forecasts alone are not systematically related to changes in the HY share.

While these dynamics are broadly consistent with (over) extrapolation, they are not consistent with pure extrapolation, as lending standards appear to move with surprising improvements in performance rather than all improvements in performance. Both behavioral models of expectations that partially update in response to news (Bordalo et al. 2018, Greenwood et al. 2019) as well as learning-based models with fully rational updating (Bhattacharya et al. 2015) could generate responsiveness to surprise improvements in contemporaneous economic performance. Recent

[12] This analysis focuses on levels of realized outcomes. Danielsson, Valenzuela & Zer (2018) show that sustained periods of low equity market volatility are more likely to be followed by excess credit growth and financial crises.

[13] Greenwood & Hanson (2013) and Greenwood et al. (2019) argue that lender risk appetite shifts with realized performance in financial markets, whereas I focus on macroeconomic performance. Two interpretations are consistent with the evidence in Table 1: first, macroeconomic performance drives risk appetite because it affects outcomes in credit markets such as defaults; and second, macroeconomic performance is in itself an important determinant of lender expectations.

work on behavioral expectations emphasizes the role of errors in updates to forecasts (Coibion & Gorodnichenko 2015, Bordalo et al. 2020).

4.2 Room for interaction between lending standards and leverage

Next, I examine whether there is room for the interaction between lending standards and leverage to matter for subsequent economic performance and to empirically assess this interaction. Conceptually, it is possible that lending standards and overall credit growth largely move in lock step (Bordalo et al. 2018, Farhi & Werning 2020, Diamond et al. 2020, Bhattacharya et al. 2015). If this were the case, the impact of the interaction between lending standards and leverage would be harder to assess empirically. It is also possible that lending standards and aggregate leverage do not move in tandem, for example because some episodes of credit growth are driven by large improvements in fundamentals that increase debt-bearing capacity (Gorton & Ordonez 2020, Gertler et al. 2020).

Empirically, co-movement between the HY share and overall leverage growth is low; there is room for their interaction to matter and to be examined. Panel A of Figure 1 shows observations in the panel split by whether changes in the HY share are above or below median, within quintiles of credit growth. There is little connection between medium-term changes in the HY share and credit to GDP ratios.[14]

4.3 Interaction between lending standards and leverage

The interaction between lending standards and leverage seems to be an important driver of macro-financial vulnerabilities. Panel B of Figure 1 shows how the relationship between leverage and subsequent economic performance varies based on the evolution of lending standards. The relationship between subsequent performance and leverage is visibly more negative when lending standards have loosened. Like Panel A, Panel B splits the data by whether changes in the HY share are above or below median within quintiles of credit to GDP growth.

[14]See Appendix Figure A.3 for a summary of time-series variation in the panel.

Table 2 presents the main results of the paper, using panel regressions to assess the relationship between the interaction of lending standards and leverage and subsequent macroeconomic performance. Dependent variables relate to subsequent cumulative real GDP growth over the subsequent three years, in percentage points. The first five specifications focus on realized subsequent GDP growth. The final two specifications turn to forecasted subsequent GDP growth and forecast errors. An increase of one unit in credit to GDP corresponds to a 10 percent increase, while an average change of one unit in the HY share corresponds to a one standard deviation move. Country fixed effects and two lags of real GDP growth are included as controls. Year fixed effects, which would not be available for a single time series, are excluded. I discuss the robustness of these results to different methodological choices below.

Begin with realized subsequent GDP growth. Rising leverage over the previous five years tends to be followed by slower GDP growth over the subsequent three years—seen across all specifications in Table 2. This is consistent with the theoretical literature emphasizing that leverage amplifies shocks and the large associated empirical literature flagging the risks associated with strong credit growth relative to GDP. In contrast, deterioration in lending standards alone is not associated with meaningful changes in subsequent GDP growth—seen in the second and subsequent specifications. Reversals in risk appetite may be less costly when debt limits are less binding. The fourth specification shows that the combination of leverage and eroding standards is followed by slower subsequent GDP growth. The fifth specification includes the change in credit to GDP squared and its interaction with lending standards to capture potential non-linearities associated with strong credit growth. The combination of worsening lending standards and sharp increases in leverage is followed by particularly slow subsequent economic growth.

Figure 2 shows that the associated economic magnitudes are large. Panel A shows that strong leverage growth alone is followed by significantly slower GDP growth. Relative to little credit to GDP growth, if credit to GDP grows by 30 percent over a period of five years, realized cumulative GDP growth over the next three years is 3.3 percentage points lower—110 basis points a year. If in addition lending standards deteriorate sharply, by two standard deviations, cumulative GDP growth over the next three years is an additional 2.4 percentage points lower—80 basis points a year. The combination of worsening standards and strong credit growth therefore adds meaningful economic impact, at a comparable scale to the effect of leverage alone.

The economic impact is both large and persistent. Panel B of Figure 2 shows impulse responses based on versions of the fifth specification in Table 2 repeated for cumulative GDP growth at different horizons. Given small changes in leverage, increases in the HY share are not associated with slower subsequent economic growth. Given strong growth in leverage, however, deterioration in the HY share is followed by growing economic impact with little sign of reversal even five years later. This evidence shows that the interaction between lending standards and leverage is an important component of macro-financial dynamics.

Leverage alone brings risks, as it amplifies the impact of shocks. In leverage-based models, financial frictions generate debt limit schedules tied to measures of borrowers' financial health such as net worth. Following a negative shock, deleveraging is required: as borrowers' financial health worsens, debt limits that apply in equilibrium fall, even if debt limit schedules stay fixed. The same shock will result in larger impact as leverage rises: the impact on borrowers' financial health is amplified further, and initial debt limits are more likely to be binding. The large body of theoretical work following Bernanke & Gertler (1989) and Kiyotaki & Moore (1997) shows that these dynamics can have significant macroeconomic impact.

The combination of leverage and worsening standards raises exposure to a sharply binding reversal in risk appetite. It is natural to interpret shifts in lending standards as temporary movements in lenders' willingness to supply credit to risky borrowers. Outward expansions in debt limit schedules—increases in debt limits at all levels of borrower financial health—are one way to conceptualize such shifts.[15] Subsequent negative shocks then not only hamper borrowers' financial health, but simultaneously trigger a contraction in debt limit schedules. When leverage has risen enough for pre-shock debt limits to bind, holding the size of the shock and leverage fixed, contracting debt limit schedules can precipitate much steeper deleveraging. Contractions in debt

[15] Changes in borrowers' willingness to demand risky credit may mean that even these expanded debt limits bind.

limit schedules in response to seemingly minor news—“Minsky moments”—may even be the trigger for many shocks (Eggertsson & Krugman 2012, Borio 2014, López-Salido et al. 2017, Bordalo et al. 2018, Stein 2019, Greenwood et al. 2020).

Both rational and behavioral models can explain why lending standards deteriorate in good times, although these models typically do not incorporate an interaction with leverage. Rational models illustrate a variety of important mechanisms that can drive excessive risk taking in credit markets even when the risks involved are correctly anticipated. To take some examples, Diamond et al. (2020) present a framework in which high future expected liquidity dims incentives to maintain standards that would preserve resale values in the event of fire sales, Bhattacharya et al. (2015) argue that lenders may not account for externalities associated with simultaneous tightening of debt limit schedules for all borrowers, Farboodi & Kondor (2020) and Fishman et al. (2020) emphasize that individual lenders' choices of lending standards affect the pool of borrowers—and hence the value of screening—for all lenders, and Martin & Ventura (2011) show that rational bubbles could temporarily inflate borrower net worth and raise debt limits.

In behavioral models, in contrast, failures to anticipate poor future outcomes drive excessive risk taking (Bordalo et al. 2018, Greenwood et al. 2019, Farhi & Werning 2020). While the repeated arrival of poor subsequent economic performance is suggestive of the role for behavioral explanations (Greenwood et al. 2020), the key testable difference between these classes of explanations lies in their predictions for forecasts.

The poor subsequent economic performance that follows the combination of deteriorating lending standards and rising leverage is not expected by forecasters, suggesting at least some role for behavioral explanations for why this interaction matters. The sixth and seventh specifications of Table 2 show regressions where the dependent variables are forecasted cumulative subsequent real GDP growth over the next three years and forecast errors relative to realized subsequent GDP growth, respectively. Subsequent GDP growth is a helpful indicator of macroeconomic performance to work with—unlike other indicators discussed below, forecasts, not just realized outcomes, are available. Forecasts do not capture the poor subsequent performance associated with the interaction between leverage and eroding standards (interaction terms in the sixth specification)—instead, this poor performance is systematically reflected in forecast errors (interaction terms in the seventh specification). These systematic forecast errors are not consistent with fully rational expectations.

These results are robust to a variety of changes to the empirical methodology. I briefly summarize five robustness exercises that leave the results broadly unchanged. First, the HY share can be calculated at a global level rather than a country-specific level, addressing concerns that bond markets in some countries in the panel are small. Second, credit to the corporate sector can be used instead of aggregate credit, while controlling for household credit growth and its interaction with the HY share. The results here seem to apply more to corporate credit, possibly because the HY share better captures lending standards for this segment of credit. Third, year fixed effects can be included. While fully assessing the role of monetary policy is not in the scope of this paper, year fixed effects do absorb variation in monetary policy common across countries, including shifts in US monetary policy. More broadly, year fixed effects absorb any global moves in risk appetite. Fourth, a backward-looking binary definition of credit booms can be used in place of squared credit to GDP growth to capture non-linearities associated with strong credit growth. Fifth, percentage point changes in credit to GDP can be used rather than percent changes, putting greater weight on changes from higher initial starting levels than in the baseline.[16]

4.4 Additional results

This section discusses the role of temporary expansions and subsequent reversals in risk appetite, the impact of macro-financial cycles on investment and unemployment, and the role of debt in raising the risk of financial distress. Table 3 presents these results.

An important element of Minsky-Kindleberger narratives regarding lending standards is that erosion in lending standards in good times is temporary. This leads to exposure to reversals in lending standards that trigger painful adjustments. The first specification of Table 3 shows that the HY share does tend to mean revert. The presence of leverage neither strengthens nor

[16] See Appendix Tables A.5-A.10. The results are also robust to winsorizing dependent variables by either country or year.

tempers this mean reversion. With the benefit of hindsight, the interaction between leverage and reversals in the HY share should drive the macroeconomic impact. Consistent with this intuition, the second specification shows that the interaction between reversals in lending standards (the product of the average change in the HY share in the previous five years and the average change in the HY share in the subsequent three years multiplied by -1) and leverage drives the impact on subsequent macroeconomic performance.

The interaction between worsening lending standards and leverage is followed by disproportionate and persistent contractions in investment, suggesting that the subsequent macroeconomic impact is driven by a credit crunch that restrains investment. The third specification in Table 3 uses the change in the investment to GDP ratio over the subsequent three years as the dependent variable. Growing leverage alone is followed by a drop in the investment to GDP ratio (a sizable drop of 1.5 percentage points if credit to GDP rises by 30 percent). While lending standards alone do not relate to subsequent changes in investment, the combination of eroding standards and rising leverage is followed by a steeper drop in the investment to GDP ratio than with leverage alone (an additional 1 percentage point drop if credit standards worsen by two standard deviations).

The widespread poor subsequent economic performance that follows the combination of eroding standards and leverage can also be seen in labor-market outcomes. The fourth specification in Table 3 uses the change in the unemployment rate over the subsequent three years as the dependent variable. Again, growing leverage alone tends to be followed by an increase in unemployment. If credit to GDP rises by 30 percent, the unemployment rate rises by about 1.3 percentage points over the subsequent three years. If in addition lending standards deteriorate sharply, by two standard deviations, the unemployment rate rises by a further 0.6 percentage points.

The dynamics of financial distress help clarify the role of debt in explaining my results. I emphasize that debt finance generates leverage that amplifies negative shocks, increasing the risk of financial distress. Eroding lending standards can be followed by reversals in risk appetite that, in the presence of sufficient leverage, trigger more severe distress. However, an alternative interpretation is that my findings reflect shifts in the cost of debt finance over time, with credit growth simply capturing the importance of debt as a source of external finance. In principle, this alternative interpretation could apply to equity finance as well, when equity is important source of external finance, with no implications for financial distress. Realized financial distress helps distinguish between these interpretations.

The risk of financial distress associated with leverage seems to be an important channel for my findings. The fifth specification of Table 3 uses the change in the Romer & Romer (2017) continuous narrative index of financial distress over the subsequent three years as the dependent variable.[17] Increases in this index reflect increases in perceived risk of financial institutions, loan defaults, and NPLs, among other dimensions of financial distress. If credit to GDP rises by 30 percent, financial distress increases over the subsequent three years by about a third of a standard deviation. If in addition lending standards worsen sharply, by two standard deviations, the severity of financial distress increases by a further three quarters of a standard deviation. Temporary expansions in risk appetite that subsequently reverse seem important in understanding when leverage is followed by financial distress.

This suggests that debt does play a particular role in driving my results. The non-linear interaction between strong credit growth and deteriorating standards (Table 2) also supports this interpretation. Consistent with this, López-Salido et al. (2017) find that measures of credit-market sentiment are more relevant for subsequent macroeconomic performance than measures of sentiment in equity markets. More broadly, prior work finds that credit markets are important for macroeconomic dynamics (Friedman & Kuttner 1992, Gilchrist & Zakrajšek 2012).

5 Conclusion

This paper constructs panel data on lending standards, drawing on activity in primary capital markets, providing coverage across decades and continents. One contribution of the paper is to show that such quantity-based measures can be informative about lending standards even where

[17] Romer & Romer (2017) construct their index for a sample of 24 OECD countries. My sample includes 22 of these countries; Luxembourg and Iceland are not present.

capital markets are relatively small. The dynamics of lending standards are consistent with the narratives of Minsky-Kindleberger: lending standards consistently erode in good times—when macroeconomic performance improves faster than expected—and subsequently mean revert.

When combined with leverage, deteriorating lending standards are followed by poor subsequent economic performance. Economic growth over subsequent years is significantly slower, beyond what might be expected based on leverage alone. Investment contracts even faster than overall output, unemployment rises, and the likelihood of financial distress increases. The joint presence of growing leverage and worsening lending standards is important: eroding standards alone are not followed by poor subsequent economic performance. It is natural to expect this interaction to matter; reversals of risk appetite in credit markets are likely to require larger and more painful adjustments when aggregate leverage has risen, and debt limits are more binding.

While this repeated pattern of poor subsequent outcomes is suggestive of behavioral dynamics, rational models can also generate erosion in lending standards in good times. Evidence from expectations helps separate between these classes of explanations. The poor subsequent performance that follows the combination of eroding standards and leverage is unexpected for forecasters: the resulting systematic forecast errors are not consistent with fully rational expectations.

These findings are relevant for policymakers. While strong credit growth often goes wrong, many episodes of strong credit growth have not been followed by economic underperformance (Dell'Ariccia, Igan, Laeven & Tong 2012). Allowing a credit boom to proceed unchecked may raise risks for future economic performance; restraining it may slow growth in the near term. This paper shows that strong credit growth should be particularly concerning when accompanied by worsening lending standards.

My findings also relate to the broader question of how policymakers should operate in behavioral environments. This paper shows that behavioral shifts in risk appetite are an important component of macro-financial dynamics. Risk taking driven by incorrect expectations can justify a policy response, as over-optimism can strengthen the impact of externalities (Farhi & Werning 2020). The implied task for policy makers is not necessarily more complicated than under the presumption of rationality: estimating output gaps, to take one example, is not straightforward either. On the other hand, forecasting errors appear to be widely shared—indeed, this paper relies on official sector forecasts—suggesting caution is warranted.

One approach to moving forwards is to better understand when behavioral dynamics are relevant at a macroeconomic level: policy actions are more likely to be needed in such contexts. This paper presents shows that behavioral shifts in willingness to take risk in credit markets are relevant for macroeconomic performance, but only when combined with aggregate leverage.

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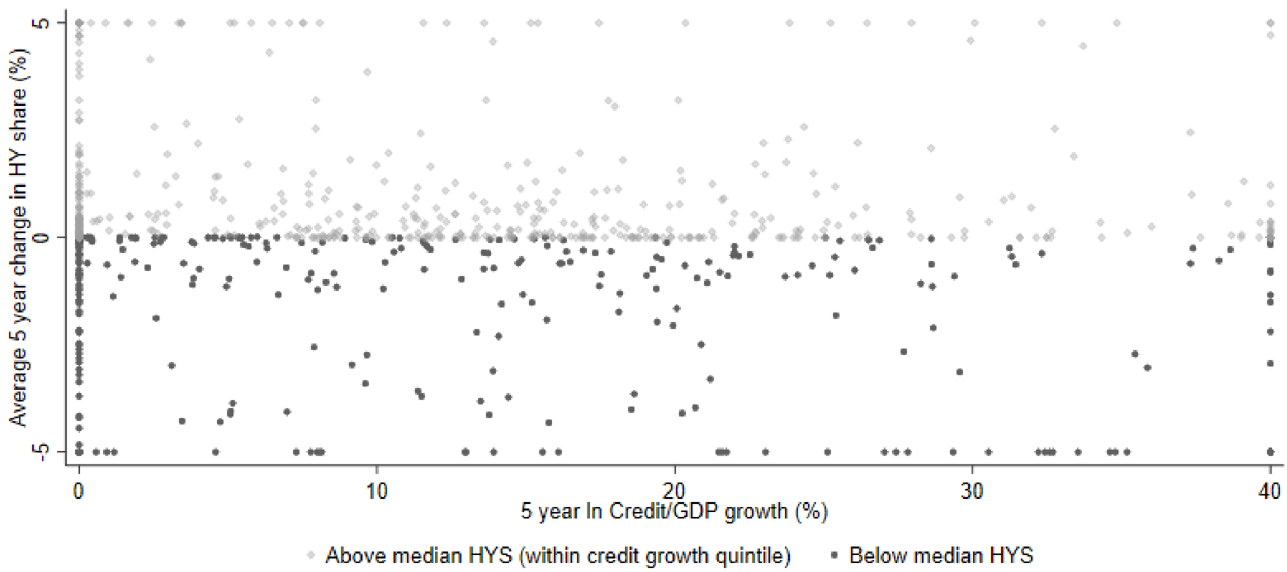
Figure 1: *Credit to GDP growth, HY share, and subsequent GDP growth*

Notes: This figure shows how the HY share, credit to GDP growth, and subsequent GDP growth are jointly distributed. Each point is a country-year observation. Both panels show changes in credit to GDP over the previous five years ($\Delta\, ln\, Credit/GDP_{it,t-5} \times 100$) on the horizontal axis, winsorized below at 0 and above at 40. Panel A shows the average change in the HY share over the previous five years ($\Delta\overline{HY}_{it,t-5}$) in percentage points on the vertical axis, winsorized below at -5 and above at 5. Panel B shows cumulative real GDP growth over the subsequent three years ($\Delta\, ln\, y_{it+3,t} \times 100$) on the vertical axis, winsorized below at 0 and above at 15. In both panels, points with lighter (darker) shading are above (below) median average changes in the HY share within credit growth quintile. Panel B shows linear trend lines separately by whether the change in the HY share is above or below median within credit growth quintile.

Panel A: Credit to GDP growth and change in HY share



Panel B: Credit to GDP growth, change in HY share, and subsequent cumulative 3 year GDP growth

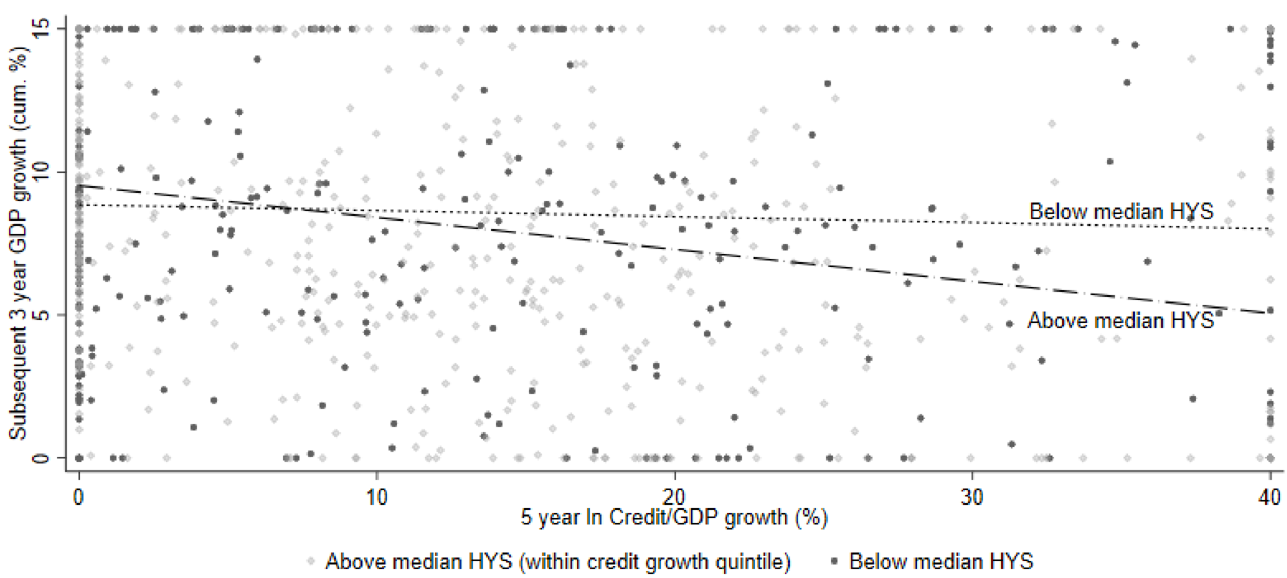
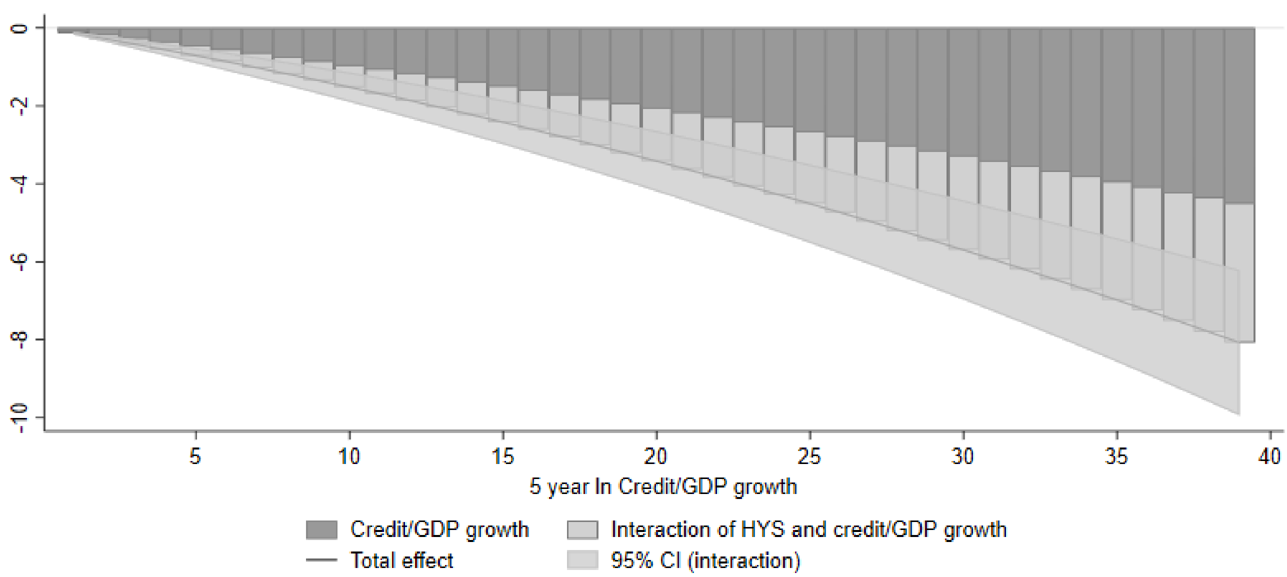


Figure 2: *Magnitude of impact on subsequent economic performance*

Notes: This figure reports magnitudes from specifications similar to the fourth specification in Table 2. Both panels show subsequent cumulative real GDP growth ($\Delta\, ln\, y_{it+h,t} \times 100$) on the vertical axis. Panel A uses a three year horizon and shows changes in credit to GDP over the previous five years ($\Delta\, ln\, Credit/GDP_{it,t-5} \times 100$) on the horizontal axis. Darker shaded bars show the linear and quadratic coefficients for credit to GDP growth. Lighter shaded bars show the additional impact from the linear and quadratic interaction terms between credit to GDP growth and the HY share. Confidence bands (95 percent) are based solely on interaction terms. Panel B shows impulse responses by varying the horizon, shown on the horizontal axis. It shows the sum of the linear and quadratic interaction coefficients given low credit to GDP growth (5 percent over the previous five years) and high credit to GDP growth (30 percent over the previous five years). Both impulse responses also show confidence bands (95 percent). Both panels show coefficients scaled to reflect a two standard deviation move in the HY share.

Panel A: Subsequent cumulative 3 year GDP growth



Panel B: Impulse response for subsequent cumulative GDP growth

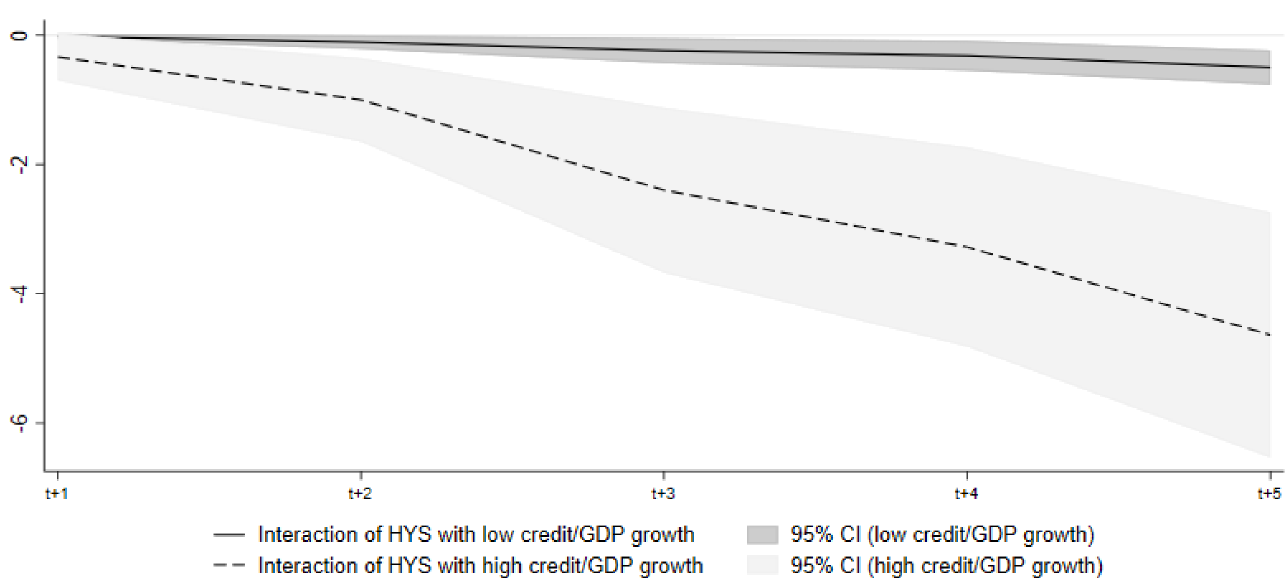


Table 1: *Average five year change in HY share*

Notes: This table shows regressions where the dependent variable is the average change in the HY share over the previous five years ($\Delta\overline{HY}_{it,t-5}$), scaled to have unit standard deviation. Credit to GDP ratios and the HY share are winsorized at the 5th and 95th percentiles within country. All specifications include country fixed effects and credit to GDP growth over the previous five years ($\Delta\, ln\, Credit/GDP_{it,t-5}$) as controls. Independent variables are constructed using average changes in realized GDP growth ($\Delta\, ln\, y_{it,t-1} \times 100$) and forecasted GDP growth ($\Delta\, ln\, \hat{y}^{t-1}_{it,t-1} \times 100$) at one year horizons. The first independent variable is the average change in real GDP growth over the previous five years. The second independent variable is the average change over the previous five years in forecast errors for one year real GDP growth relative to forecasts made in the previous year. The third independent variable is the average change in the forecast component of the second independent variable. Driscoll & Kraay (1998) standard errors are shown in parentheses. *, **, and *** denote statistical significance at the 10 percent, 5 percent, and 1 percent levels, respectively.

	$\Delta\overline{HY}_{it,t-5}$	$\Delta\overline{HY}_{it,t-5}$	$\Delta\overline{HY}_{it,t-5}$
$\Delta\overline{(\Delta\, ln\, y_{it,t-1})}_{t,t-5}$	0.19***		
	(0.06)		
$\Delta\overline{\left(\Delta\, ln\, y_{it,t-1} - \Delta\, ln\, \hat{y}^{t-1}_{it,t-1}\right)}_{t,t-5}$		0.27***	0.27***
		(0.06)	(0.06)
$\Delta\overline{\left(\Delta\, ln\, \hat{y}^{t-1}_{it,t-1}\right)}_{t,t-5}$			-0.24
			(0.22)
Country fixed effects	Y	Y	Y
Controls	Y	Y	Y
R^2 (*within*)	0.02	0.03	0.03
Country years	575	575	575
Countries	38	38	38

Table 2: *Realized and forecasted subsequent cumulative 3 year real GDP growth*

Notes: This table shows regressions where dependent variables are realized cumulative real GDP growth over the subsequent three years ($\Delta ln\, y_{it+3,t} \times 100$), forecasted cumulative real GDP growth over the subsequent three years ($\Delta ln\, \hat{y}^t_{it+3,t} \times 100$), and the gap between realized and forecasted real GDP growth over the subsequent three years. All specifications include country fixed effects and two lags of real GDP growth as controls. Credit to GDP ratios and the HY share are winsorized at the 5th and 95th percentiles within country. Changes in credit to GDP over the previous five years ($\Delta\, ln\, Credit/GDP_{it,t-5} \times 10$) are scaled so that a one unit change corresponds to a 10 percent increase. The average change in the HY share over the previous five years ($\Delta \overline{HY}_{it,t-5}$) is scaled to have unit standard deviation. Driscoll & Kraay (1998) standard errors are shown in parentheses. *, **, and *** denote statistical significance at the 10 percent, 5 percent, and 1 percent levels, respectively.

	$\Delta ln\, y_{it+3,t}$	$\Delta ln\, y_{it+3,t}$	$\Delta ln\, y_{it+3,t}$	$\Delta ln\, y_{it+3,t}$	$\Delta ln\, y_{it+3,t}$	$\Delta ln\, \hat{y}^t_{it+3,t}$	$\Delta ln\, y_{it+3,t} - \Delta ln\, \hat{y}^t_{it+3,t}$
$\Delta ln\, Credit/GDP_{it,t-5}$	-0.80***		-0.82***	-0.85***	-0.90***	0.09**	-0.99***
	(0.27)		(0.26)	(0.27)	(0.21)	(0.04)	(0.19)
$(\Delta ln\, Credit/GDP_{it,t-5})^2$					-0.06**	0.01	-0.07**
					(0.02)	(0.02)	(0.03)
$\Delta \overline{HY}_{it,t-5}$		-0.09	-0.30	-0.11	0.38	-0.17	0.55
		(0.33)	(0.26)	(0.32)	(0.36)	(0.12)	(0.36)
$\Delta ln\, Credit/GDP_{it,t-5} \times \Delta \overline{HY}_{it,t-5}$				-0.22*	-0.21*	0.04	-0.25**
				(0.13)	(0.10)	(0.05)	(0.11)
$(\Delta ln\, Credit/GDP_{it,t-5})^2 \times \Delta \overline{HY}_{it,t-5}$					-0.06**	-0.00	-0.06*
					(0.03)	(0.01)	(0.03)
Mean of dependent variable	7.34	7.34	7.34	7.34	7.34	8.84	-1.50
Country fixed effects	Y	Y	Y	Y	Y	Y	Y
Controls	Y	Y	Y	Y	Y	Y	Y
R^2 (*within*)	0.10	0.04	0.10	0.11	0.14	0.27	0.15
Country years	727	727	727	727	727	727	727
Countries	38	38	38	38	38	38	38

Table 3: *Subsequent changes in HY share, investment to GDP, unemployment, and financial distress*

Notes: This table shows regressions where the dependent variables are (i) the average change in the HY share in the subsequent three years ($\Delta\overline{HY}_{it+3,t}$), scaled to have unit standard deviation, (ii) cumulative real GDP growth over the subsequent three years ($\Delta ln\, y_{it+3,t} \times 100$), (iii) the change in the investment to GDP ratio over the subsequent three years ($\Delta(inv/y)_{it+3,t}$) in percentage points, (iv) the change in the unemployment rate over the subsequent three years ($\Delta u_{it+3,t}$) in percentage points, and (v) the change in the Romer & Romer (2017) index of financial distress three years ($\Delta FD_{t+3,t}$) over the subsequent three years, scaled to have unit standard deviation. All specifications include country fixed effects and two lags of real GDP growth as controls. Credit to GDP ratios and the HY share are winsorized at the 5th and 95th percentiles within country. Changes in credit to GDP over the previous five years ($\Delta\, ln\, Credit/GDP_{it,t-5} \times 10$) are scaled so that a one unit change corresponds to a 10 percent increase. The average change in the HY share over the previous five years ($\Delta\overline{HY}_{it,t-5}$) is scaled to have unit standard deviation. HY Share reversal is ($\Delta\overline{HY}_{it,t-5} \times -\Delta\overline{HY}_{it+3,t}$), scaled to have unit standard deviation. Driscoll & Kraay (1998) standard errors are shown in parentheses. *, **, and *** denote statistical significance at the 10 percent, 5 percent, and 1 percent levels, respectively.

	$\Delta\overline{HY}_{it+3,t}$	$\Delta ln\, y_{it+3,t}$	$\Delta(inv/y)_{it+3,t}$	$\Delta u_{it+3,t}$	$\Delta FD_{t+3,t}$
$\Delta ln\, Credit/GDP_{it,t-5}$	-0.02	-0.77***	-0.50***	0.44**	0.12***
	(0.03)	(0.26)	(0.13)	(0.18)	(0.04)
$\Delta\overline{HY}_{it,t-5}$	-0.42***		0.06	-0.15	-0.05
	(0.07)		(0.18)	(0.11)	(0.20)
HY Share Reversal		-0.39*			
		(0.22)			
$\Delta ln\, Credit/GDP_{it,t-5} \times \Delta\overline{HY}_{it,t-5}$	0.00		-0.16**	0.10**	0.13**
	(0.03)		(0.06)	(0.05)	(0.05)
$\Delta ln\, Credit/GDP_{it,t-5} \times$ HY Share Reversal		-0.16**			
		(0.06)			
Mean of dependent variable	0.02	7.33	-0.14	-0.15	0.10
Country fixed effects	Y	Y	Y	Y	Y
Controls	Y	Y	Y	Y	Y
R^2 (*within*)	0.18	0.12	0.15	0.13	0.13
Country years	738	738	738	730	408
Countries	38	38	38	37	22

Internet Appendix

Lending standards and output growth

A Additional figures and tables

Figure A.1: *Country coverage*

Notes: This figure summarizes sample coverage, showing the 38 countries covered by the decade in which coverage starts. Refer to Appendix Table A.1 for details.

Figure A.2: *US corporate investment-grade share and US SLOOS*

Notes: This figure shows the US corporate investment-grade share and lending standards for US banks based on the Federal Reserve's Senior Loan Officer Opinion Survey on Bank Lending Practices (SLOOS). The reported SLOOS index rises when lending standards tighten. I use responses related to credit to small firms. I plot the investment grade share so that both measures increase when lending standards tighten. Refer to Appendix Table A.2 for details on the SLOOS.

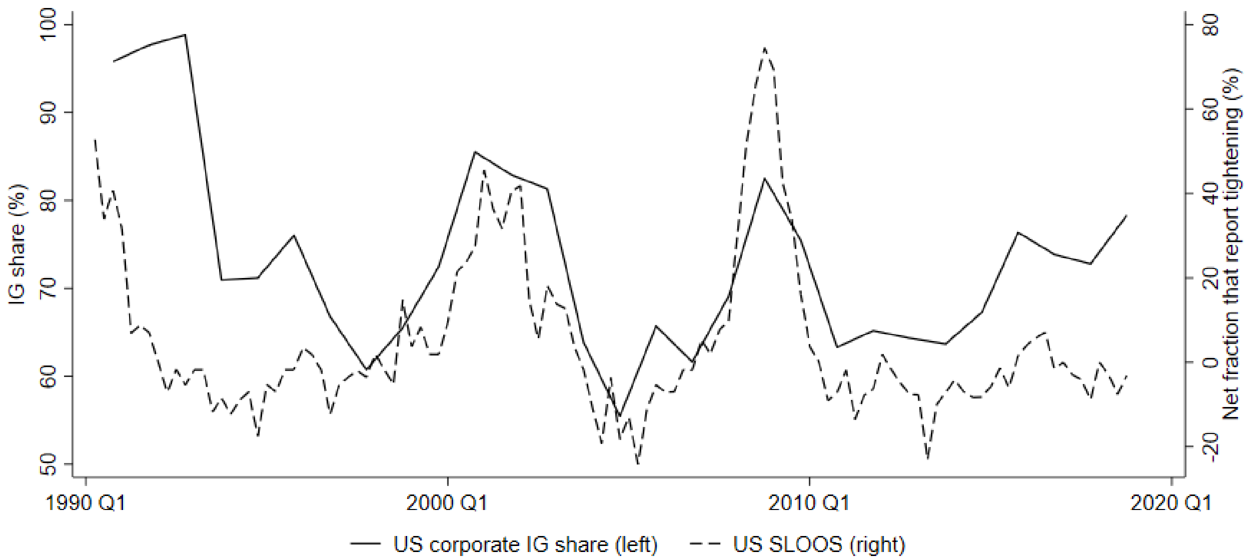


Figure A.3: *High credit growth and change in HY share in the time series*

Notes: This figure shows the share of countries in the sample in each year (in percentage points) by characteristic. The solid line shows the share of countries with a positive average change in the HY share over the previous five years ($\Delta\overline{HY}_{it,t-5} > 0$, left vertical axis). The dashed line shows the share of countries with credit to GDP growth above 25 percent over the previous five years ($\Delta\, ln\, Credit/GDP_{it,t-5} \times 100 > 25$, right vertical axis).

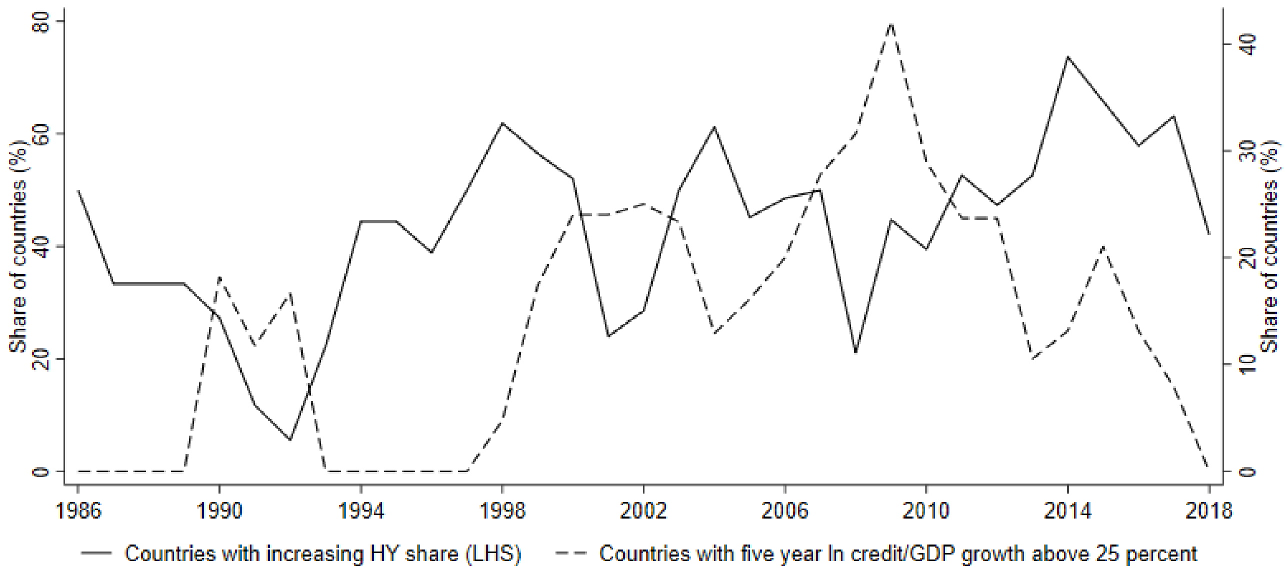


Table A.1: *Sample coverage*

Notes: This table summarizes sample coverage. *First year* indicates the year in which coverage begins for a country. *N* counts the number of years a country is in the sample. *Missing* counts the number of years for which no issues are available. *Issuers* counts the total number of distinct issuers in each country, while *Bonds in sample* counts the total number of bonds in each country. *Mean Share/GDP* is the average share of bond proceeds as a fraction of GDP over the sample period. *Advanced* is a dummy variable for advanced economies.

	First year	N	Missing	Issuers	Bonds in sample	Mean Share/GDP	Advanced
Argentina	1993	25	1	134	523	2.5	0
Australia	1984	35	.	350	2,198	2.1	1
Austria	1985	34	.	110	1,006	5.8	1
Belgium	1985	34	.	122	1,171	7.9	1
Brazil	1992	27	.	272	709	1.0	0
Canada	1981	38	.	797	3,961	4.4	1
Chile	1996	23	.	121	457	2.9	0
China	2002	17	.	5,709	22,552	5.4	0
Czech Republic	1994	25	.	76	628	4.5	1
Denmark	1984	34	1	75	889	3.4	1
Finland	1985	34	.	107	726	6.0	1
France	1980	39	.	488	4,957	5.8	1
Germany	1984	35	.	389	3,019	3.7	1
Greece	1994	25	.	40	353	8.6	1
Hong Kong	1993	26	.	265	1,214	3.8	1
Hungary	1997	22	.	10	1,194	7.2	0
India	2002	17	.	472	1,881	1.6	0
Indonesia	1996	21	2	250	1,010	1.2	0
Ireland	1991	28	.	75	386	4.8	1
Italy	1986	33	.	226	2,486	8.4	1
Japan	1984	35	.	1,136	11,822	10.9	1
Malaysia	2000	19	.	438	3,711	6.4	0
Mexico	1991	28	.	206	892	1.8	0
Netherlands	1985	34	.	219	1,365	5.5	1
New Zealand	1984	35	.	84	465	2.0	1
Norway	1985	33	1	162	802	2.5	1
Poland	1997	22	.	30	769	5.2	0
Portugal	1994	25	.	84	503	7.7	1
Russian Federation	1998	21	.	418	2,026	2.3	0
Singapore	2000	19	.	232	1,006	6.2	1
South Korea	1996	23	.	755	7,517	2.7	1
Spain	1984	34	1	149	1,730	6.2	1
Sweden	1984	35	.	170	2,395	4.4	1
Switzerland	1984	35	.	379	1,786	2.9	1
Thailand	2000	19	.	244	2,514	2.8	0
Turkey	1992	27	.	33	556	2.7	0
United Kingdom	1985	34	.	1,050	4,996	5.0	1
United States	1980	39	.	7,799	38,027	6.3	1
N	38						

Table A.2: *Availability and sources of bank loan officer surveys*

Notes: This table provides details on the availability and sources of bank loan officer surveys. These surveys are available from the central banks of 14 countries in the sample. The table lists the sources, availability, names, weighting and questions asked in the surveys. Panel A shows the 11 countries that report measures that increase as standards tighten. Net tightening is the fraction of banks that report tightening minus the fraction of banks that report easing. Canada, France, and the Netherlands report measures weighted by banks' market shares. Panel B shows the 3 countries that report measures that increase as standards ease. Net easing is the fraction of banks that report easing minus the fraction of banks that report tightening. The UK reports measures weighted by banks' market shares, while Japan uses a pre-determined weighting scheme. While surveys are also available for Russia and Thailand, I do not include these: the Russian survey does not distinguish credit supply from credit demand, and the Thai survey began in 2013.

Panel A: Countries that report measures that increase when standards tighten

Country	Source	Availability	Survey Name	Weighted	Survey Question
Austria	ECB	1/2003 - 12/2018	Bank Lending Survey	No	Credit standards for approving new loans
Belgium	ECB	1/2003 - 12/2018	Bank Lending Survey	No	Credit standards for approving new loans
France	ECB	1/2003 - 12/2018	Bank Lending Survey	Yes	Credit standards for approving new loans
Germany	ECB	1/2003 - 12/2018	Bank Lending Survey	No	Credit standards for approving new loans
Greece	ECB	1/2003 - 12/2018	Bank Lending Survey	No	Credit standards for approving new loans
Italy	ECB	1/2003 - 12/2018	Bank Lending Survey	No	Credit standards for approving new loans
Netherlands	ECB	1/2003 - 12/2018	Bank Lending Survey	Yes	Credit standards for approving new loans
Portugal	ECB	1/2003 - 12/2018	Bank Lending Survey	No	Credit standards for approving new loans
Spain	ECB	1/2003 - 12/2018	Bank Lending Survey	No	Credit standards for approving new loans
Canada	Bank of Canada	4/1999 - 12/2018	Senior Loan Officer Survey	Yes	General standards (appetite for risk) and terms for approving credit
United States	Federal Reserve	4/1990 - 12/2018	Senior Loan Officer Opinion Survey on Bank Lending Practices	No	Credit standards for approving C&I loans or credit lines

Panel B: Countries that report measures that increase when standards ease

Country	Source	Availability	Survey Name	Weighted	Survey Question
Japan	Bank of Japan	4/2000 - 12/2018	Senior Loan Officer Opinion Survey on Bank Lending Practices at Large Japanese Banks	Yes	Credit standards for applications from firms
Poland	National Bank of Poland	10/2003 - 12/2018	Senior Loan Officer Opinion Survey	No	Credit standards on corporate loans
United Kingdom	Bank of England	10/2009 - 12/2018	Credit Conditions Survey	Yes	Willingness and ability to supply credit keeping demand constant

Table A.3: *Correlation between bank loan officer surveys and HY share*

Notes: This table shows the correlation between bank loan officer surveys and HY share at the annual level. The US SLOOS is available from 1990, while surveys for other countries start in the early 2000s. Refer to Appendix Table A.2 for details on coverage. For the US, I use responses related to credit to small firms. For Poland, the loan officer survey refers to responses for long-term loans. Panel A shows correlations for countries that report measures that increase as standards tighten, while Panel B shows correlations for countries that report measures that increase as standards ease.

Panel A: Countries that report measures that increase when standards tighten

	Austria	Belgium	Canada	France	Germany	Greece	Italy	Netherlands	Portugal	Spain	United States
Correlation	0.13	-0.02	-0.36	-0.28	-0.19	-0.42	-0.46	-0.41	-0.57	-0.58	-0.32

Panel B: Countries that report measures that increase when standards ease

	Japan	Poland	United Kingdom
Correlation	0.49	0.12	0.09

Table A.4: *Contemporaneous five year changes in dispersion in credit spreads*

Notes: This table shows regressions where the dependent variables is the change in credit spread dispersion over the previous five years ($\Delta S_{it,t-5}$), scaled to have unit standard deviation. S_{it} is the difference between the 90th and 10th percentile yield within country year, winsorized at the 5th and 95th percentiles within country. All specifications include country fixed effects and two lags of real GDP growth as controls. Credit to GDP ratios and the HY share are winsorized at the 5th and 95th percentiles within country. Changes in credit to GDP over the previous five years ($\Delta\, ln\, Credit/GDP_{it,t-5} \times 10$) are scaled so that a one unit change corresponds to a 10 percent increase. The average change in the HY share over the previous five years ($\Delta\overline{HY}_{it,t-5}$) is scaled to have unit standard deviation. Driscoll & Kraay (1998) standard errors are shown in parentheses. *, **, and *** denote statistical significance at the 10 percent, 5 percent, and 1 percent levels, respectively.

	$\Delta S_{it,t-5}$	$\Delta S_{it,t-5}$	$\Delta S_{it,t-5}$	$\Delta S_{it,t-5}$
$\Delta ln\, Credit/GDP_{it,t-5}$	-0.04		-0.03	-0.03
	(0.03)		(0.04)	(0.03)
$\Delta\overline{HY}_{it,t-5}$		0.03	0.03	-0.04
		(0.09)	(0.09)	(0.09)
$\Delta ln\, Credit/GDP_{it,t-5} \times \Delta\overline{HY}_{it,t-5}$				0.08***
				(0.02)
Country fixed effects	Y	Y	Y	Y
Controls	Y	Y	Y	Y
R^2 (*within*)	0.00	0.00	0.00	0.03
Country years	659	659	659	659
Countries	38	38	38	38

Table A.5: *Robustness: global HY share*

Notes: This table repeats the final three specifications in Table 2 using the global HY share, weighted by proceeds, rather than country-specific HY shares.

	$\Delta ln\, y_{it+3,t}$	$\Delta ln\, \hat{y}^t_{it+3,t}$	$\Delta ln\, y_{it+3,t} - \Delta ln\, \hat{y}^t_{it+3,t}$
$\Delta ln\, Credit/GDP_{it,t-5}$	-0.93***	0.07	-1.00***
	(0.16)	(0.09)	(0.13)
$(\Delta ln\, Credit/GDP_{it,t-5})^2$	-0.11***	-0.00	-0.11***
	(0.03)	(0.02)	(0.03)
$\Delta \overline{HY}^G_{t,t-5}$	0.77	0.09	0.68
	(0.67)	(0.25)	(0.48)
$\Delta ln\, Credit/GDP_{it,t-5} \times \Delta \overline{HY}^G_{t,t-5}$	-0.73***	-0.12*	-0.61**
	(0.25)	(0.07)	(0.22)
$(\Delta ln\, Credit/GDP_{it,t-5})^2 \times \Delta \overline{HY}^G_{t,t-5}$	-0.10***	-0.02	-0.08***
	(0.02)	(0.01)	(0.02)
Country fixed effects	Y	Y	Y
Controls	Y	Y	Y
R^2 (*within*)	0.19	0.28	0.17
Country years	727	727	727
Countries	38	38	38

Table A.6: *Robustness: growth in credit to non-financial corporates*

Notes: This table repeats the final three specifications in Table 2 looking at credit to non-financial corporates and households separately, using data from the BIS. Terms based on growth in credit to non-financial corporates relative to GDP are shown. All corresponding terms for growth in credit to households relative to GDP, including interactions, are also included but not shown.

	$\Delta ln\, y_{it+3,t}$	$\Delta ln\, \hat{y}^{t}_{it+3,t}$	$\Delta ln\, y_{it+3,t} - \Delta ln\, \hat{y}^{t}_{it+3,t}$
$\Delta ln\, NFC\, Credit/GDP_{it,t-5}$	-0.47**	-0.10*	-0.37**
	(0.18)	(0.05)	(0.18)
$(\Delta ln\, NFC\, Credit/GDP_{it,t-5})^2$	-0.03	0.01	-0.04
	(0.02)	(0.01)	(0.03)
$\Delta \overline{HY}_{it,t-5}$	0.38	-0.24**	0.62
	(0.50)	(0.09)	(0.48)
$\Delta ln\, NFC\, Credit/GDP_{it,t-5} \times \Delta \overline{HY}_{it,t-5}$	-0.06	0.01	-0.06
	(0.09)	(0.04)	(0.08)
$(\Delta ln\, NFC\, Credit/GDP_{it,t-5})^2 \times \Delta \overline{HY}_{it,t-5}$	-0.06*	0.01*	-0.07**
	(0.03)	(0.01)	(0.03)
Country fixed effects	Y	Y	Y
Controls	Y	Y	Y
HH Credit/interactions	Y	Y	Y
R^2 (*within*)	0.19	0.32	0.22
Country years	645	645	645
Countries	38	38	38

Table A.7: *Robustness: year fixed effects*

Notes: This table repeats the final three specifications in Table 2 including year fixed effects.

	$\Delta ln\, y_{it+3,t}$	$\Delta ln\, \hat{y}^t_{it+3,t}$	$\Delta ln\, y_{it+3,t} - \Delta ln\, \hat{y}^t_{it+3,t}$
$\Delta ln\, Credit/GDP_{it,t-5}$	-0.63***	0.07	-0.70***
	(0.22)	(0.07)	(0.19)
$(\Delta ln\, Credit/GDP_{it,t-5})^2$	-0.05***	-0.01	-0.04*
	(0.02)	(0.01)	(0.02)
$\Delta \overline{HY}_{it,t-5}$	0.58***	-0.02	0.60**
	(0.20)	(0.10)	(0.24)
$\Delta ln\, Credit/GDP_{it,t-5} \times \Delta \overline{HY}_{it,t-5}$	-0.12	-0.01	-0.11
	(0.11)	(0.04)	(0.11)
$(\Delta ln\, Credit/GDP_{it,t-5})^2 \times \Delta \overline{HY}_{it,t-5}$	-0.07**	-0.01	-0.06**
	(0.02)	(0.01)	(0.03)
Country fixed effects	Y	Y	Y
Year fixed effects	Y	Y	Y
Controls	Y	Y	Y
R^2 (*within*)	0.43	0.51	0.39
Country years	727	727	727
Countries	38	38	38

Table A.8: *Robustness: binary definition of credit booms*

Notes: This table repeats the final three specifications in Table 2 using a binary definition of credit booms instead of squared credit to GDP growth to capture credit booms. Country-years where five year credit to GDP growth is above the 75th percentile of this quantity in the previous ten years for all countries with data on credit to GDP ratios are labeled as credit booms ($\mathbf{1}_{Credit\ boom\, i,t}$).

	$\Delta ln\, y_{it+3,t}$	$\Delta ln\, \hat{y}^t_{it+3,t}$	$\Delta ln\, y_{it+3,t} - \Delta ln\, \hat{y}^t_{it+3,t}$
$\Delta ln\, Credit/GDP_{it,t-5}$	-0.75***	0.08	-0.83***
	(0.22)	(0.05)	(0.25)
$\mathbf{1}_{Credit\ boom\, i,t}$	-0.95*	0.09	-1.04**
	(0.47)	(0.31)	(0.43)
$\Delta \overline{HY}_{it,t-5}$	0.41	-0.12	0.53*
	(0.30)	(0.14)	(0.30)
$\Delta ln\, Credit/GDP_{it,t-5} \times \Delta \overline{HY}_{it,t-5}$	0.10	0.08	0.03
	(0.13)	(0.09)	(0.20)
$\mathbf{1}_{Credit\ boom\, i,t} \times \Delta \overline{HY}_{it,t-5}$	-2.28***	-0.30	-1.97**
	(0.75)	(0.37)	(0.89)
Country fixed effects	Y	Y	Y
Controls	Y	Y	Y
R^2 (*within*)	0.13	0.28	0.13
Country years	727	727	727
Countries	38	38	38

Table A.9: *Robustness: percentage point changes in credit to GDP ratios*

Notes: This table repeats the final three specifications in Table 2 using changes in credit to GDP ratios in percentage points instead of percent (log) changes.

	$\Delta ln\, y_{it+3,t}$	$\Delta ln\, \hat{y}^t_{it+3,t}$	$\Delta ln\, y_{it+3,t} - \Delta ln\, \hat{y}^t_{it+3,t}$
$\Delta Credit/GDP_{it,t-5}$	-0.76***	0.10	-0.85***
	(0.15)	(0.06)	(0.14)
$(\Delta Credit/GDP_{it,t-5})^2$	-0.07***	-0.03**	-0.04
	(0.02)	(0.01)	(0.02)
$\Delta \overline{HY}_{it,t-5}$	0.34	-0.23**	0.57*
	(0.26)	(0.10)	(0.30)
$\Delta Credit/GDP_{it,t-5} \times \Delta \overline{HY}_{it,t-5}$	-0.11	0.06	-0.17
	(0.11)	(0.07)	(0.17)
$(\Delta Credit/GDP_{it,t-5})^2 \times \Delta \overline{HY}_{it,t-5}$	-0.05***	-0.00	-0.05**
	(0.01)	(0.01)	(0.02)
Country fixed effects	Y	Y	Y
Controls	Y	Y	Y
R^2 (*within*)	0.23	0.29	0.21
Country years	727	727	727
Countries	38	38	38

Table A.10: *Robustness: winsorized dependent variables*

Notes: This table repeats the final three specifications in Table 2 with dependent variables winsorized at the 5th and 95th percentiles within country (Panel A) or year (Panel B).

Panel A: Dependent variables winsorized within country

	$\Delta ln\, y_{it+3,t}$	$\Delta ln\, \hat{y}^t_{it+3,t}$	$\Delta ln\, y_{it+3,t} - \Delta ln\, \hat{y}^t_{it+3,t}$
$\Delta ln\, Credit/GDP_{it,t-5}$	-0.89***	0.09**	-0.97***
	(0.21)	(0.04)	(0.19)
$(\Delta ln\, Credit/GDP_{it,t-5})^2$	-0.06**	0.01	-0.07**
	(0.02)	(0.02)	(0.03)
$\Delta \overline{HY}_{it,t-5}$	0.37	-0.16	0.55
	(0.36)	(0.12)	(0.36)
$\Delta ln\, Credit/GDP_{it,t-5} \times \Delta \overline{HY}_{it,t-5}$	-0.20*	0.03	-0.24**
	(0.10)	(0.06)	(0.11)
$(\Delta ln\, Credit/GDP_{it,t-5})^2 \times \Delta \overline{HY}_{it,t-5}$	-0.06**	-0.00	-0.06*
	(0.03)	(0.01)	(0.03)
Country fixed effects	Y	Y	Y
Controls	Y	Y	Y
R^2 (*within*)	0.14	0.27	0.14
Country years	727	727	727
Countries	38	38	38

Panel B: Dependent variables winsorized within year

	$\Delta ln\, y_{it+3,t}$	$\Delta ln\, \hat{y}^t_{it+3,t}$	$\Delta ln\, y_{it+3,t} - \Delta ln\, \hat{y}^t_{it+3,t}$
$\Delta ln\, Credit/GDP_{it,t-5}$	-0.77***	0.10**	-0.88***
	(0.20)	(0.04)	(0.17)
$(\Delta ln\, Credit/GDP_{it,t-5})^2$	-0.05**	0.01	-0.06**
	(0.02)	(0.01)	(0.02)
$\Delta \overline{HY}_{it,t-5}$	0.29	-0.12	0.45
	(0.33)	(0.10)	(0.34)
$\Delta ln\, Credit/GDP_{it,t-5} \times \Delta \overline{HY}_{it,t-5}$	-0.21**	0.02	-0.19**
	(0.09)	(0.05)	(0.08)
$(\Delta ln\, Credit/GDP_{it,t-5})^2 \times \Delta \overline{HY}_{it,t-5}$	-0.05**	-0.00	-0.05*
	(0.02)	(0.01)	(0.03)
Country fixed effects	Y	Y	Y
Controls	Y	Y	Y
R^2 (*within*)	0.13	0.27	0.15
Country years	727	727	727
Countries	38	38	38