

The dollar and real economic activity: an evolving relationship

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How do financial conditions affect real economic activity, and how have the transmission channels changed since the Great Financial Crisis (GFC)?

We shed light on these questions by examining the empirical relationship between global manufacturing Purchasing Managers' Indices (PMIs) and indicators of global financial conditions. Of particular interest in our study is the 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 also exerts influence through its impact on financial conditions.

The particular focus of our paper is on how the transmission channels of financial conditions on real economic activity may have changed since the Great Financial Crisis (GFC). Recent changes in financial intermediation bear on this question. First, the banking sector has been noticeably subdued in the post-crisis period, especially in the 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. Assets and equity grew strongly before the crisis, but they have subsequently grown noticeably more slowly.¹ Euro area banks have been especially subdued, and have seen steady contraction of total assets since the GFC.

Given the importance of bank intermediation for real activity, we may ask how the subdued growth of the banking sector may have affected the pricing of bank balance sheet capacity. One notable recent devel-

opment is the breakdown of covered interest parity (CIP) after the crisis. 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.

Figure 2 taken from Avdjiev et al. (2019) shows the average across 10 advanced economy currencies of the difference between the money market interest rate and the implied interest rate for that currency in the FX swap against the US dollar. Figure 2 reveals that whereas CIP held pretty well before the crisis, it broke down after the crisis.² Avdjiev et al (2019) show that a dollar appreciation is associated with a widening of the CIP deviation, with this empirical association holding even in first differences and even at daily frequency. For this reason, Avdjiev et al. (2019) argue that the broad dollar index serves as a good concurrent indicator of bank balance sheet costs.

To the extent that financial conditions are good predictors of manufacturing PMIs and real economic activity more broadly, we may expect the channels of transmission of financial conditions may also have undergone changes 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. 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. Indeed, we show that in the post-crisis period, a strong dollar has emerged as a concurrent indicator that is associated with weak global trade growth, adding weight to the recent literature that has emphasized the

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¹See online appendix and Erik et al. (2020) for full list of banks.

²See online appendix for definitions of variables and data sources for all figures.

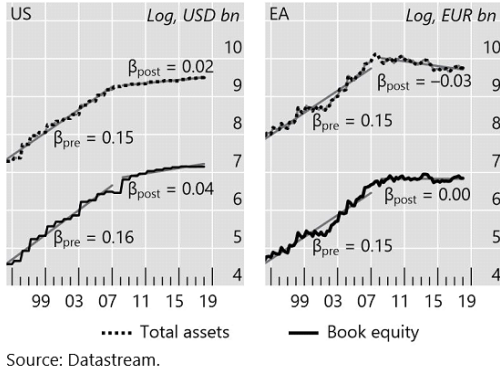


Figure 1. : Total assets and book equity of 17 US and 26 euro area banks

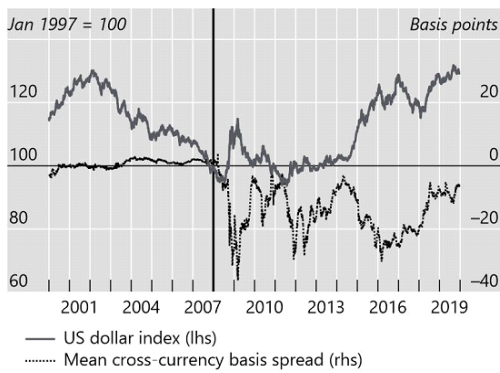


Figure 2. : Deviation from covered interest parity

trade-dampening effect of dollar appreciation (Gopinath and Stein (2018a, 2018b), Bruno and Shin (2019)).

I. The evolving relationship between the dollar and trade growth

We investigate more systematically the changes in the dollar exchange rate and real activity through a small-scale VAR.

The VAR features, in order, changes in world equity prices, changes in the dollar index, global manufacturing PMI (excluding the US), and global trade growth.³ The number of lags is fixed at 6. We compute

³Changes in world equity prices are computed as the weighted average of major stock exchange indices across 32 economies. For the US dollar index, FRB other important trading partners dollar index, goods.

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.⁴ This ordering defines a Choleski identification that is underpinned by the timing of financial variables: the 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 motivates the assumption that changes in equity prices and dollar indices are order first, i.e. 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 that financial market participants process and incorporate 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.⁵ 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.

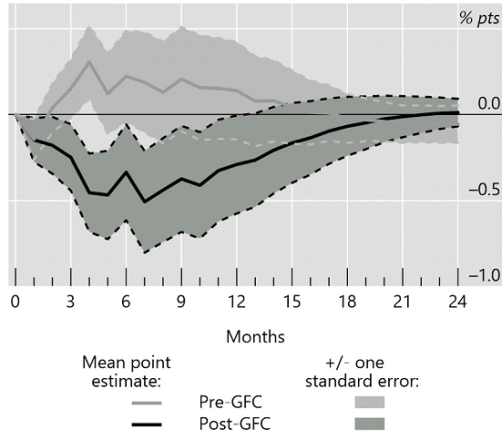
Estimating this VAR on pre- and post-GFC samples highlights a striking change in the transmission of US dollar shocks.⁶ Figure 3 reports the impulse responses of global trade growth to US dollar shocks.⁷ Before the GFC, unexpected dollar appreciation boosted world trade growth (gray line). After the GFC, unexpected dollar

⁴The additional assumption is that the survey respondents fill their questionnaires on average around the central date of the polling window.

⁵This 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.

⁶We excluded the GFC from the sample on purpose, so that the effect of the crisis does not dominate the system's dynamics.

⁷The impulse responses of global PMIs (not shown here) look very similar.



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

Figure 3. : Impulse responses of global trade growth to dollar appreciation

appreciation depresses world trade growth, despite making dollar-denominated exports cheaper (black line).

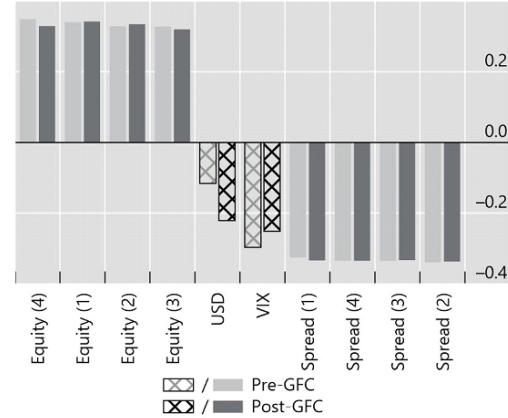
II. Factor loadings on PMI principal component

Erik et al. (2019) show that equity prices, corporate bond spreads and the broad dollar index are good predictors of current-month PMIs.⁸ Building on this earlier work, we estimate monthly regressions of the form

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

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 nominal effective exchange rate of the US dollar (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.

⁸Conversely, Peláez (2003) showed that the US PMI releases 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 4. : Factor loadings of the first principal component on financial variables

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 model that only includes lagged PMIs. On the other hand, the nowcasting gains diminish when the GFC period is excluded from the sample, and estimated coefficients are smaller in the post-GFC sample. However, the nowcasting gains as measured by RMSE remains significant.

To shed further light on the results, we examine how the principal component factor loadings have evolved over time. Figure 4 compares the loadings in the pre- and post-GFC periods (1998-2007, and 2010-19, respectively). The loading on the dollar has grown at the expense of the loading on the VIX. This evidence is consistent with the results in Forbes and Warnock (2019), who find a diminished role for the VIX in explaining capital flows. The sign of the dollar loading is negative, i.e. dollar appreciation acts as a drag on global PMIs, consistent with Bruno and Shin (2015, 2019).

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*
Δpct	0.215*	0.200*	0.077*
R^2	0.936	0.910	0.912
RMSE	0.843*	0.906*	0.950*

Note: * denotes results significance at the 1% level. 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.

III. Role of the dollar post-GFC

Our findings suggest that global trade and manufacturing PMIs may be understood by reference to the notion of the global financial cycle, as developed by Miranda-Agrippino and Rey (2019).

One channel that may be implicated in these findings is that the dollar exchange rate is closely correlated with the growth of dollar-denominated credit. Figure 5 shows the four-quarter growth rates of lending in dollars to emerging market borrowers, together with the four-quarter change in the emerging market economies dollar index.⁹ We see the negative correlation between the two: when the dollar strengthens, lending in dollars slows.

There also seems to be a structural change around the GFC. In the pre-crisis period, banks drove the overall growth in dollar credit. After the crisis, bank-intermediated dollar credit has been much more subdued compared to the overall dollar credit, which has expanded through the issuance of debt securities.

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 (2019)) 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

⁹Figure 5 shows total credit/loans to non-banks in EMEs. For the US dollar index, FRB other important trading partners dollar index, goods.

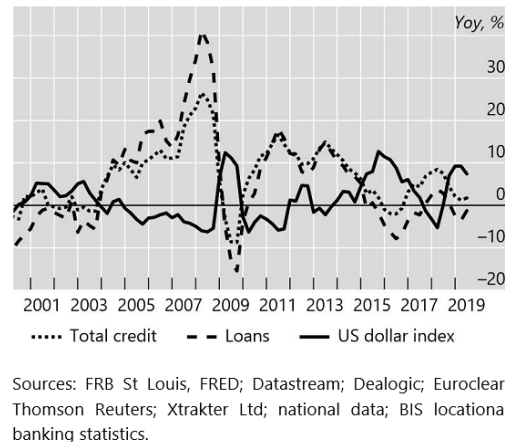


Figure 5. : Dollar denominated credit to emerging market economies

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

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 et al. (2018)). When these financing requirements go beyond the firms' own resources, the necessary working capital is typically provided via short-term bank credit. Much of this credit tends to be supplied in dollars, which means that its cost is sensitive to the dollar exchange rate. With manufacturing and, increasingly, ser-

vices being globally integrated, dollar credit conditions would therefore have some impact on economic activity along global supply chains.

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 does not appeal to the cost of financing, and works through the bilateral dollar exchange rate against the export destination country, while the financial channel works through the broad dollar index. Bruno and Shin (2019) use a matched firm- and bank credit-level data from Mexico and find evidence of both the invoicing and financing channels.

Overall, the findings in our paper suggest that structural changes have occurred in the banking sector after the GFC. Banks financing themselves in dollar wholesale markets have become a less important source of financing for manufacturing firms participating in global supply chains, and have given way to direct financing by firms in the dollar bond market. We have explored some implications for real economic activity of this shift. Future research will undoubtedly uncover more details.

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