Dollar Liquidity, Trade Invoicing and Real Effects: Evidence from India*

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Abstract

We provide causal evidence on the linkage between dollar liquidity and dollar invoicing exploiting an unanticipated shock to the dollar financing around the Taper Tantrum. Using the differential funding shock across countries, we test the impact of dollar liquidity on invoicing and imports by Indian firms using transaction-level data. We find that (i) firm-level dollar invoicing drops in response to dollar funding shock with corresponding rise in Euro and producer currency pricing, (ii) local presence of foreign banks allows Indian firms to smooth-out the liquidity shock, and (iii) firms transfer liquidity from one market to another using their internal capital markets to smooth-out country specific funding shocks.We document that firms unable to maintain the level of dollar invoicing are more likely to lose a trade connection.

JEL Codes: F32, F40, G15.

Keywords: Currency Invoicing, Dollar Funding, Importers, Switch, Taper Tantrum.

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1 Introduction

A growing body of literature documents the important role played by the US dollar in international trade and finance. For example, a significant fraction of international trade is invoiced in the dollar, even between non-US partners (Gopinath (2005); Goldberg & Tille (2008)). Non-financial corporations (Bruno *et al.* (2017); Gutiérrez *et al.* (2020); Acharya & Vij (2020)) as well as exporting firms (Gopinath & Stein (2020)) both rely heavily on dollar debt. This reliance on the dollar extends to banks (even non-US ones) where they obtain substantial dollar funding (Shin (2012)) and simultaneously engage in dollar lending (Ivashina *et al.* (2015)). However, this dependence on the dollar exposes these foreign banks to the dollar liquidity shocks (Khwaja & Mian (2008); Schnabl (2012)) which affects credit conditions for domestic exporters and importers and can result in contraction of international trade.[1] In short, there is ample evidence that the "dollar funding channel" plays a crucial role in international trade.

Despite this extensive research work linking the dollar liquidity shocks with trade, little is known whether the dollar liquidity shocks matter for trade invoicing. After all, if the cost of dollar funding increases as it did during the Global Financial Crises of 2008 or the Taper Tantrum Shock of 2013, it is natural to expect that importers would attempt to reduce their dollar invoicing. However, more importantly, the resultant inability of importers to provide dollars can affect their trade volume and linkages, given that exporters might be more willing to trade with partners who can commit to dollar invoicing. This is especially true when exporters obtain dollar funding towards their working capital needs as in Gopinath & Stein (2020).

We fill this first-order gap in the literature by providing the causal link between the dollar liquidity shock induced by the Taper Tantrum episode in 2013 and its impact on importer-level dollar invoicing. We document that this shock led to a sharp drop in the dollar invoicing. This

[1] See Amiti & Weinstein (2011); Bruno & Shin (2020); Manova (2012); Paravisini *et al.* (2014); Chor & Manova (2012). Moreover, bank health is found to affect exports disproportionately more than the domestic sales, given the higher working capital requirements for the exporters (Amiti & Weinstein (2011)).

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resultant drop in dollar invoicing has large real consequences for trade volume and connections, consistent with the narrative in the above paragraph. We call this impact the "invoicing channel" of the international trade. Our results highlight the precise mechanism, namely the dollar invoicing, through which dollar funding shocks affect trade. Our result that the dollar liquidity shock reduces the dollar invoicing assumes significance on the backdrop of the recent findings that dollar invoicing across countries, both emerging and advanced, has been stable over the years (Boz *et al.* (2020)). However, these findings are based on aggregated annual invoicing data. We overcome this data limitation by using the transaction-level invoicing data on Indian imports and identifying firm-level variation in the dollar invoicing induced by the dollar funding shock after the Taper Tantrum.

After committing to keeping the interest rates low for the foreseeable future, an unexpected hint of "tapering-down" the bond-buying program by the Federal Reserve on May 22, 2013 lead to a frenzy of capital outflows, including banking flows, back to the US from around the world. This resulted in a shortage of dollar funding, a spike in dollar funding costs, and depreciation of most currencies against the dollar (Avdjiev & Takáts (2014)). For example, between May and September, the Indian Rupee (INR) depreciated by 14%, the Indian stock market index fell by 2.35%, and the Indian government bond yields hardened by 100 basis points. We exploit the cross-sectional variation of this taper-induced dollar liquidity shock across India's trade partners to identify the impact of dollar liquidity on dollar invoicing. In particular, as a baseline, we define our *funding shock* as the drop in quarterly growth rate in cross-border dollar claims on banks of a country around the taper episode, as in Avdjiev & Takáts (2014).[2] Crucially, our taper-induced dollar funding shock is uncorrelated with a host of pre-taper country characteristics such as reliance on the dollar funding, GDP per capita, and sovereign credit ratings. Our identification finally comes from comparing the change in the dollar-invoicing for a given importing firm from pre- to post-taper period across its multiple trading partners, exposed differentially to the taper shock.

[2]Hence a positive value of shock means that a country has experienced a drop in the growth rate of cross-border banking dollar claims.

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Our first set of results establish the causal link between the taper-induced dollar funding shock and the dollar invoicing. Using our granular data we trace out invoicing variation around taper for a given firm across its partners deferentially hit by the taper shock, essentially controlling for its unobserved demand for the dollar invoicing at any point in time. We find that in response to the dollar funding shock, firms reduce their dollar invoicing when importing from countries that are more severely hit by the funding shock. This decline in dollar invoicing has a significant quantitative magnitude as well. A one-standard-deviation increase in funding shock reduces firm-level dollar invoicing by 162 basis points. Additionally, we show that our results are primarily driven by the group of "treated" partners that experience large dollar capital outflows during this period. Moreover, the drop in dollar invoicing is compensated by the rise in Euro invoicing. However, this increased Euro invoicing is driven by non-EU members. We also find some support in favor of shift to producer price currency.

These results are robust to controlling for time-invariant as well as time-varying country characteristics such as exchange rate, domestic GDP growth, and for a variety of definitions of the funding shock. Consistent with the fact that international trade contracts are drawn up in advance, we find no immediate impact on the dollar invoicing after the Taper Tantrum, i.e., in May or June 2013. However, July–September witness a sizeable negative impact on dollar invoicing. By the end of September, the Federal Reserve clarified that "taper strategy" would not be implemented. Accordingly, we find a reversal in the level of dollar invoicing to the pre-taper levels by the end of 2013. In this sense, the dollar liquidity shock has a short-lived effect on dollar-invoicing once the dollar funding market returns to normalcy.

So far, our results on change in dollar invoicing are based on changes in aggregate country-level dollar funding for banks. To demonstrate the role of the cross-border bank funding channel more clearly, we exploit the uneven presence of foreign banks in India. The idea being that the presence of a foreign bank in India can facilitate the Indian importers to secure dollar funding during period of low dollar liquidity. This hypothesis is consistent with the recent evidence that

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banks specialize in export markets to build long-term relationships, boosting international trade (Claessens *et al.* (2017)). In our case, we find that firms are able to maintain dollar invoicing with a given partner country if its bank is present in India, even when that country has experienced a sizable dollar liquidity shock. This result highlights the importance of banking relationships in the dollar funding market and, more importantly, identifies the dollar invoicing variation attributable to the dollar liquidity shock.

Our setting also allows us to test for the efficiency of the firm's internal capital markets. In particular, we document that firms having a "healthy connection" – a pre-taper trade relationship with a country not facing the dollar liquidity shock during the taper, are able to ride out of dollar liquidity shocks in other partner countries. In fact, the reduction in dollar invoicing is entirely concentrated within the group of firms not having any healthy connection. Hence, we provide strong evidence in favor of the role played by internal capital markets for firms engaged in trade across multiple locations.

Having documented the causal link between the dollar liquidity and invoicing, we turn to a more substantive question. We ask if such a shift from dollar invoicing has any real consequences for the firms. When exporters are also scrambling to obtain dollar funding, they might prefer to trade with importers who can fulfill the need for dollars. We provide evidence consistent with this narrative, both on the extensive and intensive margin. We show that "invoicing" of trade is not a sideshow and can amplify the effects of the funding shortages on trade.

We find that the survival of a trade connection (firm-partner country) is more sensitive to dollar invoicing in the post-taper period. In particular, for a given firm, a trade connection with higher dollar invoicing is more likely to survive next month (relative to its other trade connections) in the post-taper months relative to pre-taper months. We obtain this result by absorbing firm $\times$ month fixed-effects to control for the average survival probability of connections for a given firm. In a similar spirit, we also document that firms with a large drop in average dollar invoicing between pre- and post-taper months are more likely to lose at least one trade connection. Moreover, this

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effect is more substantial for the partner countries with a more severe funding shock. Additionally, we find that conditional on survival, the trade volume is also increasing in the dollar invoicing. In summary, firms that can provide dollar liquidity when financial intermediaries cannot, are able to maintain their trade volume and connections.

1.1 Related Literature

Our paper contributes to the growing literature on the dollar invoicing or more broadly dominant currency paradigm in the international trade. Most of this literature has focused on documenting the dominance of dollar invoicing (Goldberg & Tille (2008); Gopinath (2005)) or Euro invoicing (Kamps (2006)) and plausible equilibrium mechanisms. For instance, preference for a stable macroeconomic structure of the invoicing currency (Devereux 2004), stability of prices relative to large competitors who find it optimal to price the goods in their own currency generating a coalescing effect (Bacchetta & Van Wincoop (2005); Goldberg & Tille (2008)), or hedging and trade costs (Portes & Rey (1998); Devereux & Shi (2013)) can lead to dollar invoicing.[3] More recently, Boz *et al.* (2020) documents that dollar invoicing patterns are stable over the years across many countries. However, to the best of our knowledge, our paper is the first to focus on the dynamics of dollar invoicing. We show that dollar funding conditions affect the firm-level invoicing choices and that such dynamic invoicing choices have real consequences. Therefore, our more direct contribution is to link dollar funding with dollar invoicing empirically.

Recently, Gopinath & Stein (2020) show how these two features of trade and funding feed into each other, giving rise to dollar dominance in both markets. Dollar invoicing creates a large demand for safe dollar deposits, which forces financial intermediaries to offload these in the dollar loans market at cheaper rates by "walking up the supply curve". This cheaper source of funding makes it attractive for exporters to price the goods in dollars in the first place. Our paper

[3]Further extension in this literature has documented the linkages between currency of invoicing and frequency of price adjustments (Gopinath & Itskhoki (2011)), exchange rate pass-through to domestic prices (Boz *et al.* (2019)). On the other hand we focus on impact of shifts in dollar invoicing itself on the trade outcomes.

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contributes to this strand of work by providing causal evidence for the impact of dollar funding conditions on choice of invoicing.

Our paper is also connected to the vast strand of literature linking the credit conditions with trade outcomes. For example, firms linked to unhealthy banks (Amiti & Weinstein (2011)) or banks exposed to capital reversals (Paravisini *et al.* (2014)) suffer in terms of exports growth. Manova (2012) documents that credit conditions affect exports over and above the direct effect coming through the contraction of the domestic output.[4] We contribute to this literature by highlighting an entirely new channel through which credit conditions affect trade outcomes, namely the *dollar invoicing* channel. In particular, we show how the firms that can maintain dollar invoicing can retain trade connections and trade volumes.

Finally, our paper shows how banking relationships and firms' internal capital markets can help sustain dollar funding and, in turn, dollar invoicing. We provide clean evidence that the local presence of the partner country banks enables Indian firms to smooth-out dollar liquidity shocks in the partner country. The evidence that foreign bank's presence smooths out funding shocks for local firms is consistent with recent evidence in Paravisini *et al.* (2020). They show that foreign-banks specialize in the export markets and hence may not cut the local lending in response to banks' internal capital markets as in Cetorelli & Goldberg (2012).[5] Similarly, we show how firms can smooth dollar liquidity shocks through their internal capital markets as well. The reduction in dollar invoicing happens only in the case of firms that have no partner country that is immune to dollar funding shock.

More broadly, our results also shed light on the role played by importing firms in providing

[4] A number of papers also document the importance of trade finance during great trade collapse of 2008 (see for example Chor & Manova (2012); Bricongne *et al.* (2012); Levchenko *et al.* (2010). Even the dollar's strength as a proxy of credit conditions is shown to affect export performance (Bruno & Shin (2020)).

[5] Our finding runs counter to the strand of literature documenting that greater financial integration exacerbates the effect of foreign shocks on the domestic economy (Forbes & Rigobon (2002); Goldberg (2001); Bekaert *et al.* (2005); Jotikasthira *et al.* (2012); Cetorelli & Goldberg (2012)). Similarly, Schnabl (2012) documents that during Russian default crises of 1998, foreign banks cut the bank-to-bank lending to local firms. At the same time, there is considerable evidence that foreign-owned banks increase lending after financial crises relative to domestic banks (Diamond & Rajan (2001); Peek & Rosengren (2000); Detragiache *et al.* (2008)).

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dollar liquidity in times of stress via dollar invoicing to their exporters and that exporters value such liquidity provisioning. It is related to the work describing how firms engage in carry trades by borrowing in foreign currency and building cash buffers (Acharya & Vij (2020); Bruno & Shin (2020)). Since we utilize Taper Tantrum event to build our empirical strategy, we also add to the literature documenting its effects on the financial and non-financial sectors (see Avdjiev & Takáts (2014), Li (2019), and Sahay *et al.* (2014)).

We describe our empirical methodology in the next section, followed by the data description. Section 4 presents the main empirical results. We test the main channels in Section 5 and document the real consequences of invoicing choices in Section 6. Section 7 concludes.

2 Empirical Methodology

In this section, we describe how we use the taper-tantrum event to construct our identification strategy. We first present the construction of dollar funding shock. We then describe how we measure the impact of dollar funding on dollar invoicing using this shock.

2.1 Description: Dollar Funding Shock

On January 25, 2012, the Federal Reserve (Fed) stated that it would maintain low-interest rates "at least through late 2014" as part of its forward guidance policy. However, on May 22, 2013, Fed Chairman Ben Bernanke reversed this policy and spoke about the possibility of tapering off the bond-buying program before the earlier-stated deadline. It led to a sharp impact on cross-border capital flows, exchange rates, equity prices, and credit default spread across many economies. Most importantly, the shock had an enormous impact on dollar funding available in various countries.

We exploit the cross-sectional heterogeneity of capital outflows across countries following this unanticipated event to construct our dollar funding shock at the exporting country-level. Using

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this shock, we measure the sensitivity of the dollar invoicing of Indian imports to changes in dollar funding across exporting countries. The dollar funding shock in the exporter's location can impact invoicing choices of Indian importers in multiple ways. First, a substantial fraction of trade-funding in India is provided by the foreign banks or their subsidiaries operating in India. A shock to dollar funding in an exporting country would impact dollar funding available with its banks, which, in turn, would impact how much trade-credit they can provide to Indian importers.[6] Second, the funding shock to exporters can spill-over to importers if exporters cut the duration of trade-credit due to lack of dollar funding. In either case, the shock would impact dollar funding available with Indian importers.

Dollar Funding Shock: Following Avdjiev & Takáts (2014), we measure our dollar funding shock as a change in the growth rate of dollar funding available in a country around the taper-tantrum episode of May 22, 2013. The information on dollar funding comes from the Bank of International Settlement (BIS), which we describe in the next section. In particular, for a country c, the $n - quarter$ horizon shock is defined as:

$$\text{Shock}_c = -\frac{1}{n}\left[\sum_{\tau=0}^{n-1} g_{c\tau} - \sum_{\tau=-1}^{-n} g_{c\tau}\right] \tag{1}$$

where

$$g_{c\tau} = \frac{\text{Dollar Funding}_{c\tau}}{\text{Dollar Funding}_{c\tau-1}} - 1 \tag{2}$$

and denotes the Quarter-on-Quarter (Q-o-Q) growth rate in cross-border Dollar funding for quarter τ. The variable $\tau = 0$ corresponds to Quarter (Q) 2, 2013, i.e., the quarter corresponding to the taper-tantrum event. Therefore, Equation 1 denotes the change in average Q-o-Q funding growth before and after the taper-tantrum. We consider two cases for shock construction with $n = 1$ and $n = 2$. For $n = 1$, our shock is the difference in funding growth rate between Q1 and Q2, 2013.

[6] Cite Report and Numbers. Claessens *et al.* (2017) provide evidence for this trade-credit channel through presence of foreign banks.

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For $n = 2$, it captures the difference in average funding growth between Q4, 2012 and Q1, 2013 vs. Q2 and Q3, 2013. Therefore, a larger dollar outflow from c after taper-tantrum would give $shock_c$ a positive value in both cases. In the results section, we present estimates based on $n = 2$. However, $n = 1$ gives similar results and provides a robustness check for shock construction.

One critical assumption for constructing $shock_c$ is that we assign Q2 2013 to the post-taper period even if the taper-tantrum occurred in the middle of the quarter. This assignment is motivated by the fact that most emerging nations felt the taper impact on capital flows, exchange rates and equity prices in May and June. Sahay *et al.* (2014) documents that all major emerging countries experienced a severe negative Z-score on capital flows during May and June of 2013, potentially dominating any action that happened prior to taper-tantrum in that quarter.[7] For example, Mexico, Turkey, South Africa, and China all experienced at least three standard deviation shock to capital flows in June while India, Indonesia, and Thailand experienced around two standard deviation of shock to capital flows. We present summary statistics on $shock_c$ in Section 3.

2.2 Identification Strategy

We exploit the cross-country variation in dollar funding shock, $shock_c$, to measure dollar funding impact on dollar invoicing. We primarily employ a Difference-in-Differences (DD) estimation strategy for this exercise. We aggregate transaction-level imports data at firm×partner×month level and compare invoicing patterns before and after the taper-tantrum. We assign January–May 2013 to our pre-period and June–December 2013 to the post-taper-tantrum period, which provides our first difference. The second difference comes from the partner-level, or cross-country, variation in $shock_c$. Our primary dependent variable is the fraction of imports invoiced in dollar at the firm×partner×month level. We denote it by $\$\,inv_{ict}$, where i, c, and t indexes the firm,

[7] Sahay *et al.* (2014) defines the Z-score as the "variable normalized by historical variances". See page 17 and page 18 for definition and the data.

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the exporting partner, and the month respectively.[8] The impact of the funding shock is captured through the following specification:

$$\$inv_{ict} = \delta_{it} + \beta_0 \left[shock_{\,c}\right] + \beta_1 \left[\mathbb{1}_{t \in Post} \times shock_{\,c}\right] + \theta' \left[\text{Country-Controls}_{ct}\right] + \varepsilon_{ict} \tag{3}$$

where the main coefficient of interest is β_1 on the interaction term $\mathbb{1}_{t \in Post} \times shock_{\,c}$, where $\mathbb{1}_{t \in Post}$ takes a value one after May 2013, else zero. β_1 captures the impact of funding shock on dollar invoicing, $\$\,inv_{ict}$, across the countries affected differentially by this shock. Therefore, the identification comes by comparing the response of dollar invoicing of a given firm before and after taper-tantrum and across multiple trade-partners affected differentially by the shock. Essentially, we test if, within a given firm, the impact on dollar invoicing differs across the partner countries due to partner's exposure to the funding shock. To account for firm-level time-varying demand factors, the above specification also includes $firm \times month$ fixed effects (δ_{it}) similar to Jiménez *et al.* (2012). A prime example of unobserved factors would be firm's preference for dollar invoicing in response to changing business or investment opportunity set. Other firm-level unobserved covariates such as the firm's financial position, shocks to its local bankers are also absorbed by the firm $\times$ month fixed-effects, δ_{it}. Our identification differs from that in Paravisini *et al.* (2014) where they absorb product$\times$destination$\times$time fixed-effects, which absorbs demand fluctuations of a product in a given destination. It allows them to compare the export performance of two firms exporting the same product to the same destination, but where firms connected to banks are affected less by a credit shock. Instead, we track fluctuating invoicing choice within a firm across multiple destinations.

[8]The fraction of dollar imports is computed over all the imports transactions for which invoicing currency is available.

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3 Data

We utilize transaction-level customs data on Indian imports from 2013. The data correspond to three ports in Delhi and is obtained from a private vendor. Each transaction provides us a firm identifier, customs clearing date, port of export/import, HS8 code of the product, the value of transaction (denominated in the US Dollars), quantity, country of export/import, and most importantly, the currency of invoicing. The data contain over twenty million transactions and covers 95 percent of imports via Delhi in 2013.

We report firm-level import statistics in Table 1. We report information on the number of firms, partner countries, average import value per firm, and other similar variables, for the pre- and post-taper tantrum period. We find that the average number of firms transacting each month decreases after the taper-tantrum. However, the number of multi-invoice firms increases marginally. We also see a reduction in average trade value in the latter period. The number of multi-partner firms is around 900 in both periods. As our identification comes from exploiting within-firm variation across partners, our sample provides sufficient heterogeneity to estimate the causal impact of dollar funding shock. An average firm has 1.6 and 1.8 partners in the pre- and post-period reflecting the fact that larger firms were better able to survive the dollar funding shock. Average firm uses an average of 1.2 currencies for invoicing.

Table 2 provides further information related to firm-level invoicing in our data. Panel (a) shows that the invoicing patterns in our data are similar to the aggregate official invoicing shares of currencies reported by the Reserve Bank of India. The US dollar is the dominant currency for import invoicing with a share of over 78 percent, followed by euro with an invoicing share of 14 percent. Next, we report heterogeneity in the count of invoicing currency vs. trading partners at the firm-level in Panel (b). Panel I shows the percentage of firms by the count of transactions, and Panel II provides similar information for the value of transactions. A total of 64.5 percent of firms have only one partner country and use only one currency (Panel I). However, these firms are

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small, and the total value of their imports account for only 9.8 percent. Panel II shows that the value of imports is dominated by firms with five or more trading partners (last row). These firms frequently use more than one currency for invoicing. Since our identification would depend on this set of firms, the above statistics suggest that we are capturing a significant share of imports in our analysis.

Now we describe the other crucial data source that we use to construct the funding shock variable. It comes from the locational statistics on cross-border claims provided by the Bank of International Settlement (BIS).[9] The data provides the cross-border claims on a country by currency×instrument×sector of counterparty at a quarterly frequency. In particular, we focus on two types of cross-border claims in our analyses. First, is the USD denominated cross-border banking claims on a country. Second is the aggregate USD denominated claims on a country which includes both bank and non-bank claims. Non-bank sector mainly includes claims by non-bank financial corporations such as mutual funds, hedge funds, insurance companies, money-market funds, security brokers and similar entities. The main results in the paper are based on cross-border banking claims; however, the results are similar for aggregate cross-border claims.

Finally, we explore whether foreign bank presence in India mitigated the effects of funding shock. To test this, we collect information on the presence of the foreign banks in India on March 31, 2013, from the Reserve Bank of India.

4 Results

In this section we present our main results documenting the shift in invoicing currencies after the taper-shock as well as highlight what determines this shift.

[9] See Table A6.1 on BIS statistics for more details.

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4.1 Anatomy of Funding Shock

Before moving to the main results, we describe here the properties of taper-induced funding shock in Table 3. In the full sample of 139 countries, the median value of funding shock is -1% with a standard deviation of 40% (Panel (a)).Lower middle income countries lost substantial capital with dollar funding (banking) growth rate falling by 5% for a median country, however, many of the advanced economies also lost dollar funding post taper episode as highlighted by the fact that 25th percentile advanced country dropping the growth rate in bank dollar funding by nearly 8%, same as that for the lower income countries. We also compute the shock statistics for the group of 23 countries whose banks have a presence in India just prior to the taper episode. Though it is true that on average, these countries have lost less dollar capital, there is a substantial cross-sectional variation within this group with quarter of these countries registering at least 3% drop in dollar funding growth rate.

Next, we provide correlation across various alternative measures of defining funding shock and some important macro variables in Panel (b). Column (1) shows that our preferred shock variable has high correlation with alternative shock definitions. Specifically, we construct alternative shocks by considering shorter window around taper, and also by considering cross-border dollar funding from all sources instead of just banking shock with other measures of shock. Hence our main findings are not sensitive to the exact definition used to construct the shock. More importantly, our shock is uncorrelated with other ex-ante characteristics of the partner country, such as dependence on dollar funding level, GDP per capita, and sovereign ratings (row 6-10). It makes our funding shock unanticipated, both in timing as well as severity.

4.2 Funding And Dollar Invoicing

In this section, we tackle the core question of the paper, namely if the Indian firms respond to dollar funding shock by cutting down the dollar invoicing on their imports. To this end, we

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employ a standard Difference-in-Difference (DiD) estimation specified in equation 3 by regressing the fraction of firm-country-month imports invoiced in dollars on the country's dollar funding shock and its interaction with the post-taper period dummy. We estimate the differential change in dollar invoicing at the firm-country pair level between the pre- and post-taper months by utilizing the heterogeneity in funding shock intensity across countries. In the baseline case, our funding shock variable is the difference in growth rates of cross-border dollar banking flows between (Q4,2012 & Q1, 2013) and (Q2 & Q3, 2013). Since we subtract the average post-taper period dollar funding growth (banking sector) from the pre-taper growth, the funding squeeze is captured as the dollar outflow from a country and corresponds to a positive value of shock.

We report the baseline results in column (1) of Table 4. The coefficient on the interaction term, $\mathbb{1}(Post) \times$ Funding Shock, is negative (-0.109) and significant. It reflects a reduction in the fraction of firm-country imports invoiced in dollars for the countries experiencing more severe funding shock relative to countries not experiencing such a funding shock. A one-standard-deviation change in funding shock translates into 162 basis points (bp) change in dollar invoicing. As our baseline specification includes Firm×Month fixed-effects, we identify the impact of the dollar funding shock by copmparing the dollar invoicing for the same firm across its multiple partners exposed deferentially to the shock. This specification allows us to control any observable or unobservable factors affecting the firm-demand in a particular month for dollar invoicing as in Jiménez *et al.* (2012). Our results indicate that if a firm reduces dollar invoicing on average across all its partners in the post-period, it does more so in the countries that are hit more strongly by the funding shock.

Our baseline specification relies on within-firm variation, where identification comes from the set of firms having at least two partner countries present in both the pre- and post-taper period. Typically these multi-partner firms are larger and less credit constrained due to access to financial markets in multiple. Therefore, we expect these multi-partner firms to be among the least affected by such funding shocks. Thus, the impact on dollar invoicing in response to the funding shock

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using Firm×Month fixed-effects captures a lower bound of the impact of the dollar funding shock on the invoicing.

Next, we increase the set of firms in our estimation by absorbing firm and month fixed-effects separately. It includes all those firms that have at least one transaction in both periods. The results for this specification are reported in column (2). We find that the dollar invoicing drops more for partners experiencing a more severe funding shock. The sign and magnitude of the interaction coefficient is similar to the one in column (1).

Since our funding shock is at the country level, our results may be driven by country-level characteristics. To address this concern, we control for country fixed-effects in column (3) along with firm and month fixed-effects, thereby comparing if *within-country* the change in the dollar invoicing from pre- to post-taper period is related to the funding drop. Once again, the coefficient on $\mathbb{1}(Post) \times$ Funding Shock is negative and significant, suggesting that in countries with higher funding drop, the post-period dollar usage is lower than pre-period systematically. Additionally, the invoicing patterns may be affected not due to the funding shock but due to changes in other macroeconomic conditions correlated with funding shock in the partner country. Note that we can not control for Country×Month fixed-effects as our shock is defined at the country level. However, to ameliorate the possible impact of other macroeconomic variables, we include time-varying country characteristics like currency depreciation and exports growth in column (4) as in Chor & Manova (2012). The interaction coefficient increases by 50% as compared to column (1) once we isolate the effect of funding shock from other variables.

Next, we test if the invoicing sensitivity to funding shock is non-linear with a prior that it becomes stronger with the severity of shock. We split our sample of partner countries into two groups – those experiencing a drop in funding or dollar outflow, i.e., positive shock (column (5)), and others that did not experience such a drop (column (6)). The results indicate that the effect of funding shock on dollar invoicing is concentrated within countries where dollar funding eroded post-taper. The interaction coefficient in column (5) is -0.219 and significant. Moreover, the

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magnitude of this coefficient is more than twice the average effect obtained in column (1). Hence in a country experiencing a 15% drop in growth rate of cross-border dollar banking flows port taper, (approximately one-standard-deviation), firms reduce dollar invoicing by 300 basis points. However, they do not increase dollar invoicing in the post-period in countries that experience an increase in the dollar funding, as the interaction coefficient is not significant in column (6).

4.2.1 Product-Level Heterogeneity

Now we extend the results to incorporate heterogeneity in invoicing at the product-level. Paravisini *et al.* (2014) show that international trade is highly seasonal, and the product mix changes over the months, even within the same firm-country pair. The average invoicing patterns may differ across product groups. Hence the observed invoicing change at the firm-country-month level during taper tantrum could be instead driven by a shift in the product mix. To alleviate this concern, we construct the data at *firm-country-product-month* level, where the product group is identified at HS 2-digit level. We show that the response of dollar invoicing post-taper is robust even within the product group.

In columns (7) and (8) of Table 4, the dependent variable is the fraction of dollar invoicing for a given firm-country-product-month. we again obtain large negative interaction coefficient in both the columns implying that the dollar invoicing reduces in response to the funding shock even within the same product category.

In column (7), we absorb the Firm×Month and Product×Month fixed effects separately. The Product×Month fixed-effects control average dollar invoicing used to trade that product identified at HS 2-digit level during that month across all the trading pairs. In column (8), we identify variation at the Firm×HS 2-digit×Month level. In essence, column (8) shows a relatively higher drop in dollar invoicing for a given HS 2-digit product by the same firm between the pre- and post-taper months averaged across its partners.

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In a nutshell, Table 4 establishes a novel fact that dollar invoicing is sensitive to dollar funding, even within a narrow product range. After the taper episode, countries experiencing an erosion in dollar funding used less dollars on average to trade. Next, we conduct a battery of tests to show that our results are robust to alternate measures of shocks, specifications and set of countries.

4.2.2 Month-By-Month Effects of Funding Shock on Invoicing

Identifying Assumptions: The key identifying assumption for our difference-in-differences estimation is that the trend of dollar invoicing in the pre-period for a given firm would have continued in the post-period in the absence of the taper funding shock. This identification allows the falling or rising trend of invoicing across all the countries, as well as the difference in the average level of invoicing across treated and control countries. This could be the case if the countries which were hard-hit by the shock may be structurally different than those not so severely affected. What our identification requires is that the dollar invoicing for a given firm was not falling (or rising) at a rate different across the treated and the controls countries.To validate the identifying assumption, we estimate our DID model in equation 3 by interacting monthly dummies with the country shock variable and examine the pre-trends of dollar invoicing across treated and control countries as is standard in the literature. We absorb the Firm×Month fixed effects as in the baseline. The results are presented in Figure 1 with April 2013 as our baseline month.

The estimation shows that coefficients on interaction terms until May 2013 are statistically not different than zero. Hence, our results are not driven by the possibility that the dollar invoicing share was falling faster (or rising slower) in the treated countries even prior to the taper shock. The results also rules out the reverse-causality. For example, the dollar funding shock could be the results of the fact that the firms in the affected countries were reducing the dollar invoicing in the pre-period. However we rule out this to be the case by showing similar trends in dollar invoicing across treated and control countries. As the figure highlights, the firms trading with countries that faced a higher funding squeeze reduced reliance on dollar invoicing relatively more

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in the post-taper period.

Transitory Shifts in Dollar Invoicing: The figure also shows that the dollar invoicing fell relatively more in the countries affected by the shock between July and September with the difference magnifying the most in the month of September. The dollar invoicing recovers to the pre-shock levels by November.

The fact that we do see limited effects in the month of June is consistent with the fact that international trade contract are negotiated in advance. For example, on average, goods remain on vessels for 20 days between Europe and the USA (Hummels & Schaur (2013)), and it takes anywhere between 10 to 25 days in developed and Asian countries to clear the exports formalities before loading the goods (Djankov *et al.* (2010)). More significant changes to dollar invoicing take place between the July-September quarter. On 18 September, Federal Reserve issued the statement that it will not be descaling the bond-buying program at a rapid pace, which alleviated the taper-risk. Consistent with this, we see recovery in the month of October and full recovery in the dollar invoicing by November. These results and the timeline over which dollar invoicing shifted provides a robust evidence that dollar invoicing is causally linked to the dollar funding and taper episode provides a clean identification of this linkage.

4.2.3 Robustness

Alternate Measures of Shocks: In Table 5, we test the main results above by using alternate definitions of funding shocks. In column (1), we use aggregate cross-border dollar funding from all the institutions instead of just cross-border bank dollar funding component to define the shock. Here the shock is the drop in the growth rate of aggregate cross-border dollar funding between two quarters before and after the taper event as before. In columns (2) and (3), instead of using shock to growth rates, we use shock to the level of funding – cross-border bank dollar funding in column (2), and cross-border aggregate dollar funding in column (3). In column (4), we use a

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tighter one-quarter window around the taper event measured by the drop in the growth rate of cross-border dollar bank funding between Q1 of 2013 to Q2 of 2013, as most of the capital outflow took place in the last week of May and month of June 2013 in response to the event. The results are robust to all these alterations as the interaction coefficient is negative and significant in all columns.

Excluding Dominant Country and the USA: One feature of the imports data is that certain countries might be dominant partners, thereby constituting a relatively larger share of observations. To correct this imbalance in the panel, we weigh each firm-county-month observation by the inverse of the frequency that the country shows up in the data (column (5)). The results are robust even after such correction. In column (6), we exclude China, which constitutes 30 percent of our transactions, to ensure that it is not driving our results. Our results continue to hold for the remaining subset of countries.

Alternate Dependent Variables: Finally, in the last column, we change the dependent variable from the fraction of value invoiced in dollars to the fraction of transactions invoiced in dollars at the firm-country level. We give equal weight to each transaction irrespective of its size and tackle the concern that invoicing dynamics might differ across large and small transactions. Again, the results are robust to using this alternate dependent variable, and the interaction term coefficient is similar in magnitude to that in column (1) of Table 4.

4.2.4 Alternatives To Dollar Invoicing

If the importers reduced the extent of the dollar invoicing while trading with the countries experiencing dollar funding shock, which currencies did they end up using? In Table 6 we document this shift to other currencies by employing the same difference-in-differences model, except that the dependent variable now is the fraction of firm-country imports invoiced in currency x, where we analyze multiple choices for x. Column 3 documents a strong relative spike in the usage of Euro

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post-taper in the countries facing dollar funding shock, which is not surprising given that EURO is the second largest vehicle currency in the international trade. However, what is interesting is that this shift from dollars to Euro is attributable to import transactions with non-Eurozone countries. The imports from Eurozone countries are already dominantly invoiced in Euros, leaving little room for a further upward shift (column (5)). Despite this pre-taper preference for dollar invoicing, the firms adjusted swiftly in the post-taper period to invoice in Euros – the magnitude of coefficient on the interaction substantially nullifies the pre-taper dollar preference effect in column (3) and (4). We also find that there is a significant shift towards producer currency invoicing (Column (2)). This perhaps reflects the outcome of the bargaining process that ensues post taper in the wake of the dollar funding shortage.

However, we find no evidence of any major shift towards invoicing in domestic currency INR (Column 1) or currencies which were formerly *dominant*, namely Yen (Columns (6)) and GBP (Columns (7)).

5 Mechanisms

5.1 Foreign Bank Presence Matters

The results suggest that countries, hard-hit by funding shocks, witnessed a significant shift away from dollars and towards Euro for trade invoicing. This is a clear reflection of the dollar shortage, hurting the patterns of trade invoicing. Indian importers are affected by the shock in the exporter's country because a significant fraction of trade finance is intermediated using the cross-border banking flows, potentially in conjunction with lead domestic banks. In India's case, the data from the Reserve Bank of India shows that roughly one-third of import credit before the taper event was financed by foreign banks (Jain *et al.* (2019)).

In this section, we pin down the role of cross-border bank financing behind the changes in the

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pattern of trade invoicing. We exploit the cross-sectional variation across India's trading partners arising due to an uneven presence of partner-country banks or their subsidiaries in India (foreign banks henceforth). Claessens *et al.* (2017) document that the presence of importing country's bank in exporting country boost the exports to those countries. On the other hand, we analyze the importance of the presence of exporting county's banks on imports and patterns of invoicing in importing countries. We test the following hypothesis. If a foreign country's bank is operational in India, then obtaining dollar funding on a preferred basis would be relatively easier for firms importing from these countries than firms importing from countries with no banking presence in India. The presence of a foreign bank in India suggests better trade finance ties. Such ties should become even more crucial during the taper tantrum. This is also consistent with the recent evidence in Paravisini *et al.* (2020) showing that foreign banks tend to specialize in certain export markets.

To this end, we create a country-level dummy variable *Foreign Bank Presence* indicating if any parent bank belonging to the partner-country or its subsidiary is present in India just before the taper funding shock, as on March 31, 2013. Banks from around 23 countries were operational in India, with a total of 326 branches in 2013. These 23 countries are a good mix of developed and emerging markets. We have the U.S., U.K, Germany, France, and Japan, among other developed nations. It also includes Thailand, Indonesia, South Africa, Russian, the U.A.E., other middle eastern countries as well as smaller countries like Bangladesh. This alleviates the concern that bank presence in India is merely a proxy of exporter country development.

We estimate the same DID model as before, and report the results in Table 7. Column (1) shows that funding shock has no impact on the fraction of dollar invoicing for countries with foreign bank presence in India. On the other hand, column (2) shows that the shift away from dollar invoicing is significant only for countries with no banking presence in India. The coefficient on interaction is -0.20, which is double than the baseline coefficient reported in column (1) of table 4. The results clearly highlight that having presence of foreign banks allows importers to obtain

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the dollar funding relatively easily. More importantly, it helps us pin down the role of funding shocks for trade invoicing patterns.

One potential concern with these results is that the distribution of funding shock across the two groups of countries, with and without banking presence in India, could be different. Indeed, the countries having no bank presence in India suffered a larger median drop in the growth rate of cross-border bank dollar funding of around 6.35%. Hence, the larger coefficient on the interaction term in column (2) could instead be capturing the intensity of shock rather than the effects of foreign banking ties. We tackle this concern in columns (3) and (4) by estimating the results within the countries which experienced drop in the growth rate of dollar banking capital denoted by the dummy variable $\mathbb{1}$(Positive Shock). There is no effect on the dollar invoicing for the countries with bank presence in India even if they were hit by a severe shock (column (3)). On the other hand, firms importing from countries with no bank presence show a substantial drop in dollar invoicing (column (4)) in the post-taper period.

Overall, the results strongly support the role that trade credit plays for invoicing patterns.

5.2 Internal Capital Markets Matters

So far, we have analyzed the impact of country-level dollar funding shock on dollar invoicing by the firms trading with that country. However, next we study if the country shocks spillover to the other countries through the firms having multiple trade connections. Alternatively, we test if firms are able to utilize their cross-border banking connections to smooth-out the country-specific shocks. In spirit, this hypothesis is similar to Shin & Stulz (1998). They document that investments of individual segments of multi-segment firms depend upon cash flows of other segments, which reduces their sensitivity to segment-specific cash-flows. On the other hand, it is also possible that an adverse firm-specific shock exacerbates the country-shock. This analysis is more directly connected to Matvos & Seru (2014) who document how the internal capital markets within the

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firm provides an important force countervailing the financial markets dislocations.

To this end, we create a "leave-one-out" firm-shock (specific to country c) denoted by $Firmshock_{i/c}$ as the shock to firm i net of the funding shock contribution by country c as follows:

$$FirmShock_{i/c} = \sum_{c' \in C_i/c} \frac{w_{ic',pre}}{1 - w_{ic,pre}} \times shock_{c'} \tag{4}$$

where C_i/c denotes the pre-taper tantrum set of partners for firm i excluding c, and $w_{ic',pre}$ denote the pre-taper average trading weight of firm i with country c'.[10] $shock_{c'}$

which defines firm-shock as a weighted average of country-shocks over the rest of the firm's trading partners, excluding the partner in contention, for each firm-country pair. The weights are given by the fraction of pre-taper trading volume with each of the trading partners. Table 8 documents the importance of firm-shocks for dollar invoicing by absorbing Country×Month fixed effects. Column (1) shows that firm's funding position in other countries does not lead to any significant drop in dollar invoicing in a given country. This result holds even if we consider only the firms severely affected by the funding shock in other countries (Column (2)). An average country did not experience the drop in the dollar funding post-taper. Our results in column 1 and 2 imply that firm's could use market within that country to smooth out the firm-level shocks elsewhere.

However, we next focus on the countries facing the dollar funding shock in column 3. The interaction between the post-dummy and the firm-shock elsewhere is economically large and statistically significant with the coefficient of -0.06. Given that we absorb country× Month fixed effects, the results imply that in the cross-section of the firms operating within a given country-month, those facing larger funding shocks elsewhere reduce dollar invoicing more relative to the firms not facing dollar funding shock in other countries. Alternatively, one can interpret this result as suggesting that firms having relatively comfortable dollar funding position are able to smooth-out country-specific dollar funding shocks and experience lower cut in the dollar invoicing.

[10] The weights on the remaining partners c' are re-scaled to sum to one.

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The results are robust even when we consider a fully saturated model involving interactions.[11]

We test the internal capital markets hypothesis more directly in Table 9. We test if having a "healthy trading connection" can ameliorate shocks that firms face in other trading destinations. In particular, we label a firm-country relationship as healthy during a specific month if that partner did not suffer a drop in the growth rate of cross-border banking dollar funding during taper and if at least 25% of firm's imports during that month are accounted for by that partner. We create a dummy "has a healthy partner" to indicate if a firm has at least one healthy connection during the month.[12]

Table 9 show that firms having healthy connection are do not reduce dollar invoicing due to country-specific shocks (column (1)) and even in the case if the country shock is severe (column (2)). On the other hand, column (3) shows that dollar invoicing is highly sensitive to the country-shocks for the firms not having any healthy connection during the month, and the sensitivity rises with the severity of country shocks (column (4)). In column (5), we confirm the finding using a fully saturated model with all the interactions. The country-shock reduces the dollar invoicing (coefficient of -0.17) but much less if the firm has a healthy connection (as the triple interaction has a positive coefficient of 0.12).

In a nutshell, Tables 8 and 9 provide consistent evidence that having multiple trading connections allows a firm to utilize its internal capital markets whereby it can smooth out the country-level funding shocks by arranging funding from other partners. However, we also document that firm's funding situation can exacerbate the country-shocks especially.

[11] However, column (4) shows that though firm-shock matters within a country-month, these don't exacerbate the effect of country-shocks as triple interaction between country-shock, firm-shock, and post-taper dummy is insignificant.

[12] Results are robust to other definitions of a healthy partner.

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6 Real Consequences of Invoicing

6.1 Extensive Margin: Trade Connections

A large body of trade literature documents how the funding shocks curtails the real activity measured by imports and exports. In this section, we document our novel finding that changes in the extent of dollar invoicing induced by dollar funding shock has real consequences in terms of trade connections. In other words, we highlight the precise channel through which the funding shocks matter for the trade outcomes. Table 10 provides evidence that firms maintaining dollar invoicing in the post-period are better able to sustain trade connections. In other words, our results indicate that firms which are able to supply dollar liquidity after the funding shock are valued by their exporters. We absorb Firm-Month fixed effects as well as country fixed effects. Therefore our estimation controls for the average probability that the firm loses the connections next month due to firm's observed or unobserved factors.

In panel A, using our DiD framework, we estimate the probability that the firm-country pair ceases to exist from next month as function of dollar invoicing in the current month for that pair. That is, we estimate the probability that the connection is lost from next month on wards and never re-appears in the year 2013. In column (1), the coefficient on the interaction of the post-period and the dollar invoicing is negative and significant, equal to -0.029. It indicates that during post-taper period, a given firm is 2.9% less likely to lose its trade connection next month (compared to its average probability of loss of connection next month across all current partners) with a country where its usage of dollar invoicing is higher by one unit (compared to its average usage that month across its partners). Focusing only on the countries which experienced funding drop during the taper, column (2) shows that using more dollar invoicing reduces the probability of losing such a trade-connection by multiple times — with a negative coefficient of -0.064. While using more dollars in the non-affected countries has no significant effect on the probability of connection loss (column (3)). Note that we also include country fixed-effects in each regression. The results are

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also robust instead of controlling for Country×Month fixed-effects, thereby enabling to compare firms within a country.

The results provide strong support to the "liquidity provisioning role" of trade-invoicing. By invoicing in dollars, the importers are effectively supplying dollar liquidity to the exporter, relaxing exporter's dollar funding constraints. Exporters prefer to trade with liquidity-providing importers in the post-taper period and especially in the countries where dollars are in short supply post the taper event. The result shed light on how invoicing induced liquidity plays important role during the crises episodes.

As a robustness in Panel B we also consider a pair-level cross-sectional specification to test the extensive margin results.We label a pair as destroyed in the post-period if it never appears in the post-period ever. Then we estimate the probability that a pair is destroyed in the post-period as a function of average change in the dollar invoicing for the firm in question, computed over all the pre-period and surviving post-period connections that the firm has.

The result in column 4 strongly corroborate the liquidity provision view. Firms whose average dollar invoicing has increased are less likely to lose any given pair. The magnitude is economically large with 1 unit increase of dollar invoicing from pre- to post-period reduces the probability of pair destruction by 14.5%. The specification controls for country and firm fixed effects. Hence, we control for the average probability for the firm to lose a pair. The results are even stronger for the connections in the countries suffering larger drop in the dollar funding (Column 5). However, we see no effect in the countries where dollar funding did not evaporate during taper.[13] The result suggests that firms having better ability to provide dollars to its exporters — reflected in the increased average dollar invoicing post-taper also maintain its pre-taper connections with higher probability. The average dollar invoicing is a reflection of firm-level dollar liquidity.

[13]Note that the average dollar invoicing is computed only over the surviving pairs by construction

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6.2 Firm-Level Real Consequences

The above analysis documents that a firm not able to provide dollar liquidity is more likely to lose out a trade connection, especially when the exporter's country is hit with severe funding shock. However, it could be that a firm is able to form a new trade connection or leverage other its existing trade connections to compensate for the lost connection. We present the evidence that this is not the case. In particular, we show that firms reducing the dollar invoicing in the post-period suffer loss trade value and volume at the firm-level, confirming that the firm is not able to use other trade links to substitute for lost connections.

Table 11 present the evidence. Column 1 shows that in a cross-section of firms during a given month, firms with lower dollar invoicing engage in relatively lower firm-wide imports in nominal terms as indicated by the positive interaction between firm-level dollar invoicing and the post-period. We improve upon our results by considering firm-product trade in columns 2 and 3, where product is identified by HS2 code. Event the firm-product-month trade in the post-period months is lower for firms using lower dollar invoicing for that product-month. We control for product-month fixed effects to tackle any product-wide seasonality or product-specific supply or demand factors for that month. We additionally absorb for firm-product pair fixed effect. Hence our results are robust to any firm-specific demand factors for that product. The results are robust whether we use nominal trade value or quantity of trade as indicated by positive interaction of firm-product-month dollar invoicing and the post-period dummy.

In summary, we present the robust evidence that firms lose trade connections due to shifts in dollar invoicing induced by dollar funding shock and that firm is unable to substitute the lost trade by forming other connections as evidenced by the drop in firm-wide imports level.

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7 Conclusion

This paper supports the fact that currency of trade invoicing is impacted by trade funding using a novel transaction level imports data from India. We use seemingly exogenous variation in the intensity of dollar funding squeeze across India's export partners around the taper tantrum episode in 2013. We find that dollar invoicing dropped by 162 basis points for firms in countries with one standard deviation higher dollar squeeze. Our headline result is robust to alternate measures of dollar invoicing, definitions of the dollar shock, looking within firm-product-country category, and to excluding India's biggest trade partners.

Apart from establishing a switch away from dollar for an average firm-country pair affected by dollar squeeze, we test the duration of impact, which currency the firms switched into, heterogeneity of effect across different partner classifications, within-firm spillovers, and the real consequences of invoicing. The dollar invoicing returned to pre-taper levels by October 2013 as it became clear that the Federal Reserve would not raise interest rates. In the meanwhile, firms preferred to switch to other dominant currency, the Euro, when dollar was unavailable. These effects were concentrated in countries which saw a dollar funding squeeze, and there was no effect in countries which saw a dollar inflow during the event. Having foreign bank branches in India helped alleviate the dollar shortage. We find evidence of significant spillover within firms. Dollar invoicing within firm-country pair fell more when a firm was impacted by dollar squeeze with its other trade partners, where as having trade links with other countries which did not see a dollar squeeze helped with dollar invoicing in affected countries. Finally, we document real consequences of funding squeeze by showing that a firm is less likely to lose a trade connection with a country where its dollar invoicing is higher.

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References

Acharya, Viral, & Vij, Sidharth. 2020. Foreign Currency Borrowing Of Corporations As Carry Trades: Evidence from India. *NBER Working Paper*.

Amiti, Mary, & Weinstein, David E. 2011. Exports and Financial Shocks. *The Quarterly Journal of Economics*, **126**(4), 1841–1877.

Avdjiev, Stefan, & Takáts, Előd. 2014. Cross-border bank lending during the taper tantrum: the role of emerging market fundamentals. *BIS Quarterly Review*, 09.

Bacchetta, Philippe, & Van Wincoop, Eric. 2005. A theory of the currency denomination of international trade. *Journal of international Economics*, **67**(2), 295–319.

Bekaert, Geert, Harvey, Campbell R., & Ng, Angela. 2005. Market Integration and Contagion. *The Journal of Business*, **78**(1), 39–69.

Boz, Emine, Gopinath, Gita, & Plagborg-Møller, Mikkel. 2019. Dollar Invoicing and the Heterogeneity of Exchange Rate Pass-Through. *AEA Papers and Proceedings*, **109**(May), 527–532.

Boz, Emine, Casas, Camila, Georgiadis, Georgios, Gopinath, Gita, Mezo, Helena Le, Mehl, Arnaud, & Nguyen, Tra. 2020. Patterns in Invoicing Currency in Global Trade. *IMF Working Paper Series*, **126**(20).

Bricongne, Jean-Charles, Fontagné, Lionel, Gaulier, Guillaume, Taglioni, Daria, & Vicard, Vincent. 2012. Firms and the global crisis: French exports in the turmoil. *Journal of International Economics*, **87**(1), 134–146.

Bruno, Valentina, Shim, Ilhyock, & Shin, Hyun Song. 2017. Comparative assessment of macroprudential policies. *Journal of Financial Stability*, **28**, 183–202.

Bruno, Valentina Giulia, & Shin, Hyun Song. 2020. Dollar and Exports. *Bank for International Settlements Working Paper*.

Cetorelli, Nicola, & Goldberg, Linda S. 2012. Liquidity management of U.S. global banks: Internal capital markets in the great recession. *Journal of International Economics*, **88**(2), 299 – 311. NBER Global.

Chor, Davin, & Manova, Kalina. 2012. Off the cliff and back? Credit conditions and international trade during the global financial crisis. *Journal of International Economics*, **87**(1), 117 – 133. Symposium on the Global Dimensions of the Financial Crisis.

Electronic copy available at: https://ssrn.com/abstract=3806450

Claessens, Stijn, Hassib, Omar, & Van Horen, Neeltje. 2017. *The Role of Foreign Banks in Trade.* CEPR Discussion Papers 11821. C.E.P.R. Discussion Papers.

Detragiache, Enrica, Tressel, Thierry, & Gupta, Poonam. 2008. Foreign Banks in Poor Countries: Theory and Evidence. *The Journal of Finance*, **63**(5), 2123–2160.

Devereux, Michael B., & Shi, Shouyong. 2013. VEHICLE CURRENCY*. *International Economic Review*, **54**(1), 97–133.

Diamond, Douglas W., & Rajan, Raghuram G. 2001. Banks, short-term debt and financial crises: theory, policy implications and applications. *Carnegie-Rochester Conference Series on Public Policy*, **54**(1), 37–71.

Djankov, Simeon, Freund, Caroline, & Pham, Cong S. 2010. Trading on Time. *The Review of Economics and Statistics*, **92**(1), 166–173.

Forbes, Kristin J., & Rigobon, Roberto. 2002. No Contagion, Only Interdependence: Measuring Stock Market Comovements. *The Journal of Finance*, **57**(5), 2223–2261.

Goldberg, Linda, & Tille, Cédric. 2008. Vehicle currency use in international trade. *Journal of International Economics*, **76**(2), 177–192.

Goldberg, Linda S. 2001. *When is U.S. bank lending to emerging markets volatile?* Tech. rept.

Gopinath, Gita. 2005. The International Price System. *In Jackson Hole Symposium, Federal Reserve Bank at Kansas City.*, **27**.

Gopinath, Gita, & Itskhoki, Oleg. 2011. In Search of Real Rigidities. *Pages 261–309 of: NBER Macroeconomics Annual 2010, Volume 25.* NBER Chapters. National Bureau of Economic Research, Inc.

Gopinath, Gita, & Stein, Jeremy. 2020. Banking, Trade and the Making of a Dominant Currency. *Working Paper.*

Gutiérrez, Bryan, Ivashina, Victoria, & Salomao, Juliana. 2020. Why is Dollar Debt Cheaper? Evidence from Peru.

Hummels, David L., & Schaur, Georg. 2013. Time as a Trade Barrier. *The American Economic Review*, **103**(7), 2935–2959.

Ivashina, Victoria, Scharfstein, David S., & Stein, Jeremy C. 2015. Dollar Funding and the Lending Behavior of Global Banks*. *The Quarterly Journal of Economics*, **130**(3), 1241–1281.

Electronic copy available at: https://ssrn.com/abstract=3806450

Jain, Rajeev, Gajbhiye, Dhirendra, & Tewari, Soumasree. 2019. Credit Supply and Monetary Policy: Identifying the Bank Balance-Sheet Channel with Loan Applications. *RBI Working Paper Series*.

Jiménez, Gabriel, Ongena, Steven, Peydró, José-Luis, & Saurina, Jesús. 2012. Credit Supply and Monetary Policy: Identifying the Bank Balance-Sheet Channel with Loan Applications. *The American Economic Review*, **102**(5), 2301.

Jotikasthira, Chotibhak, Lundblad, Christian, & Ramadorai, Tarun. 2012. Asset Fire Sales and Purchases and the International Transmission of Funding Shocks. *The Journal of Finance*, **67**(6), 2015–2050.

Kamps, Annette. 2006. *The euro as invoicing currency in international trade*. Working Paper Series 665. European Central Bank.

Khwaja, Asim Ijaz, & Mian, Atif. 2008. Tracing the Impact of Bank Liquidity Shocks: Evidence from an Emerging Market. *American Economic Review*, **98**(4), 1413–42.

Levchenko, Andrei A., Lewis, Logan T., & Tesar, Linda L. 2010. The Collapse of International Trade during the 2008–09 Crisis: In Search of the Smoking Gun. *IMF Economic Review*, **58**(2), 214–253.

Li, Mai. 2019. Dollar Funding, Bank Currency Mismatch, and the Transmission of Exchange Rate Policy. *Job Market Paper, University of Columbia*, Noveber.

Manova, Kalina. 2012. Credit Constraints, Heterogeneous Firms, and International Trade. *The Review of Economic Studies*, **80**(2), 711–744.

Matvos, Gregor, & Seru, Amit. 2014. Resource Allocation within Firms and Financial Market Dislocation: Evidence from Diversified Conglomerates. *The Review of Financial Studies*, **27**(4), 1143–1189.

Paravisini, Daniel, Rappoport, Veronica, Schnabl, Philipp, & Wolfenzon, Daniel. 2014. Dissecting the Effect of Credit Supply on Trade: Evidence from Matched Credit-Export Data. *The Review of Economic Studies*, **82**(1), 333–359.

Paravisini, Daniel, Rappoport, Veronica, & Schnabl, Philipp. 2020. Specialization in Bank Lending: Evidence from Exporting Firms. *Working Paper*.

Peek, Joe, & Rosengren, Eric S. 2000. Implications of the globalization of the banking sector: the Latin American experience. *Conference Series ; [Proceedings]*, **44**(Jun), 145–185.

Electronic copy available at: https://ssrn.com/abstract=3806450

Portes, R., & Rey, H. 1998. The emergence of the euro as an international currency. *Economic Policy*, 305–343. cited By 93.

Sahay, Ratna, Arora, Vivek, Arvanitis, Athanasios, Faruqee, Hamid, N'Diaye, Papa, & Griffoli, Tommaso. 2014. Emerging Market Volatility: Lessons from The Taper Tantrum. *Staff Discussion Notes*, **14**(01), 1.

Schnabl, Philipp. 2012. The International Transmission of Bank Liquidity Shocks: Evidence from an Emerging Market. *The Journal of Finance*, **67**(3), 897–932.

Shin, Hyun-Han, & Stulz, René M. 1998. Are Internal Capital Markets Efficient? *The Quarterly Journal of Economics*, **113**(2), 531–552.

Shin, Hyun Song. 2012. Global Banking Glut and Loan Risk Premium. *IMF Economic Review*, **60**(2), 155–192.

Electronic copy available at: https://ssrn.com/abstract=3806450

Appendix A: Tables

Table 1: Firm-level Statistics in the Transaction Data

This table provides summary of the transaction-level data used in the analysis. We report monthly statistics for the pre- and post-Taper period.

	Pre-Taper (1)	Post-Taper (2)
# of Firms	3,230	2,866
# of Firm × Country	5,306	5,167
# of Multi-invoice firms	490	521
# of Multi-partner firms	901	899
Average trade value per firm (USD)	73,272	64,269
Average # of partners per firm	1.64	1.80
Average # of currencies per firm	1.20	1.25
Average # of transactions per firm	10.83	12.12
Average # of products per firm	4.96	6.13

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Table 2: Aggregate and Firm-Level Invoicing Statistics

Panel (a) reports the aggregate summary statistics of invoicing shares of currencies. Dollar, Euro, Rupee, and producer currency (PC) shares are defined as the share of total imports (in value) invoiced in those currencies respectively. The Count variable is based on monthly frequency. Panel (b) reports the distribution of firms by number of destinations and number of currency of invoicing. Each row refers to a given number of destinations depicted in the left-most column, while each column refers to a given number of currency of invoicing choice given in the top row. We report the percentage both by count of firms and their value of transactions. Both panels are based on firm-level transactions data for 2013.

Panel (a): Aggregate Invoicing Shares of Currencies

	Mean	Median	SD	Min	Max	Count
% Dollar Invoicing	78.7	100	37.8	0	100	24,424
% Euro Invoicing	14.1	0	31.9	0	100	24,424
% INR Invoicing	0.08	0	0.7	0	6.6	24,424
% Producer Country Invoicing	25.02	0	39.9	0	100	24,424

Panel (b): Number of Trade Partners vs. Invoicing Currencies

	Number of Invoicing Currencies					
# of Trading Partners	1	2	3	4	5+	Total
	Panel I: % of Firms					
1	64.5	.6	0	0	0	65.1
2	11.3	5.6	.2	0	0	17.1
3	3.2	3.0	.6	0	0	6.8
4	1.3	1.7	.6	0.1	0	3.7
5+	1.3	2.9	1.9	.8	.4	7.3
Total	81.6	13.8	3.3	.9	.4	100
	Panel II: % of Trade Value					
1	9.8	.2	0	0	0	10
2	6.1	1.7	.1	0	0	7.9
3	4.2	1.3	.3	0	0	5.8
4	1.6	1.7	.4	.1	0	3.8
5+	11.1	11	7.1	12.7	30.3	72.2
Total	32.8	15.9	7.9	12.8	30.3	≈ 100

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Table 3: Description of Funding Shock

Panel (a) reports the distribution of the Dollar funding shock. All calculations are based on USD 2-quarter funding shock in the banking sector except the last row which is based on USD 2-quarter funding shock in all sectors. Panel (b) lists the correlation of Dollar funding shocks measured in multiple ways with themselves and other country characteristics such as pre-taper levels of bank and all external funding, income per capita, and sovereign credit rating. Rows 6,7&8 denotes the level of funding in banking sector that is made available in USD, in all currencies and their fraction respectively. These calculation are based on Quarter 1 2013, i.e. just before the Taper Tantrum. Sovereign Credit Ratings are from Standard and Poor for year 2012. The funding shock is constructed using data from the BIS.

Panel (a): Funding Shock Distribution Statistics

	Min (1)	P25 (2)	P50 (3)	P75 (4)	Max (5)	SD (6)	Observations (7)
All Countries	-1.37	-.13	-.01	.12	1.84	.40	138
Countries w/ Foreign Banks	-.35	-.03	.01	.10	.24	.13	23
Countries w/o Foreign Banks	-1.37	-.14	-.03	.13	1.84	.43	115
High Income Countries	-1.36	-.08	-.00	.08	.98	.27	52
Upper Middle Income Countries	-.75	-.15	-.05	.09	1.84	.43	38
Lower Middle Income Countries	-1.37	-.08	.02	.17	.74	.34	32
Lower Income Countries	-1.37	-.33	.01	.25	1.84	.70	16
All Sectors(USD)	-.38	-.08	.01	.08	.51	.16	139

Panel (b): Correlation Matrix of Funding Shocks

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
(1) 2 Qtr Banking(USD)	1									
(2) 2 Qtr All Sectors(USD)	0.57	1								
(3) 1 Qtr Banking(USD)	0.63	0.39	1							
(4) 1 Qtr All Sectors(USD)	0.46	0.65	0.62	1						
(5) 2 Qtr All Sectors(EUR)	0.19	0.24	0.05	0.08	1					
(6) Banks Funding Level(USD)	-0.01	-0.02	0.02	0.02	0.01	1				
(7) Banks Funding Level(All Curr)	0.01	-0.01	0.03	0.03	0.00	0.89	1			
(8) Banks Funding Level Fraction	0.07	-0.03	-0.06	0.00	-0.10	0.06	-0.07	1		
(9) GDP Per Capita	-0.01	-0.04	0.00	-0.05	0.04	0.32	0.38	-0.23	1	
(10) S&P Ratings	0.00	0.07	-0.02	0.00	0.04	0.36	0.43	-0.19	0.76	1

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Table 4: Funding Shocks and Dollar Invoicing

This table reports the impact of dollar-funding shock during Taper Tantrum on dollar-invoicing of Indian imports. The dependent variable is the fraction of imports (by value) dollar invoiced and this variable is measured at Firm-Country-Month unit level. The sample period is all the months of 2013 in the baseline specification and $\mathbb{1}(Post)$ is a dummy indicating period from June to December 2013. Funding shock is the growth shock to the banking $-funding measured over two quarters post-taper (Q2 & Q3, 2013) relative to two quarters pre-taper (Q4,2012 & Q1, 2013). Currency depreciation is the monthly depreciation of country's currency against USD. Errors are clustered at Firm×Month level. Superscripts ***, ** ,* indicate significance at the 1%, 5%, and 10% level.

Dep Var	Fraction of Dollar Invoiced Imports							
Aggregation	Firm-Country-Month						Firm-Country-HS2-Month	
					Funding Drop=1	Funding Drop=0		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Funding Shock	0.285***	0.283***		0.332***	0.377***	-0.169***	0.330***	0.258***
	(0.022)	(0.017)		(0.026)	(0.056)	(0.052)	(0.026)	(0.022)
Funding Shock×Post	-0.109***	-0.084***	-0.034**	-0.154***	-0.219***	0.059	-0.094***	-0.078***
	(0.027)	(0.019)	(0.014)	(0.032)	(0.063)	(0.059)	(0.032)	(0.026)
Currency Depreciation				3.066***				
				(0.166)				
Exports Growth				-0.549***				
				(0.033)				
Firm FE		Y	Y					
Firm*Month FE	Y			Y	Y	Y		
Country FE			Y					
HS2*Month FE							Y	
Firm*HS2*Month FE								Y
Time FE		Y	Y					
Observations	55453	112383	112368	51566	25241	15547	175172	61381
Adj R-Sq	0.216	0.454	0.707	0.230	0.123	0.246	0.589	0.306

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Table 5: Robustness: Funding Shock and Dollar Invoicing

This table performs some robustness while estimating the impact of $-funding shock during Taper Tantrum on $-invoicing of Indian imports. The sample period all months of 2013 in the baseline specification and $\mathbb{1}(Post)$ is a dummy indicating period from June to December 2013. The dependent variable is the fraction of imports (by value) $-invoiced (columns 1-4) and fraction of $-invoiced transaction (column 5) and these variable is measured at Firm-Country-Month unit level. We use host of shocks - shock to growth rate of total $-funding (column 1), shock to level of banking $-funding (column 2), shock to level of total $-funding (column 3), and shock to growth rate of banking $-funding (column 4 and 5). These shocks are measured over two (one) quarters post-taper (Q2 & Q3, 2013) relative to two quarters pre-taper (Q4,2012 & Q1, 2013) for columns 1-3,5 (column 4). All the models include Firm×Month fixed effects. Errors are clustered at Firm×Month level. Superscripts ***, ** ,* indicate significance at the 1%, 5%, and 10% level.

	Fraction of Firm-Country Imports Invoiced in Dollars							
	Fraction of Value							Fraction of Transaction
Type of shock	Aggregate $ (Growth, 2 qtr)	Bank $ (Level, 2 qtr)	Aggregate $ (Level, 2 qtr)	Bank $ (Growth, 1 qtr)	Bank $ (growth, 2 qtr)			
Restriction					Weighted (1/obs)	Excludes China		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Funding Shock	0.060***	0.519***	0.611***	0.325***	0.186***	0.144***	0.285**	0.285***
	(0.015)	(0.020)	(0.026)	(0.016)	(0.023)	(0.023)	(0.120)	(0.022)
Funding Shock*Post	-0.035*	-0.099***	-0.070**	-0.117***	-0.110***	-0.075***	-0.109	-0.108***
	(0.020)	(0.025)	(0.032)	(0.019)	(0.027)	(0.027)	(0.144)	(0.027)
Firm×Month FE	Y	Y	Y	Y	Y	Y	Y	Y
Firm×Month Cluster	Y	Y	Y	Y	Y	Y		Y
Country×Month Cluster							Y	
Firm-Country-Month Obs	55454	55453	55454	55453	55453	40778	55453	55453
Adj R-Sq	0.210	0.251	0.238	0.233	0.300	0.247	0.216	0.218

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Table 6: Shift of Invoicing Currency

This table reports the impact of $-funding shock during Taper Tantrum on shifts in currency of invoicing of Indian imports. The dependent variable is the fraction of firm-country-month imports (by value) invoiced in INR (Column 1), Producer Currency or PC for short (Column 2), Euro (columns 3-5), Japanese Yen (Column 6) and Pound (Column 7). Funding shock is the growth shock to the banking $-funding measured over two quarters post-taper (Q2 & Q3, 2013) relative to two quarters pre-taper (Q4,2012 & Q1, 2013). Sample is "all the countries" in columns 1-3, Non-EU countries in column 4, EU countries in column 5, and "all countries (ex-Japan)" and "all countries (ex U.K)" in columns 6 and 7 respectively. Currency depreciation denotes the depreciation of exporter's currency relative to USD in that month. The sample period all months of 2013 in all the specifications. $\mathbb{1}(Post)$ is a dummy indicating period from June to December 2013. Superscripts ***, ** ,* indicate significance at the 1%, 5%, and 10% level.

	Fraction of Firm-Country-Month Imports Invoiced In						
Invoicing Currency	INR	PC	EUR	EUR	EUR	JPY	GBP
Sample	All	All	All	Non-EU	EU	Ex Japan	Ex UK
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Funding Shock	-0.006	-0.082***	-0.300***	-0.105***	0.066	0.003	-0.008
	(0.005)	(0.022)	(0.023)	(0.023)	(0.063)	(0.003)	(0.007)
$\mathbb{1}(Post)\times$Funding Shock	0.010*	0.059**	0.203***	0.083***	-0.026	-0.001	0.007
	(0.005)	(0.026)	(0.027)	(0.027)	(0.077)	(0.003)	(0.008)
Currency Depreciation		-1.278***	-4.487***	-0.683***		0.054**	0.011
		(0.151)	(0.130)	(0.091)		(0.025)	(0.024)
Firm×Month FE	Y	Y	Y	Y	Y	Y	Y
Firm-Ctr-Month Obs	55354	55036	55036	37976	7721	50925	51858
Adj R-Sq	0.518	0.063	0.214	0.126	0.445	0.212	0.210

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Table 7: Foreign Bank Presence in India and Dollar Invoicing

This table reports the impact of dollar-funding shock during Taper Tantrum on imports invoicing patterns for India. The dependent variable is the fraction of firm-country-month imports (by value) invoiced in USD. Funding shock is the change in growth rates for banking Dollar-funding measured over two quarters pre-taper (Q4,2012 & Q1, 2013) relative to two quarters post-taper (Q2 & Q3, 2013). The sample period all months of 2013 in all the specifications. $\mathbb{1}(Post)$ is a dummy indicating period from June to December 2013. Foreign Bank Presence indicates if any bank from exporter's country is operational in India (as a foreign bank) as on 31st March 2013. $\mathbb{1}(PositiveShock)$ is a dummy indicating if the growth shock is negative or positive. All errors are clustered at $Firm \times Month$ level and all the models include $Firm \times Month$ fixed effect. Superscripts ***, ** ,* indicate significance at the 1%, 5%, and 10% level.

	Fraction of Firm-Ctr-Month Imports Invoiced in Dollars			
Foreign Bank Presence	Yes	No	Yes	No
	(1)	(2)	(3)	(4)
Funding Shock	0.166***	0.329***		
	(0.041)	(0.038)		
$\mathbb{1}(Post)\times$Funding Shock	0.011	-0.202***		
	(0.051)	(0.042)		
$\mathbb{1}(PositiveShock)$			0.124***	0.171***
			(0.011)	(0.019)
$\mathbb{1}(Post)\times\mathbb{1}(PositiveShock)$			0.003	-0.083***
			(0.013)	(0.022)
Firm×Month FE	Y	Y	Y	Y
Firm-Ctr-Month Obs	24246	16305	24246	16306
Adj R-Sq	0.186	0.158	0.203	0.159

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Table 8: Firm-Level Funding Shocks and Dollar Invoicing

This table reports the impact of firm-level dollar-funding shock during Taper Tantrum on firm-country-month dollar invoicing. Funding shock is the country-shock computed as change in growth rates for bank dollar funding measured over two quarters post-taper (Q2 & Q3, 2013) relative to two quarters pre-taper (Q4,2012 & Q1, 2013). Firm-shock is a "leave-one-out" shock for a given firm-country pair — computed as the weighted average of the country-funding shocks across other partners of the firm. The sample period all months of 2013 in all the specifications. $\mathbb{1}(Post)$ is a dummy indicating period from June to December 2013. All errors are clustered at $Firm \times Month$ level and all the models include $Country \times Month$ fixed effect. Superscripts ***, ** ,* indicate significance at the 1%, 5%, and 10% level.

	Fraction of Firm-Ctr-Month Imports Invoiced in Dollars			
Sample		$\mathbb{1}$(Firm Funding Drop) =1	$\mathbb{1}$(Country Funding Drop) =1	
	(1)	(2)	(3)	(4)
Firm Shock (Ex-Country)	-0.010	0.219***	0.039**	0.042*
	(0.022)	(0.051)	(0.020)	(0.025)
$\mathbb{1}(Post)\times$ Firm Shock (Ex-Country)	-0.049	-0.045	-0.060**	-0.070**
	(0.031)	(0.071)	(0.027)	(0.035)
Firm Shock (Ex-Country)$\times$ Country Shock				-0.035
				(0.178)
$\mathbb{1}(Post)\times$Country Shock $\times$Firm Shock (Ex-Country)				0.139
				(0.246)
Country$\times$Month FE	Y	Y	Y	Y
Fund-Country-Month Obs	52664	32092	32096	32096
Adj R-Sq	0.519	0.520	0.614	0.614

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Table 9: Healthy Connections and Dollar Invoicing

This table reports the impact of dollar funding shock at country-level during Taper Tantrum on imports invoicing patterns for India. The dependent variable is the fraction of firm-country-month imports (by value) invoiced in dollars. (Country) Funding shock is the drop in growth rates for banking Dollar-funding measured between two quarters pre-taper (Q4,2012 & Q1, 2013) to two quarters post-taper (Q2 & Q3, 2013). $\mathbb{1}$(Healthy Partner) is a dummy indicating if a firm has a healthy partner in that month defined as a country which did not experience funding squeeze during the taper and at least 25% of firm-month imports are from that partner. The sample period all months of 2013 in all the specifications. $\mathbb{1}(Post)$ is a dummy indicating period from June to December 2013. All errors are clustered at $Firm \times Month$ level and all the models include $Firm \times Month$ fixed effect. Superscripts ***, ** ,* indicate significance at the 1%, 5%, and 10% level.

	Fraction of Firm-Ctr-Month Imports Invoiced in Dollars				
	Healthy Partner = 1		Healthy Partner = 0		
		$\mathbb{1}$(Country Funding Drop) =1		$\mathbb{1}$(Country Funding Drop) =1	
	(1)	(2)	(3)	(4)	(5)
Country Shock	0.207***	0.205**	0.377***	0.455***	0.377***
	(0.030)	(0.093)	(0.033)	(0.069)	(0.033)
$\mathbb{1}(Post)\times$Country Shock	-0.056	-0.064	-0.177***	-0.290***	-0.177***
	(0.037)	(0.110)	(0.039)	(0.075)	(0.039)
$\mathbb{1}$(Healthy Partner)$\times$ Country Shock					-0.171***
					(0.045)
$\mathbb{1}(Post)\times$Country Shock $\times\mathbb{1}$(Healthy Partner)					0.121**
					(0.054)
Firm-Month FE	Y	Y	Y	Y	Y
Firm-Ctr-Month Obs	27435	6792	28018	18449	55453
Adj R-Sq	0.241	0.119	0.191	0.124	0.217

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Table 10: Real Consequences of Invoicing Patterns

The table reports the probability of destruction of trade relation in the Post-taper period ($\mathbb{1}(Post)$) as a function of invoicing patterns. Panel A estimate the probability that a given Firm-Country pair ceases to exit from next month. Main independent variable of interest in Panel A is the fraction of a Firm-Country imports invoiced in dollars during the current month. The sample for Panel A is from January-October to avoid capturing mechanical rise in exit probabilities as we approach the end of the year. Panel B estimates the probability that a Firm-Country pair ceases to exit in post-period using cross-sectional regression. The independent variable of interest is the change in fraction of firm's total imports (aggregated across all the surviving partners) invoiced in dollars between pre and post taper period denoted by ΔFirm Dollar Invoicing. Hence ΔFirm Dollar Invoicing> 0 means that firm has increased the fraction of its dollar invoicing from pre-taper period. |Shock| gives the absolute value of funding shock, where shock is drop in growth rate of of cross-border bank dollar funding between pre-tape period (Q4,2012 & Q1, 2013) and post-taper period (Q2 & Q3, 2013). $\mathbb{1}$(Funding Drop) is a dummy indicating if country experienced shock to its funding. Panel A absorb Firm$\times$Month and Country Fixed effects while Panel B absorbs Firm and Country fixed effects. Errors are clustered at Firm$\times$Month level in Panel A while at Firm level in panel B. Superscripts ***, ** ,* indicate significance at the 1%, 5%, and 10% level.

	Panel A			Panel B		
Dependent Variable	$\mathbb{1}$(Firm-Ctr Exit From Next Month)			$\mathbb{1}$(Firm-Ctr Exit in Post Period)		
$\mathbb{1}$(Funding Drop)		Yes	No		Yes	No
	(1)	(2)	(3)	(4)	(5)	(6)
Dollar Invoicing	0.012	0.026*	0.008			
	(0.009)	(0.014)	(0.015)			
$\mathbb{1}(Post)\times$ Dollar Invoicing	-0.029***	-0.064***	-0.022			
	(0.010)	(0.015)	(0.018)			
$\mathbb{1}$(Funding Drop) $\times\Delta$Dollar Invoicing (Post-Pre)				-0.145***		
				(0.022)		
|Shock|$\times$ ΔDollar Invoicing (Post-Pre)					-0.440***	-0.044
					(0.169)	(0.132)
Firm$\times$Month FE	Y	Y	Y			
Country FE	Y	Y	Y	Y	Y	Y
Firm FE				Y	Y	Y
Firm-Ctr-Month Obs	50968	23352	14367			
Firm-Ctr Obs				25876	12968	8431
Adj R-Sq	0.394	0.387	0.411	0.043	0.049	0.086

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Table 11: Welfare Effects of Invoicing Patterns

The dependent variable is the aggregate imports at a firm-month level (column 1) and at firm-product-month level in columns 2-3. In column 1-2, the imports are measured in nominal dollars, while in column 3 measures quantity of import. The main independent variable is the dollar invoicing at firm-month level (column 1) and at firm-product-month level in columns 2-3. Post indicate the dummy for the period after taper-tantrum (June 2013 to December 2013). Errors are clustered at Firm×Month level. Superscripts ***, ** ,* indicate significance at the 1%, 5%, and 10% level.

	Log Firm-Month Imports	Log Firm-Product-Month Imports	
	Nominal	Nominal	Qty
	(1)	(2)	(3)
Firm-Month Dollar Invoicing	0.037		
	(0.035)		
Firm-Month Dollar Invoicing×Post	0.135***		
	(0.032)		
Firm-HS2-Month Dollar Invoicing		-0.128***	0.109*
		(0.045)	(0.055)
Firm-HS2-Month Dollar Invoicing×Post		0.290***	0.244***
		(0.040)	(0.046)
Month FE	Y		
Firm-HS2 FE		Y	Y
HS2-Month FE		Y	Y
Observations	84454	76035	76035
Adj R-Sq	0.024	0.518	0.667

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Appendix B: Figures

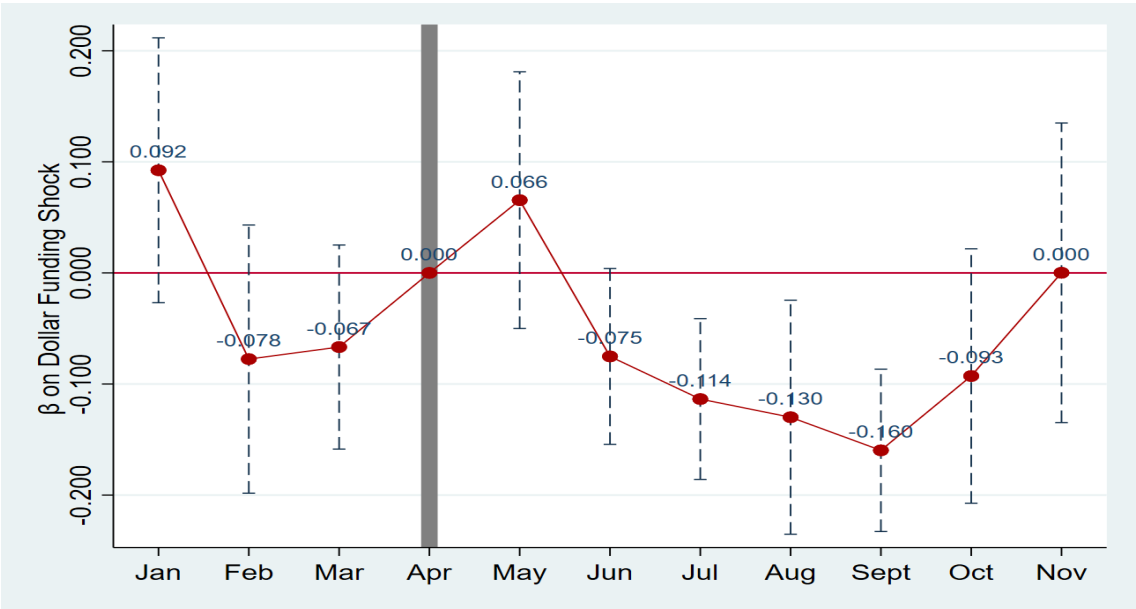

Figure 1: Sensitivity of Dollar Invoicing To Funding Shock

In this figure, we plot the coefficient on interaction in following model

$$\$inv_{ict} = \delta_{it} + \beta_0 \left[shock_c\right] + \sum_t \beta_t \left[\mathbb{1}_t \times shock_c\right] + \varepsilon_{ict}$$

where $\$inv_{ict}$ is the fraction of dollar invoiced imports between firm i and country c during month t, $shock_c$ is the taper funding shock for country c defined as the drop in growth of cross-border dollar banking flows between two quarters before and after the taper event, and $\mathbb{1}_t$ is the dummy for month t. The estimation absorbs δ_{it} – the Firm×Month fixed effects. The figure plots thee month-by-month β coefficients with 95% confidence interval. The base month is April 2013.

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