



BANK FOR INTERNATIONAL SETTLEMENTS



BIS Working Papers

No 847

The dollar, bank leverage and real economic activity: an evolving relationship

by Burcu Erik, Marco J. Lombardi, Dubravko Mihajjek
and Hyun Song Shin

Monetary and Economic Department

March 2020

JEL classification: C5, E2, F3, F4, F6.

Keywords: financial conditions, economic activity, world trade, dollar exchange rate, bank leverage, purchasing managers' indices, nowcasting, global supply chains.

BIS Working Papers are written by members of the Monetary and Economic Department of the Bank for International Settlements, and from time to time by other economists, and are published by the Bank. The papers are on subjects of topical interest and are technical in character. The views expressed in them are those of their authors and not necessarily the views of the BIS.

This publication is available on the BIS website (www.bis.org).

© *Bank for International Settlements 2020. All rights reserved. Brief excerpts may be reproduced or translated provided the source is stated.*

ISSN 1020-0959 (print)
ISSN 1682-7678 (online)

The dollar, bank leverage and real economic activity: an evolving relationship

Burcu Erik, Marco J. Lombardi,
Dubravko Mihaljek and Hyun Song Shin*

March 17, 2020

Abstract

The interest in how financial conditions affect real economic activity has grown since the Great Financial Crisis (GFC), not least because some of the mechanisms at play in the financial sector may have changed. We shed light on this issue by examining the empirical relationship between global Purchasing Managers' Indices, world trade and indicators of global financial conditions, with a special focus on the broad dollar index. We show that the influence of the dollar on real economic activity and global trade seems to have increased since the GFC, while that of the VIX has decreased.

JEL classification: C5, E2, F3, F4, F6.

*Bank for International Settlements, Centralbahnplatz 2, 4002 Basel, Switzerland. Corresponding author: dubravko.mihaljek@bis.org. We thank Valentina Bruno, Stijn Claessens, Kristin Forbes, Eduardo Levy Yeyati, Benoît Mojon, Raghuraj Rajan, Helene Rey, Livio Stracca, Christian Upper and participants of the session Has the global financial cycle changed since the crisis at the American Economic Association Annual Meetings in San Diego for helpful comments. The views expressed in this paper are solely those of the authors and not necessarily those of the BIS. The paper is forthcoming in American Economic Association Papers and Proceedings, Vol 110, May 2020.

Introduction

The COVID-19 pandemic has heightened awareness of the how tightening financial conditions spill over to real economic activity. How do financial conditions affect real economic activity, and how have the transmission channels changed since the Great Financial Crisis (GFC) of 2008-9?

An important backdrop to our discussion is the set of changes in the pattern of financial intermediation that have taken place over the past decade or so. These changes have had a bearing on the transmission of financial conditions to economic activity, with the emphasis shifting from the banking sector to market-based intermediation.

We shed further light on the impact of financial conditions on real economic activity by examining the empirical relationship between global manufacturing Purchasing Managers' Indices (PMIs) and indicators of global financial conditions.

A notable finding in our study is the growing role of the broad dollar index. As well as its classical role as the relative price of goods in international trade, the broad dollar index affects real economic activity through its impact on financial conditions, and has attributes of a barometer of risk capacity affecting financial intermediaries.

Section II looks more closely at the evolving relationship between the dollar and indicators of global economic activity. In Section III, we identify drivers of change in these linkages. Section IV concludes with reflections on the nature of risks in the new environment.

1 Changes in Financial Intermediation

The focus of our study is on how the transmission channels of financial conditions on real activity may have changed since the GFC. Three recent changes in financial intermediation bear on this question.

First, the formal banking sector has been noticeably subdued in the post-crisis period, especially in advanced economies that bore the brunt of the financial crisis. Figure 1 plots the total assets and book equity for a group of 43 large US and euro area banks.¹ Assets and equity expanded strongly before the crisis, but they have subsequently grown more slowly. Euro area banks have been particularly subdued, seeing steady contraction of total assets since the GFC.

Second, the relationship between bank leverage and measures of risk appetite has changed. Before the crisis, bank leverage (total assets divided by equity) was closely correlated with the VIX index of implied volatility in equity markets (Adrian and Shin 2010, 2014). When the VIX was low, bank leverage was high, and vice versa. Figure 2 illustrates the relationship between VIX and leverage through the US broker-dealer sector, which offers a window on market-based

¹See appendix for definitions of variables and data sources (including the list of banks) for all figures.

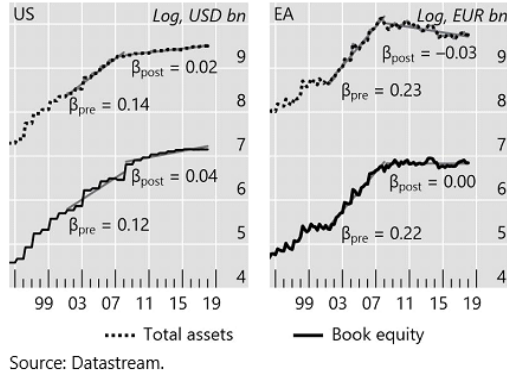


Figure 1: Total assets and book equity of 17 US and 26 euro area banks

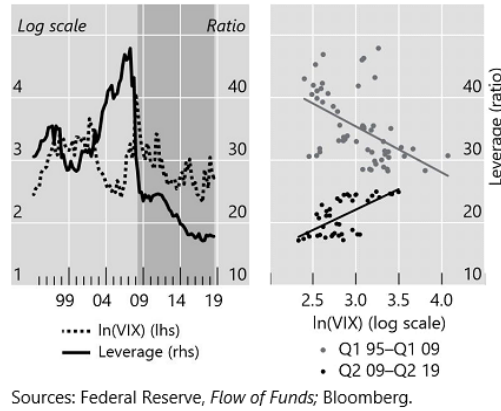
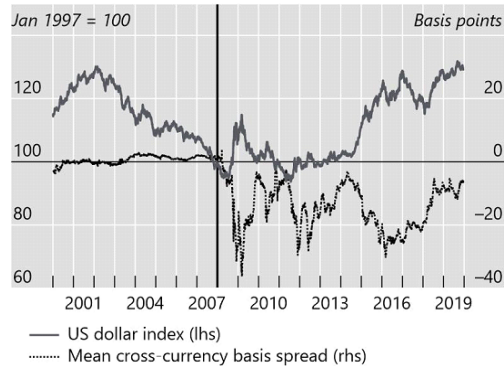


Figure 2: Leverage and VIX index

intermediation. The negative relationship between leverage and the VIX index has broken down since 2009: even though the VIX eased close to pre-crisis lows up to 2019, bank leverage continued to fall. Forbes and Warnock (2020) and Miranda-Agrippino and Rey (2020) similarly note the diminished role of the VIX as an explanatory variable for credit growth and capital flows.

The right-hand panel of Figure 2 shows the structural break: the grey dots indicate a negative relationship between leverage and the VIX before the GFC; the black dots indicate that, post-crisis, leverage no longer responds to shifts in the VIX.

Third, the pricing of bank balance sheet capacity has changed after the crisis. One notable symptom has been the breakdown of covered interest parity (CIP). CIP is the proposition that the interest rate on a currency in the money market is equal to the implied interest rate on that same currency in the FX swap market.



Sources: FRB St Louis, FRED; Bloomberg.

Figure 3: Deviation from covered interest parity

Figure 3, taken from Avdjiev et al. (2019), shows the difference between the money market interest rate and the implied interest rate for the dollar implicit in the FX swap market (averaged across ten advanced economy currencies vis-à-vis the dollar). The figure reveals that, whereas CIP held pretty well before the crisis, it broke down after the crisis. Avdjiev et al. (2019) shows that a dollar appreciation is associated with a widening of the CIP deviation. This empirical association holds even in first differences and at daily frequency. For this reason, they argue that the broad dollar index serves as a good concurrent indicator of bank balance sheet costs.

In sum, changes since the GFC suggest a diminished role for the formal banking sector in financial intermediation, and a greater role for market-based intermediation and the dollar as a key indicator of risk appetite. Just as the VIX index was a good summary measure of the price of the balance sheet before the crisis, so the dollar has become a good measure of the price of the balance sheet after the crisis.

2 The Evolving Relationship between the Dollar, PMIs and Trade Growth

In view of these changes, we may expect that the channels of transmission of financial conditions may also have changed since the GFC.

Commentary accompanying monthly PMI releases suggests that purchasing managers closely follow financial data in order to assess the financing conditions their firms face and, more broadly, the current and expected economic activity. Furthermore, given the structural break in banking sector balance sheet costs around the time of the GFC, we may expect to detect changes in the way that financial conditions feed into real activity.

In the post-crisis period, a strong dollar has emerged as a concurrent indicator associated with weak PMI and real activity. We investigate the empirical relationships through a small-scale VAR. The VAR features, in order, changes in world equity prices, the nominal effective exchange rate of the US dollar (the “dollar index”), global manufacturing PMIs (excluding the United States), and global trade growth.² The number of lags is fixed at six. We compute the monthly changes over a 30-day period around central PMI survey dates so as to align market information available to purchasing managers at the time of the poll.³ This ordering defines a Choleski identification that is underpinned by the timing of financial variables: changes in equity prices and the dollar index are computed over a 30-day window that predates the survey of at least one half of purchasing managers. This timing sequence supports the assumption that changes in equity prices and dollar indices are ordered first, that is, they do not react contemporaneously to PMI- and trade-specific shocks.

Based on this ordering, the first shock, associated with equity price changes, can be interpreted as the continuous flow of news related to macroeconomic and financing conditions. Financial market participants process this information and incorporate it in equity prices at high frequency before the PMI and world trade data are released. The second shock, associated with the dollar index, can be thought of as the additional information conveyed by changes in the dollar exchange rate.⁴ The third shock (associated with PMIs) is then the change in PMIs that was not already priced into financial variables, and can thus be related to private information available to purchasing managers during the polling period.

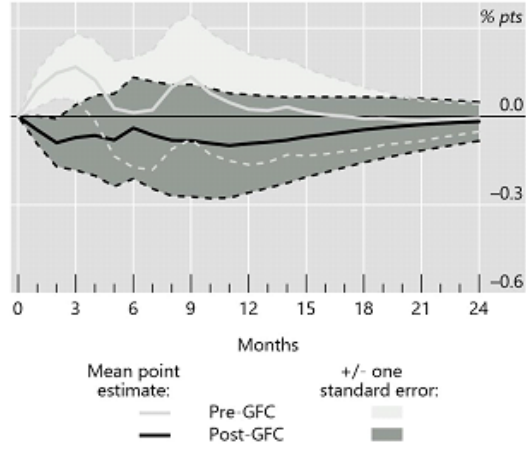
Estimating this VAR on pre- and post-GFC samples highlights a striking change in the transmission of US dollar shocks.⁵ Before the GFC, global PMIs (excluding the United States) expanded moderately after an unexpected dollar appreciation (Figure 4, grey line). This response is in line with a view that US import demand increases after a dollar appreciation. After the GFC, however, global PMIs contract in response to an unexpected dollar appreciation (black line). The results are even more striking when the response of trade is considered (Figure 5). Before the GFC, unexpected dollar appreciation boosted world trade growth (grey line). After the GFC, unexpected dollar appreciation depresses world trade growth, despite making dollar-denominated exports cheaper (black line).

²See appendix for details. Changes in world equity prices are computed as the weighted average of equity price changes across 32 major economies. For the US dollar index, we use the FRB’s Trade Weighted U.S. Dollar Index: Other Important Trading Partners, Goods.”

³The additional assumption is that the survey respondents fill their questionnaires on average around the central date of the polling window.

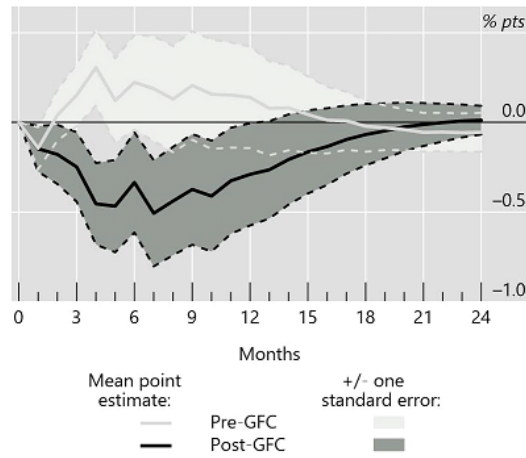
⁴This ordering stacks the odds against a role of the dollar: the dollar shock is by construction orthogonal to and a residual of the global equity shock, which absorbs the bulk of information on the global outlook and financing conditions.

⁵We excluded the GFC from the sample on purpose, so that the effect of the crisis does not dominate the system’s dynamics.



Sources: FRB St Louis, FRED; CPB, Netherlands Bureau of Economic Policy Analysis; Bloomberg; Datastream; IHS Markit.

Figure 4: Impulse responses of global PMIs (excluding the US) to dollar appreciation



Sources: FRB St Louis, FRED; CPB, Netherlands Bureau of Economic Policy Analysis; Bloomberg; Datastream; IHS Markit.

Figure 5: Impulse responses of global trade growth to dollar appreciation

Table 1: Nowcasting PMIs with the first principal component of financial variables

	Full sample	Pre-GFC	Post-GFC
PMI_{t-1}	0.944	0.944	0.943
Δpc_t	0.215	0.200	0.077
R^2	0.936	0.910	0.912
RMSE	0.843	0.906	0.950

Note: All coefficients and RMSE are significant at 1%. RMSE is computed as the ratio over a plain AR(1) benchmark; significance is determined by Clark and McCracken (2012) test. Full sample: 2/1998 – 10/2019 (261 observations); pre-GFC: 2/1998 – 12/2007 (119 observations); post-GFC: 1/2010 – 10/2019 (118 observations).

Sources: FRB St Louis, FRED; Bloomberg; Datastream; ICE BofAML indices; IHS Markit; MSCI.

3 Financial Variables and PMIs: What Has Changed?

We now turn to the relationship between PMIs and financial conditions. Erik et al. (2019) shows that equity prices, corporate bond spreads, and the broad dollar index are good predictors of current-month PMIs.⁶ Building on this earlier work, we estimate monthly regressions of the form

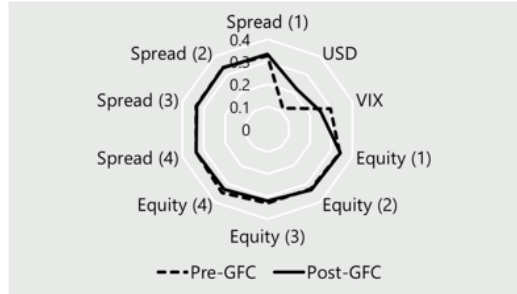
$$PMI_t = \alpha + \beta \Delta pc_t + \phi PMI_{t-1} + \epsilon_t \quad (1)$$

where PMI_t is the global manufacturing PMI release in month t , and pc_t is the first principal component of monthly changes in a set of financial indicators that include equity prices, corporate bond spreads, the VIX, and the broad dollar index. As before, we compute the monthly changes over a 30-day period around central PMI survey dates so as to mimic market information available on average to purchasing managers at the time of the poll.

Table 1 compares the PMI nowcasting performance of the principal component model with the model based on the global composite equity price index, the best performing one in Erik et al. (2019). A test for superior in-sample predictive ability (Clark and McCracken 2012) highlights significant gains over a benchmark model that only includes lagged PMIs. One notable finding is that the nowcasting gains diminish when the GFC period is excluded from the sample. Another is that estimated coefficients are smaller in the post-GFC sample. However, the nowcasting gain, as measured by RMSE, remains significant (Erik et al. 2020).

To shed further light on the results, we examine how the principal component factor loadings have evolved over time. Figure 6 compares the loadings in the pre- and post-GFC periods (1998-2007 and 2010-2019). It highlights the changes

⁶Conversely, Peláez (2003) showed that releases of the US PMI influence bond and equity prices, trading activity in the Treasury bond market, and interest rates in US Treasury and Eurodollar markets.



Sources: FRB St Louis, FRED; Bloomberg; Datastream; ICE BofAML indices; IHS Markit; MSCI.

Figure 6: Factor loadings of the first principal component of financial variables

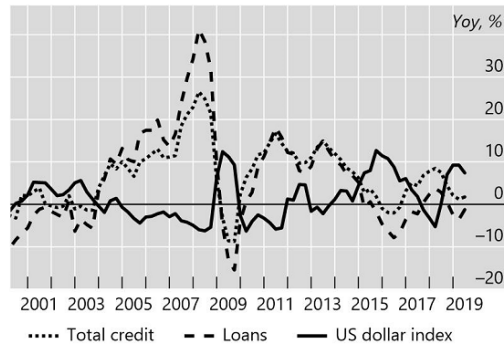
in the loadings of the dollar and the VIX: the dollar loading has increased, and the VIX loading has decreased. This evidence is consistent with the results in Forbes and Warnock (2020) and Miranda-Agrippino and Rey (2020), which also note the diminished post-crisis role for the VIX. Notably, the sign of the dollar loading is negative, that is, dollar appreciation acts as a drag on global PMIs, consistent with Bruno and Shin (2015, 2019).

4 Role of the Dollar Post-GFC

What could explain the greater role of the dollar as a determinant of global economic activity? One possible channel is through determinants of risk capacity, and in particular the role of the dollar exchange rate as an indicator of this risk capacity (Bruno and Shin (2015)). Indeed, the dollar is closely correlated with the growth of dollar-denominated credit outside the United States. Figure 7 shows the four-quarter growth rates of lending in dollars to emerging market economies (EMEs) and the four-quarter change in the EME-weighted dollar index.⁷ The two series are negatively correlated: when the dollar strengthens, lending in dollars to EMEs slows.

The negative relationship between dollar strength and growth of dollar credit may be explained by the financial channel of exchange rates, which works through the greater liquidity of assets (Diamond, Hu, and Rajan 2020), or through fluctuating lending capacity of banks that intermediate US dollar credit (Bruno and Shin 2015). If a global bank has a diversified portfolio of loans to borrowers around the world, a broad-based depreciation of the dollar results in lower tail risk in the bank's credit portfolio and a relaxation of the bank's Value-at-Risk (VaR) constraint. The result is an expansion in the supply of dollar credit through increased leverage. In this way, a broad depreciation of

⁷Figure 7 shows total credit/loans to non-banks in EMEs. For the US dollar index, FRB other important trading partners dollar index, goods.



Sources: FRB St Louis, FRED; Datastream; Dealogic; Euroclear; Thomson Reuters; Xtrakter Ltd; national data; BIS locational banking statistics.

Figure 7: Dollar-denominated credit to emerging market economies and US dollar index

the dollar is associated with greater risk-taking by banks.

Interestingly, Niepmann and Schmidt-Eisenlohr (2019) shows that domestic credit in the United States also has a negative relationship with the dollar, even to firms in the nontradeables sector. The mechanism is through the demand from institutional investors in the secondary market for loans originated by US banks.

The resulting shifts in dollar credit conditions may affect financing requirements for manufacturing firms, especially those participating in global supply chains. These firms generally have large working capital financing requirements because they need to carry on their balance sheet inventories of intermediate goods, and often of accounts receivable when selling to other firms along the supply chain (Bruno, Kim, and Shin 2018). With manufacturing and, increasingly, services being globally integrated, dollar credit conditions would therefore have some impact on economic activity along global supply chains. Shousha (2019) shows that real activity in emerging market economies is negatively affected by a stronger dollar.

Another explanation of the impact of a stronger dollar on global trade is the invoicing channel of trade. Gopinath and Stein (2018a, 2018b) show that when the US dollar is used as an invoicing currency for trade, the volume of trade between two countries (neither of which is the United States) may experience a decline because of the competitive implications of dollar invoicing. Both in the invoicing and our channel, a stronger dollar is associated with weaker trade activity. The invoicing channel works through the bilateral dollar exchange rate against the export destination country. Bruno and Shin (2019) uses matched firm- and bank credit-level data from Mexico and finds evidence of both the invoicing and financing channels.

Overall, the findings in our paper suggest that structural changes have oc-

curred in the banking sector after the GFC.

Most notably, the mantle of the barometer of risk capacity and leverage has slipped from the VIX and passed to the dollar. Risk capacity appears to be better measured through the broad dollar index than the VIX. The formal banking sector has remained subdued, giving way to market-based financing and non-bank intermediation. We have explored some implications for real economic activity of this shift. Future research will undoubtedly uncover more details.

References

- Adrian, Tobias, and Hyun Song Shin.** 2010. “Liquidity and Leverage.” *Journal of Financial Intermediation*, 19 (3): 418–37.
- Adrian, Tobias, and Hyun Song Shin.** 2014. “Procyclical Leverage and Value-at-Risk.” *Review of Financial Studies, Society for Financial Studies*, 27 (2): 373–403.
- Avdjiev, Stefan, Wenxin Du, Cathérine Koch, and Hyun Song Shin.** 2019. “The Dollar, Bank Leverage, and Deviations from Covered Interest Parity.” *American Economic Review: Insights*, 1 (2): 193:208.
- Bruno, Valentina, Se-Jik Kim, and Hyun Song Shin.** 2018. “Exchange Rates and the Working Capital Channel of Trade Fluctuations.” *AEA Papers and Proceedings*, 108: 531–6.
- Bruno, Valentina, and Hyun Song Shin.** 2015. “Capital Flows and the Risk-Taking Channel of Monetary Policy.” *Journal of Monetary Economics*, 71: 119–32.
- Bruno, Valentina, and Hyun Song Shin.** 2019. “Dollar Exchange Rate as a Credit Supply Factor— Evidence from Firm-Level Exports.” Bank for International Settlements Working Paper 819.
- Clark, Todd E., and Michael W. McCracken.** 2012. “In-Sample Tests of Predictive Ability: A New Approach.” *Journal of Econometrics*, 170 (1): 1–14.
- Diamond, Douglas W., Yunzhi Hu, and Raghuram G. Rajan.** 2020. “The Spillovers from Easy Liquidity and the Implications for Multilateralism.” *IMF Economic Review*, 68: 4–34.
- Erik, Burcu, Marco Jacopo Lombardi, Dubravko Mihaljek, and Hyun Song Shin.** 2019. “Financial Conditions and Purchasing Managers’ Indices: Exploring the Links.” *Bank for International Settlements Quarterly Review*, 23 (3): 65–79.
- Erik, Burcu, Marco Jacopo Lombardi, Dubravko Mihaljek, and Hyun Song Shin.** 2020. “Financial Conditions, the Dollar and Real Economic Activity.” Bank for International Settlements Working Paper, forthcoming.

- Forbes, Kristin J., and Francis E. Warnock.** 2020. “Capital Flow Waves— or Ripples?: Extreme Capital Flow Movements in an Era of Easy Monetary and Tight Macroprudential Policy.” *AEA Papers and Proceedings*, 110, forthcoming.
- Gopinath, Gita, and Jeremy C. Stein.** 2018a. “Banking, Trade, and the Making of a Dominant Currency.” NBER Working Paper 24485.
- Gopinath, Gita, and Jeremy C. Stein.** 2018b. “Trade Invoicing, Bank Funding, and Central Bank Reserve Holdings.” *AEA Papers and Proceedings*, 108: 542–46.
- Miranda-Agrippino, Silvia, and Hélène Rey.** 2020. “The Global Financial Cycle after Lehman.” *AEA Papers and Proceedings*, 110, forthcoming.
- Niepmann, Friederike, and Tim Schmidt-Eisenlohr.** 2019. “Institutional Investors, the Dollar and U.S. Credit Conditions.” International Finance Discussion Paper 1246.
- Peláez, Rolando F.** 2003. “A Reassessment of the Purchasing Managers’ Index.” *Business Economics*, 38 (4): 35–41.
- Shousha, Samer.** 2019. “The Dollar and Emerging Market Economies: Financial Vulnerabilities Meet the International Trade System.” International Finance Discussion Paper 1258.

Appendix

Figure 1: Total assets and book equity of 17 US and 26 euro area banks

United States	Bank of America Corporation; Bank of New York Mellon Corporation; Capital One Financial Corporation; Citigroup Inc.; Citizens Financial Group Inc.; Fifth Third Bancorp; JPMorgan Chase & Co.; Morgan Stanley; Goldman Sachs Group Inc.; Northern Trust Corporation; PNC Financial Services Group Inc.; Regions Financial Corporation; State Street Corporation; SunTrust Banks Inc.; Truist Financial Corporation; U.S. Bancorp and Wells Fargo & Company.
Euro area	AIB Group Plc; Banca Monte dei Paschi di Siena SpA; Banco Bilbao Vizcaya Argentaria SA; Banco Bpm SpA; Banco de Sabadell SA; Banco Popular Español SA; Banco Santander SA; Bank of Ireland Group; Bankia SA; BNP Paribas SA; CaixaBank SA; Commerzbank AG; Crédit Agricole SA; Crédit Industriel et Commercial SA; Deutsche Bank AG; Dexia SA; Erste Group Bank AG; ING Groep NV and Nordea Bank Abp.; Intesa Sanpaolo SpA; KBC Group NV; Natixis SA; Raiffeisen Bank International AG; Société Générale SA; UniCredit SpA; Unione di Banche Italiane SpA.

Sources: Datastream Worldscope; authors' calculations.

Figure 2: Leverage and VIX index

Leverage	Total assets divided by equity for the broker-dealer sector in the US.
VIX	CBOE Volatility Index.

Sources: Federal Reserve, Flow of Funds; Bloomberg; authors' calculations.

Figure 3: Deviation from covered interest parity

US dollar index	Federal Reserve Board trade-weighted US dollar index, broad, goods.
Mean cross-currency basis spread	Mean of five-year cross-currency basis spread across AUD, CAD, CHF, DKK, EUR, GBP, JPY, NOK, NZD and SEK.

Sources: Federal Reserve Bank of St Louis (FRED); Bloomberg; authors' calculations.

Figure 4-5: Impulse responses of global PMIs (excluding the US) and global trade growth to dollar appreciation

World equity price	Weighted average of equity prices in major local stock exchanges across 32 economies based on GDP and PPP exchange rates.
US dollar index	Federal Reserve Board trade-weighted US dollar index, other important trading partners, goods.
Global PMI	Simple average of manufacturing PMIs across 31 economies (excluding the United States) (less countries for earlier periods due to data constraints).
Global trade growth	World trade volume index, seasonally adjusted.

Sources: Federal Reserve Bank of St Louis (FRED); CPB Netherlands Bureau of Economic Policy Analysis; Bloomberg; Datastream; IHS Markit; authors' calculations.

Figure 6: Factor loadings of the first principal component of financial variables

Equity (1)	MSCI All Country World Index, local currency (2,844 constituents; large and mid-cap firms in 23 advanced economies and 26 EMEs; US (56%), Japan (7%), UK (5%), China (4%), France (3%), others (25%)).
Equity (2)	MSCI All Country World Industrials Index, local currency (432 constituents).
Equity (3)	MSCI Emerging Markets Index, local currency (1,194 constituents).
Equity (4)	Weighted average of equity prices in major local stock exchanges across 32 economies based on GDP and PPP exchange rates.
Spread (1)	ICE BofAML Global Corporate Index, investment grade, option adjusted spread (14,404 constituents).
Spread (2)	ICE BofAML Global High Yield Index, below investment grade, option adjusted spread (3,131 constituents).
Spread (3)	ICE BofAML Global Non-financial Corporate Index, investment grade, option adjusted spread (10,346 constituents).
Spread (4)	ICE BofAML Global Industrial Index, investment grade, option adjusted spread (8,430 constituents).
VIX	CBOE Volatility Index.
USD	Federal Reserve Board trade-weighted US dollar index, broad, goods.

Sources: Federal Reserve Bank of St Louis (FRED); Bloomberg; Datastream; ICE BofAML indices; MSCI; authors' calculations.

Figure 7: Dollar denominated credit to emerging market economies

Total credit	Total credit denominated in USD to non-banks in EMEs.
Loans	Loans denominated in USD to non-banks in EMEs.
US dollar index	Federal Reserve Board trade-weighted US dollar index, other important trading partners, goods.

Sources: Federal Reserve Bank of St Louis (FRED); Dealogic; Euroclear; Thomson Reuters; Xtrakter Ltd; national data; BIS local banking statistics; authors' calculations.

Table 1: Nowcasting PMIs with the first principal component of financial variables

PMI_{t-1}	Global manufacturing PMI.
Δpc_t	First principal component of the following variables: equity (1-4), spread (1-4), VIX and USD (see note for Figure 6 for variable descriptions).

Sources: Federal Reserve Bank of St Louis (FRED); Bloomberg; Datastream; ICE BofAML indices; IHS Markit; MSCI; authors' calculations.

Previous volumes in this series

846 March 2020	Financial Crises and Innovation	Bryan Hardy and Can Sever
845 March 2020	Foreign banks, liquidity shocks, and credit stability	Daniel Belton, Leonardo Gambacorta, Sotirios Kokas and Raoul Minetti
844 February 2020	Variability in risk-weighted assets: what does the market think?	Edson Bastos e Santos, Neil Esho, Marc Farag and Christopher Zuin
843 February 2020	Dollar borrowing, firm-characteristics, and FX-hedged funding opportunities	Leonardo Gambacorta, Sergio Mayordomo and José Maria Serena
842 February 2020	Do credit card companies screen for behavioural biases?	Hong Ru and Antoinette Schoar
841 February 2020	On fintech and financial inclusion	Thomas Philippon
840 February 2020	Operational and cyber risks in the financial sector	Iñaki Aldasoro, Leonardo Gambacorta, Paolo Giudici and Thomas Leach
839 February 2020	Corporate investment and the exchange rate: The financial channel	Ryan Banerjee, Boris Hofmann and Aaron Mehrotra
838 January 2020	The economic forces driving fintech adoption across countries	Jon Frost
837 January 2020	Bad bank resolutions and bank lending	Michael Brei, Leonardo Gambacorta, Marcella Lucchetta and Bruno Maria Parigi
836 January 2020	FX spot and swap market liquidity spillovers	Ingomar Krohn and Vladyslav Sushko
835 December 2019	The Cost of Steering in Financial Markets: Evidence from the Mortgage Market	Leonardo Gambacorta, Luigi Guiso, Paolo Emilio Mistrulli, Andrea Pozzi and Anton Tsoy
834 December 2019	How do machine learning and non-traditional data affect credit scoring? New evidence from a Chinese fintech firm	Leonardo Gambacorta, Yiping Huang, Han Qiu and Jingyi Wang
833 December 2019	Central Counterparty Exposure in Stressed Markets	Wenqian Huang, Albert J. Menkveld and Shihao Yu

All volumes are available on our website www.bis.org.