Currency crises and foreign credit in emerging markets: Credit crunch or demand effect?

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Abstract
Currency crises of the past decade highlighted the importance of balance-sheet effects of large devaluations. Currency crisis literature identified a decline in credit as one of the channels through which such crises affect real economic activity. We find empirical evidence of the existence of this channel and quantify its extent and persistence: controlling for a host of fundamentals, we find a decline in foreign credit to emerging market private firms of about 25 percent in the first year following large depreciations. This decline is especially large in the first five months, is less pronounced in the second year, and disappears entirely by the third year. We show that only about a quarter of the initial decline in credit could be attributed to the “credit crunch,” while the rest of the decline is due to contracting demand. After six months, however, most of the credit decline could be attributed to supply effects.

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1. Introduction

In the past two decades, many currency crises in emerging markets were accompanied by a substantial decline in economic activity in affected countries (Gupta et al., 2003; Hong and Tornell, 2005; Hutchison, 2001; Hutchison and Noy, 2002). Much of the literature attributes a large part of this decline to currency-related balance-sheet problems that arise when firms borrowing in foreign currency find their net worth deteriorate after a large depreciation of domestic currency. The literature on the balance-sheet effects has shown that these effects can lead to a decline in investment. A popular view seems to be that this decline in investment is driven by a credit crunch through a financial accelerator effect à la Bernanke and Gertler (1989). Indeed, Calvo et al. (2006) show that the recovery from financial crises tends to take place without recovery in credit. In this paper we take the analysis one step further and attempt to identify how much of the decline in credit is indeed due to a credit crunch and how much is driven by a reduction in the demand for credit.

While the decline in credit following currency crises is frequently discussed, the empirical analysis of this phenomenon is scarce.2 We contribute to this literature by systematically analyzing the effects of currency crises that occurred since 1980 on the credit provided to emerging markets’ domestic private firms by foreign creditors, both through banks and on...
the bond market. In addition to documenting the qualitative decline in foreign credit to the emerging markets’ private sector, which represents over 30 percent of total foreign credit to emerging markets, we provide quantitative analysis of the size and the duration of this decline.

Documenting a decline in credit, however, is not the same as identifying a credit crunch. A credit crunch implies that firms are interested in obtaining credit, but are either unable to do so or find the cost of credit prohibitively high. Nevertheless, there are reasons to believe that some of the decline in credit could be due to a reduction in firms’ demand for credit. To our knowledge, there is no systematic evidence on the effects of currency crises on the demand and supply of foreign credit to emerging market private firms. This paper provides such an analysis.

We begin with an informal discussion of the reasons currency collapses could lead to a decline in supply of credit and demand for credit. Currency crises may make foreign creditors less willing to lend, which is likely to lead to an increased risk premium that all the firms in the affected country are charged by foreign creditors. Faced with this increase in costs, firms are likely to choose to borrow less from foreign creditors and switch to other types of financing. We refer to such effects as “supply effects” or “credit crunch,” because it is a change in the quantity of foreign credit demanded by firms as a result of an increased cost. Firms, however, might choose to borrow less on foreign markets for reasons that are not related to the cost of borrowing—we refer to such changes as “demand effects.” Finally, firms’ borrowing needs might remain the same in local currency, which would imply that they need to borrow less in foreign currency after the currency crisis—we refer to this as the “accounting effect.” In our empirical analysis we are able to differentiate between these three types of effects.

We use firm-level data on foreign bond issuance and foreign syndicated bank loan contracts for 29 emerging markets between 1981 and 2004 to calculate the total amount of new credit that private domestically owned firms obtained on the bond market or from bank syndicates in each month. We then analyze how this aggregate measure of credit is affected by large real depreciations. We construct a number of indicators that describe various aspects of each country’s economy as well as factors that affect the world supply of capital to emerging markets, which we use as control variables. Since foreign credit to the country could be conditional on the country having an agreement with the IMF, we include this indicator in our list of control variables. In addition, we control for banking crises (Caprio and Klingebiel, 1996; Demirgüç-Kunt and Detragiache, 1998; Hutchison and Noy, 2005) and for debt crises (Arteta and Hale, 2008).

Using fixed-effect panel data regressions, we find, not surprisingly, that there is indeed a significant decline in credit to emerging market firms (measured either in U.S. dollars (USD) or in local currency) in the aftermath of large currency depreciations. We find that, compared to the country mean, foreign credit to the private sector falls by over 30 percent in the first two years after a large depreciation and then recovers. About 10 percentage points of this decline in credit in the first year and about 15 percentage points decline in the second year are explained by the worsening of macroeconomic fundamentals and other control variables. We find that the decline in credit is most severe during the first five months after the crisis and that there is little or no evidence of the decline in credit prior to the currency crisis.

By separating demand factors from supply factors and using a proxy for the price of credit, we are able to identify separately the demand and the supply of credit and see whether the decline in credit that we document comes from the demand or the supply side. Because we do not have good exclusion restrictions for the supply equation, we estimate the effect of a currency crisis on the average cost of borrowing. Thus, our supply equation is simply the price equation. We simultaneously estimate the demand equation without imposing restrictions on its slope with respect to our measure of price. Finally, we convert the amounts borrowed into local currencies to see whether our results are driven by the accounting effect and find that the accounting effect turns out to be negligible.

At first it appears that both demand and supply contribute equally to the decline in credit. However, once we control for sovereign debt crises (Arteta and Hale, 2008), we find that the decline in demand for credit (which is large at 30 percent) only persists for five months, while the initial decline in the market value of bonds (over 20 percent) recovers very gradually and is still statistically significant and equal to over 10 percent in the second year after the crisis. Given our estimate of the price elasticity of demand, this decline in the market value of bonds translates to about 8 percent decline in credit initially and about 5 percent decline in credit in the second year. These results square well with our findings for the reduced form—the initial large decline in credit is driven by the reduction in both demand and supply, while the persistent decline is due to the fall in supply only.

We estimate a number of additional regressions as extensions and robustness tests and find that the above results are robust to the definition of the dependent variable and the currency crisis indicator, econometric model specification, the sample, and the set of control variables.

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3 We focus on emerging markets because the exchange rate movements appear to be more destabilizing in developing countries than in industrial countries (Ahmed et al., 2002). We have no access to the firm-level data on domestic lending. Instead, we include foreign borrowing by the financial sector in our analysis, thus analyzing total availability of foreign capital to the country’s private sector.

4 See, for example, Chapter 4 of the Global Development Finance, The World Bank, 2005. According to Chapter 4 of the Global Financial Stability Report, IMF, April 2005, about 25 percent of emerging markets’ corporate bonds and bank credit are external, and this number is much larger for Latin American emerging economies.

5 We exclude from our analysis all the firms that are foreign-owned and all the firms that are owned by central or local governments, which we would not be able to do with aggregate data. In addition, using firm-level data avoids biases that are due to credit going through offshore centers (Warnock and Cleaver, 2003), because we are able to identify the true nationality of a borrower.
Thus, we find systematic evidence of substantial and persistent foreign credit crunch in the aftermath of large depreciations. This foreign credit crunch is important because it extends to the entire private sector of the economy, thus limiting the overall credit availability in the country. In that respect, our findings are consistent with the evidence presented in Desai et al. (2008) and Blalock et al. (2004). While we do find an even larger decline in demand for foreign credit, it only lasts for about five months after the crisis and therefore does not contribute much to the credit-less recovery phenomenon described in Calvo et al. (2006). Our results on the demand and supply of credit are different from those in Beng and Ying (2001), who find using the Maddala and Nelson (1974) disequilibrium approach that, for the case of Malaysia, the decline in demand for credit was more persistent than the decline in supply.

The remainder of the paper is organized as follows. Part two presents an informal discussion of the theory behind our empirical work. Part three describes the empirical approach of the paper and the data. Part four presents the results of the empirical analysis. Part five concludes.

2. Effects of a currency collapse on demand and supply of credit

The goal of this paper is twofold: first, we are interested in estimating how large is the decline in foreign credit to the private sector after a currency crisis; second, we want to measure how much of this decline is due to worsening borrowing conditions (the supply side, or “credit crunch”) and how much of this decline is due to a reduction in firms’ demand for foreign credit. In this section we discuss mechanisms through which both borrowing conditions and private demand for foreign credit may be affected by a currency crisis.

Importantly, we assume that individual firms as well as foreign lenders view currency crises as unexpected exogenous shocks and react to them. While true endogeneity is unlikely—neither individual borrowers nor individual lenders (with rare exceptions) can create a currency collapse—a number of variables can simultaneously affect borrowing conditions, demand for funds, and the probability of a currency crisis. As described below, we do our best to control for such variables, summarizing each group of factors describing the macroeconomy in a group of indexes.

Current literature suggests that borrowing conditions are likely to tighten for a country that experienced a currency collapse because of the balance-sheet effects that are due to the currency mismatches in the balance sheets of the firms. The “original sin” literature argues that most emerging market borrowers cannot borrow abroad in their own currency. As a result, they may accumulate large foreign-currency liabilities. If the asset side of these borrowers’ balance sheets is denominated primarily in local currency, a large depreciation of local currency leads to a large reduction in a company’s net worth and collateral and potentially to solvency problems. Thus, according to the standard credit rationing argument (Calomiris and Hubbard, 1990; Mason, 1998; Stiglitz and Weiss, 1981) or a more recent literature on collateral constraints (Aghion et al., 2000, 2004b; Cho and Kasa, 2008; Kiyotaki and Moore, 1997; Mendoza, 2006), it is natural to expect that foreign lenders will reduce the supply of credit to these borrowers.

Instead of thinking about this tightening of borrowing conditions as a reduction in an inelastic supply of credit, we think of it as an upward shift in the entire supply schedule of credit, that is, an increase in the cost of foreign credit for any amount borrowed. The reason for such a shift could be an increased risk premium for all loans due to a decline in the value of collateral that is denominated in local currency, the deterioration of borrowers’ balance sheets due to currency mismatches, or increased country risk that is due to general economic and political instability that usually accompanies a currency crisis.

While firms are certainly heterogeneous in their collateral and balance-sheet exposure to currency risk, such a shift in the supply of credit is likely to affect all firms at least to some extent. This is obviously the case with country risk, but it also can be true with respect to the balance-sheet exposure, because verification of a specific firm’s exposure to currency fluctuations by foreign lenders is costly, especially in the case of the arm’s-length debt. Thus, on average, we would expect the risk premium on foreign credit to rise as a result of a currency collapse.

We view each firm as facing the supply of credit and choosing how much to borrow. If the supply shift was the only effect of a currency crisis, we would expect the amount of credit to fall as firms would choose to scale down their foreign borrowing when faced with higher costs, either switching to domestic financing, internal financing, or tapping equity markets.

In addition to these supply effects, however, we believe it is likely that the demand for credit will fall even at a given cost. Such decline in demand could be due to increased uncertainty and worsening long-term forecasts, which both would lead to lower investment and therefore lower demand for credit. While we control for current macroeconomic conditions at the time of crisis, they are unlikely to fully capture uncertainty and growth prospects; therefore, we would expect to see a decline in demand for funds following a currency crisis. Moreover, firms might decide to reduce the currency mismatch on their balance sheets and increase their borrowing in domestic currency. Since they are unable to do that in foreign capital markets because of the “original sin,” they will increase their demand for domestic funds and reduce their demand for foreign credit.

In addition to the supply and demand effects described above, there is a straightforward accounting effect. Whether firms are using foreign credit for operating expenses or for long-term investment, if their costs are denominated primarily
in local currency, even in the absence of demand and supply effects, they will borrow less in foreign currency to maintain the same level of borrowing in terms of domestic currency.

3. Empirical approach and data sources

We begin by analyzing the reduced-form specification, which excludes the cost of credit. As we will discuss later, estimating the demand and supply effects requires a proxy for the cost of credit that limits our sample size and does not vary by sector. Using a longer sample period allows us to estimate the size and the persistence of the decline in foreign credit to the private sector more precisely.

3.1. Reduced-form specification

In order to test for a decline in credit in the aftermath of a large currency depreciation, we estimate the following reduced-form equation, using regressions with fixed effects:

\[ q_{it} = z_i + \beta_i t + \beta_0 d_{it} + \sum_{t=1}^{K} \gamma_{zt} t + X_{it} \eta + \epsilon_{it}, \]  

(1)

where \( q_{it} \) is a measure of credit, \( z_i \) is a set of country fixed effects absorbing the effect of initial conditions, \( \beta_i \) is a set of year fixed effects absorbing the effect of common trend, \( d_{it} \) is an indicator of a devaluation/depreciation month, \( z_{it} \) is an indicator that depreciation occurred more than \( t - 1 \) but less than \( t \) years ago (we set \( K = 3 \)), \( X_{it} \) is a set of all control variables, and \( \epsilon_{it} \) is a set of robust errors clustered on country. Specific definitions of all these variables are below. Data sources are described in detail in Table 6.

We estimate the above equation by ordinary least squares (OLS). In addition, we test for the robustness of our results to empirical specification: we allow for autocorrelation in errors; we include a lagged dependent variable on the right-hand side by itself and also interact with country fixed effects; we estimate a two-sided Tobit model by maximum likelihood; we estimate the above equation country by country and obtain average \( \beta \) coefficients. Some of these test results are reported below, the rest are described along with other robustness tests.

The above specification assumes that the decline in credit is constant throughout each year following a currency crisis. It is, however, reasonable to expect that, at least in the first year, the effect subsides over time. In addition, there is a possibility that credit falls before the crisis strikes, either because a currency crisis is expected or because of the sudden stop in capital flows (Calvo, 1998) that would lead to a decline in credit to the private sector and could also precipitate the currency crisis as foreign investors convert their local currency assets to USD or another "hard" currency.

To estimate whether there is a dampening of the effect in the first year after the depreciation, we replace in the above regression \( z_{it} \)'s with the \( m_{it} \)'s which indicate that the depreciation occurred exactly \( \zeta \) months ago. We include up to 11 months in the regressions, since further effects are captured by the \( z_{it} \)'s, \( t = 2, 3 \). To test for the sudden stop effects and expectations of currency crises, we include 12 monthly leads in the regression as well.

3.2. Estimating demand and supply

In line with our discussion in Section 2, we use a triangular identification technique in order to identify demand and supply effects of currency crises. In particular, we estimate a cost of credit equation, which reflects average borrowing conditions that firms in a given country face. This cost of credit equation (to which we will loosely refer as the supply equation) does not depend on the quantity the firm borrows, as it represents a vertical shift in the entire supply schedule.

Simultaneously, we estimate a quantity equation (to which we will loosely refer as the demand equation), which reflects each firm’s choice of how much to borrow given borrowing conditions, i.e. quantity borrowed does depend on the cost of credit. This way, we will be able to distinguish between the decline in borrowing that is due to worsening borrowing conditions (credit crunch), which would be represented by a combination of an increase in the cost of borrowing and the response of quantity to this cost, and the decline in demand for foreign credit that is not the result of a change in borrowing conditions.

This triangular identification allows us to avoid making assumptions regarding the exclusion restrictions from the supply equation. From an economic standpoint, any variable that might affect borrower’s demand for funds is also likely to affect the cost of funds this firm will be facing, which makes it impossible to find variables that would help identify an upward-sloping supply curve. On the other hand, we have no difficulty finding variables that are not likely to affect the demand for credit but affect the supply of credit, as described below.

We estimate the following system using three-stage least squares for more robust estimates:

\[ p_{it} = z_i + \beta_i t + \beta_0 d_{it} + \sum_{t=1}^{K} \gamma_{zt} t + X_{it} \eta + \epsilon_{it}, \]  

(2)

\[ q_{it} = z_i + \lambda p_{it} + \beta_0 d_{it} + \sum_{t=1}^{K} \gamma_{zt} t + X_{it} \eta + \epsilon_{it}, \]  

(3)
where $p_{it}$ is a measure of the cost of credit, $X_{it}^d$ is a set of control variables excluded from the demand (or quantity) equation, and $X_{it}^s$ is a set of control variables that affect both demand and supply of credit.

We do not impose restrictions on $\lambda$, but rather test whether it has the correct sign and yields a downward-sloping demand.

### 3.3. Definition of a large depreciation event: $d_{it}$

For our exchange rate variable, we use JP Morgan Real Broad Effective Exchange Rate (REER) series. As Krugman (2001) points out, small amounts of currency depreciation do not lead to changes in firms’ behavior. We therefore focus on episodes of large depreciations, which we define as a monthly decline in the real effective exchange rate of the currency by over 10 percent. We choose 10 percent as a starting point, because it represents just over 1 percent of the country-month observations and is about three standard deviations over the mean change in the REER. Thus, our currency crisis episodes are rare.

Since some of the countries in our sample experienced prolonged periods of currency depreciation, we observe sequences of months in which our depreciation episode indicator takes on a value of one. Since each of these sequences clearly represents one continuing currency crisis, we set our currency crisis indicator to be equal to one in the first of these months, but not in the subsequent months. We allow for this indicator to take on a value of one again only after three consecutive months of REER depreciation of less than 10 percent. Table 1 lists all 63 currency crisis episodes that are defined in this way, as well as the countries in our sample for which a currency crisis did not occur between 1981 and 2004, according to our definition. As one can see, our definition captures most “major” financial crises.

For most of the paper, we do not make a distinction between devaluations, currency crises, and large depreciation events during floating exchange rate regimes. In light of our discussion of the mechanism that links currency crises to the provision of foreign credit to the private sector, this distinction should not matter much overall. We would expect, however, the effects of regime switches to be larger because such currency crises tend to be more severe. We address this issue in the robustness tests.

### 3.4. A measure of credit: $q_{it}$

From Bondware and Loanware data sets, we gather all foreign bond issues and foreign syndicated loan contracts obtained by emerging market firms between January 1981 and August 2004. Importantly, these do not include trade credit.

For bonds issued through offshore centers, we trace the true nationality of the borrower by the location of its headquarters. We exclude all the firms that are owned by the government or by multinational or foreign companies. Most international bonds and loans are denominated in some OECD country currency, so we first convert the amounts into USD, according to the average exchange rate in the issue month, and then aggregate the amounts of bond issues and of loans for each country-month. We drop from our analysis countries for which the total amount of bonds and loans for both sectors was nonzero in fewer than 24 months out of 264 months in our data sample. This ensures that we have enough identifying observations for each country, and leaves us with the 28 countries listed in Table 1.

We divide each amount by the U.S. consumer price index (CPI) to obtain the quantity of credit for each country-month in real dollars. We then construct our dependent variables as a percentage deviation from the country-specific average for all continuous variables. Differences in means are captured by country fixed effects, while common trends are captured by year fixed effects.
A lot of credit is being repaid as times of low access to credit, which need not be the case. The robustness tests section of the paper demonstrates that our results are robust to controlling for principal and interest repayments as well as using a measure of net borrowing on the left-hand side.

Fig. 1 illustrates the dynamics of credit measured in USD for the six major currency crises of the 1990s. We can see that foreign credit to the private sector fell sharply after crises in Korea, Russia, and Argentina. However, for the other three countries presented—Mexico, Brazil, and Turkey, the decline is not as evident. Of course, currency crises are accompanied by a number of changes in the economy that can affect foreign credit to the private sector. We do our best to control for these changes in the regression analysis presented in the next part of the paper.

3.5. Cost of credit: $p_{it}$

In order to estimate demand and supply equations separately, we need to measure the cost of credit. As described in Section 2, we are interested in measuring the effect of currency crises on the average cost of credit for domestic firms. Therefore, we would like to construct or find a measure that is aggregated at the country level.

Unfortunately, Loanware and Bondware do not provide sufficient information on the pricing of credit. They include spreads only on a small subset of loan contracts and bond issues and these spreads are only primary—there is no information on secondary market pricing of credit. In addition, the pricing of each individual loan or bond issue might be driven by specific characteristics of the firms borrowing in a particular month. Since these characteristics are not available, pricing information obtained by aggregating these primary spreads would be affected by the composition of the firms that borrowed in a particular month and therefore would be noisy.

Secondary price data are available only for a small subset of the bonds and are also quite sparse. For this reason, we resort to the JP Morgan country-specific EMBI Global Market Values Index that combines spreads on private and sovereign foreign bonds. For the cases when a country-specific index is not available, we use the region-specific index. We use percentage deviations of the index from country-specific 10-year averages. This index represents the price of country bonds.
on the secondary market; as such, it is inversely related to the cost of credit. Thus, we expect the demand curve to have a positive slope with respect to this price measure.

We realize that EMBI indexes are noisy measures of the cost of foreign credit to private firms, because they only cover the largest issuers and also because they include sovereign bonds. A measurement error needs to be considered especially carefully here, because the cost of credit appears both on the left- and on the right-hand sides of our equations. Nevertheless, we have no reason to believe that any measurement error would be systematically correlated with either our control variables or with an error terms. Thus, the only potential problem it can cause is an attenuation bias in the estimated response of quantity to the cost of credit in the demand equation, i.e., we might be underestimating the magnitude of the credit crunch effect.

The EMBI Global indexes only go as far back as January 1994; therefore, our analysis of demand and supply is limited to the 1994–2004 time period. However, we still capture the effects of currency depreciation episodes that occurred up to two years prior to January 1994. As a result, we have 25 currency crises during this time period.

3.6. Demand and supply controls

The control variables are indexes that describe different dimensions of the economy.16 In each case, the variables are used as percentage deviation from their 25-year country-specific average from 1980 to 2004 on a monthly basis. All the indexes described below are lagged by one month.17

Since many of the variables we would like to control for are highly correlated, we construct the indexes using the method of principal components. Because a principal component is a linear combination of the variables that enter it, in cases when some variables are missing, other weights can be rescaled to compensate for missing variables. In this way, many of the gaps in the data may be filled, which in our case of many missing observations is the main advantage of using these indexes.

16 We draw on the broad empirical literature on emerging market spreads to select our variables (Eichengreen et al., 2001; Eichengreen and Mody, 2000a, b; Gelos et al., 2004; Kaminsky et al., 1998; Mody et al., 2001).

17 This turns out not to make much difference in our estimates compared to the case when they are not lagged.
We group the variables in the following categories, summarized in Table 2. For each of these indexes, we use only the first principal component in our estimation.

- **International competitiveness.** A country’s international competitiveness affects the profitability of firms in both the export and the import substitution sectors and, therefore, their demand for credit. It also reflects a country’s ability to bring in enough foreign currency to service its foreign debt and thus will affect foreign investors’ interest in the country. The following variables are used to construct the index: terms of trade, change in the current account, index of the market prices of the country’s export commodities, and volatility of export revenues. This index is scaled by a measure of trade openness—the ratio of trade volume (sum of exports and imports) to GDP.

- **Investment climate and monetary stability.** This index accounts for the short-run macroeconomic situation in the country. It reflects demand for investment, the availability of domestic funds, and foreign investors’ interest in the country. This index is constructed using the following variables: ratio of debt service to exports, ratio of investment to GDP, real interest rate, ratio of lending interest rate to deposit interest rate, inflation rate, ratio of domestic credit to GDP, and change in the domestic stock market index.

- **Financial development.** The level of development of the financial market affects domestic funding opportunities for firms and, therefore, their demand for foreign credit. This index is based on the ratio of stock market capitalization to GDP, the ratio of commercial bank assets to GDP, and the degree of financial account openness, which reflects how easy it is for firms to access foreign capital directly.

- **Long-run macroeconomic prospects.** The economy’s growth prospects affect the investment demand of firms. This index is based on the ratio of total foreign debt to GDP, the growth rate of real GDP, the growth rate of nominal GDP measured in USD, and the unemployment rate.

In addition to these indexes, we include indicators for banking crises constructed by Hutchison and Noy (2005) following the criteria of Caprio and Klingebiel (1996) and Demirgüç-Kunt and Detragiache (1998) and for the sovereign debt crises as defined by Arteta and Hale (2008). We simplify debt crises indicators used in Arteta and Hale (2008) to create a single “debt crisis” indicator, which is equal to one either in the month of the onset of negotiations or in the month of debt restructuring that was not preceded by a period of debt negotiations.²⁹

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²⁸ Many emerging markets rely heavily on the export of a small number of commodities. We identify up to five of these commodities (or commodity groups) for each country and merge these data with monthly commodity prices from the Global Financial Data and the International Financial Statistics. For each commodity, we calculate monthly percentage deviations from its 25-year average (1980–2004). For each country and each month, we construct the index as a simple average of relevant deviations of commodity prices. If a country is exporting a variety of manufactured goods and does not rely on commodity exports, this index is set to zero.

²⁹ Coefficients on banking and debt crisis indicators are identified mainly by banking and debt crises, respectively, which did not coincide in time with currency crises. In cases when two or three crises occurred at the same time, our model implicitly assumes that each of these crises had an additive effect on our dependent variables. We confront this assumption for the case of simultaneous currency and debt crises in Section 4.3.
Table 3
Effects of large depreciation on total amount borrowed (U.S. dollars).

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<td>Month of depreciation</td>
<td>–32.71**</td>
<td>–24.11*</td>
<td>–24.79**</td>
<td>–21.93*</td>
<td>–17.39*</td>
<td>–55.35**</td>
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<td>Year 1 since depreciation</td>
<td>–36.77**</td>
<td>–26.30**</td>
<td>–25.91**</td>
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<td>–18.96**</td>
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<td>2.24**</td>
<td>1.73**</td>
<td>1.65**</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.97)</td>
<td>(0.91)</td>
<td>(1.04)</td>
<td>(0.81)</td>
<td>(1.72)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(5.52)</td>
<td>(5.45)</td>
<td>(5.29)</td>
<td>(5.22)</td>
<td>(8.29)</td>
<td></td>
</tr>
<tr>
<td>Index 5.2</td>
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<td>12.10***</td>
<td>10.97***</td>
<td>11.23***</td>
<td>14.05***</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(6.75)</td>
<td>(6.03)</td>
<td>(3.77)</td>
<td>(5.41)</td>
<td>(6.09)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(10.03)</td>
<td>(9.96)</td>
<td>(4.97)</td>
<td>(7.73)</td>
<td>(7.67)</td>
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</tr>
<tr>
<td>Debt crisis</td>
<td>–29.51**</td>
<td>–28.80**</td>
<td>–28.03**</td>
<td>–28.93**</td>
<td>–73.25**</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(13.20)</td>
<td>(10.93)</td>
<td>(10.93)</td>
<td>(12.1)</td>
<td>(21.9)</td>
<td></td>
</tr>
<tr>
<td>Year 1 since debt crisis</td>
<td>–31.24***</td>
<td>–30.71***</td>
<td>–30.27***</td>
<td>–67.83***</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(9.07)</td>
<td>(4.99)</td>
<td>(8.94)</td>
<td>(8.34)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Year 2 since debt crisis</td>
<td>–31.42***</td>
<td>–30.32***</td>
<td>–29.29**</td>
<td>–58.83***</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(8.18)</td>
<td>(5.52)</td>
<td>(8.38)</td>
<td>(8.96)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Observations</td>
<td>7850</td>
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<td>6240</td>
<td>6212</td>
<td>5975</td>
<td>6240</td>
</tr>
<tr>
<td>Adjusted R²</td>
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<td>0.20</td>
<td>0.15</td>
<td>0.21</td>
<td></td>
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<tr>
<td>AR(1)ρ</td>
<td>0.095</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

OLS in columns (1)–(3), (5); ML in (4), (6); (5) includes lagged dependent variable interacted with country fixed effects; (6) is Tobit. Dependent variable: total amount borrowed (USD) in percentage deviations from the mean. Robust standard errors clustered on country are in parentheses (except (4), (6)). Year and country fixed effects are included in all regressions. *Significant at 10 percent; **significant at 5 percent; ***significant at 1 percent.

The following variables are included in the reduced-form equation and in the supply (price) equation. We believe that they do not directly affect the demand for foreign funds by emerging market private borrowers.

- **Global supply of capital.** This index reflects the availability of capital in general, changes in investors’ risk attitude, and their willingness to provide capital to emerging markets. This index is constructed on the basis of an investor confidence index, the growth rate of the U.S. stock market index, the U.S. Treasury rate, the volume of gross international capital outflows from OECD countries, and Merrill Lynch High Yield Spreads. All variables are presented as percentage deviations from their 25-year average. This index is not country-specific and therefore does not affect an individual country’s changes in its demand for credit.

Some creditors are not able or willing to lend to the countries that do not have an IMF agreement in place; therefore, the supply of credit to these countries can be adversely affected, especially in the aftermath of financial crises. We construct a variable that is equal to one if either a stand-by or an extended funds facility is in place for each month for a given country. Since the IMF funding is extended to sovereigns, they might affect sovereign demand for funds from commercial creditors, but are not likely to directly affect private demand for foreign credit.

4. Empirical findings

We first analyze whether there is a reduction in credit due to currency crises as defined above and then analyze demand and supply effects separately. We first focus on the long run—including our main explanatory variable for up to three years. We then repeat the analysis with monthly indicators of the event. The coefficients in the regressions are easy to interpret: since the dependent variable (quantity of credit) is defined as a percentage deviation from the mean, the coefficients on
binary variables indicate the percentage change (relative to the mean) of the dependent variable if the indicator value switches from 0 to 1.

4.1. Reduced-form analysis

The results of the reduced-form analysis that tests for a decline in credit in the aftermath of a currency depreciation are presented in Tables 3 and 4. Table 3 reports the results for the regressions with credit measured in USD, while Table 4 reports the results with credit measured in local currency. Since most of the costs that firms incur are in local currency, while foreign credit is usually denominated in foreign currency, firms might reduce their demand for foreign credit when measured in dollars, while borrowing the same amount in local currency. Since most borrowing occurs in the foreign currency, we translate borrowing into local currency using the average exchange rate for each month, and then discount the measure by the local CPI. It turns out that the decline in credit following a currency crisis is roughly the same whether it is measured in USD or in local currency. We proceed with a detailed discussion of the results in Table 3 and merely point out any differences that arise in Table 4.

In Table 3, the dependent variable is the percentage deviation in foreign credit, measured in USD, received by the private sector. The first three columns report the results of our baseline specification, while the last three present alternative econometric specifications. In particular, we are concerned that borrowing by a given country could be correlated over time, which would lead to incorrect estimates of the variance–covariance matrix and thus incorrect standard errors. We

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### Table 4

Effects of large depreciation on total amount borrowed (local currency).

<table>
<thead>
<tr>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
<th>(4)</th>
<th>(5)</th>
<th>(6)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Month of depreciation</td>
<td>−25.54</td>
<td>−8.82</td>
<td>−10.40</td>
<td>−8.53</td>
<td>−20.12</td>
</tr>
<tr>
<td>Year 2 since depreciation</td>
<td>(14.03)</td>
<td>(13.53)</td>
<td>(8.73)</td>
<td>(8.83)</td>
<td>(10.48)</td>
</tr>
<tr>
<td>Year 3 since depreciation</td>
<td>(14.38)</td>
<td>(13.51)</td>
<td>(9.08)</td>
<td>(8.86)</td>
<td>(10.59)</td>
</tr>
<tr>
<td>Index 1</td>
<td>−24.84</td>
<td>−23.19</td>
<td>−23.28</td>
<td>−13.25</td>
<td>(9.24)</td>
</tr>
<tr>
<td>Index 2</td>
<td>(24.64)</td>
<td>(24.24)</td>
<td>(19.16)</td>
<td>(27.00)</td>
<td>(19.96)</td>
</tr>
<tr>
<td>Index 3</td>
<td>(3.01)</td>
<td>(2.72)</td>
<td>(2.02)</td>
<td>(2.17)</td>
<td>(2.67)</td>
</tr>
<tr>
<td>Index 4</td>
<td>(2.98)</td>
<td>(3.07)</td>
<td>(1.47)</td>
<td>(2.51)</td>
<td>(1.71)</td>
</tr>
<tr>
<td>Index 5.1</td>
<td>2.88**</td>
<td>2.48**</td>
<td>2.50*</td>
<td>2.22**</td>
<td>3.38*</td>
</tr>
<tr>
<td>Index 5.2</td>
<td>(1.32)</td>
<td>(1.21)</td>
<td>(1.48)</td>
<td>(0.89)</td>
<td>(1.81)</td>
</tr>
<tr>
<td>IMF agreement indicator</td>
<td>−19.86**</td>
<td>−15.67**</td>
<td>−15.57***</td>
<td>−14.81***</td>
<td>−18.42**</td>
</tr>
<tr>
<td>Banking crisis indicator</td>
<td>(8.61)</td>
<td>(7.80)</td>
<td>(5.47)</td>
<td>(5.56)</td>
<td>(6.56)</td>
</tr>
<tr>
<td>Debt crisis</td>
<td>−18.01</td>
<td>−15.69</td>
<td>−16.09**</td>
<td>−8.44</td>
<td>−26.77**</td>
</tr>
<tr>
<td>Year 1 since debt crisis</td>
<td>(12.18)</td>
<td>(12.67)</td>
<td>(7.45)</td>
<td>(8.14)</td>
<td>(8.70)</td>
</tr>
<tr>
<td>Year 2 since debt crisis</td>
<td>−16.73</td>
<td>−16.78</td>
<td>−23.98</td>
<td>−23.04***</td>
<td></td>
</tr>
<tr>
<td>Observations</td>
<td>7050</td>
<td>6121</td>
<td>6121</td>
<td>6093</td>
<td>5825</td>
</tr>
<tr>
<td>Adjusted R²</td>
<td>0.13</td>
<td>0.14</td>
<td>0.14</td>
<td>0.21</td>
<td>0.16</td>
</tr>
<tr>
<td>AR(1) p</td>
<td>0.095</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

OLS in columns (1)–(3); ML in (4), (6); (5) includes lagged dependent variable interacted with country fixed effects; (6) is Tobit.

Dependent variable: total amount borrowed (loc. cur.) in percentage deviations from the mean. Robust standard errors clustered on country are in parentheses (except (4), (6)). Year and country fixed effects are included in all regressions.

*p Significant at 10 percent; **significant at 5 percent; ***significant at 1 percent.

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20 Prices tend to adjust quite slowly after large depreciation events (Burstein et al., 2002, 2005), thus our “real local currency” measure of credit is quite different from the one measured in dollars.
address this issue in columns (4) and (5). We are also concerned that our left-hand side variable is truncated at $-100$ on the left and $+100$ on the right, therefore, we estimate a Tobit regression (column (6)).

- Column (1) presents the results that are obtained without including any of the control variables described in the previous section. We can see that, if we do not control for fundamentals, the decline in credit after large currency depreciation events is large—over 30 percent in the first two years after the event, only subsiding in the third year. If measured in local currency, the credit declines even more, by over 40 percent, in the first year.

- Column (2) includes our control variables, except for the effects of a debt crisis. We can see that the effect of depreciation is now smaller, suggesting that some of the decline in credit we observed in the first column is due to worsening fundamentals. However, the remaining effect is still large (over 25 percent) and significant in the first year. Therefore, it appears that, controlling for fundamentals, credit recovers faster than the fundamentals themselves. The same is true if credit is measured in local currency.

- As shown in column (3), the effects of currency crisis diminish further if we control for the effects of sovereign debt crisis, but not by much.

- In column (4), we allow for errors to be correlated over time and find that the correlation coefficient is less than 0.10 and that the rest of our results are almost identical to those in column (3). One exception is that now the decline in credit in the second year after a currency crisis is significant, which is due to a reduction in the standard error; the point estimate remains the same.

- In column (5), we include a lagged dependent variable interacted with country fixed effects, thus allowing for a different persistence of deviations in credit from the mean in different countries. Again, our baseline results are not affected—the coefficients of interest are now smaller, but due to the lagged dependent variable on the right-hand side, they are not directly comparable with the baseline model.

- In column (6), we estimate a Tobit regression with truncation points at $-100$ and $+100$. Again, the magnitudes of coefficients in this regression are not directly comparable to the baseline model. Nevertheless, we observe the same pattern qualitatively.

While it is difficult to discuss the signs of the coefficients on our indexes, we can see that the coefficients on other controls—IMF agreements, banking crises, and debt crises—are of the expected sign and are statistically significant.

In what follows, we use the specification in column (3) of Table 3 as a baseline. Since the borrowing takes place in foreign currency and it appears that measuring it in local currency does not make a difference, in the following regressions our dependent variable is a percentage change in foreign credit to the private sector measured in USD.

In order to analyze how fast the effect of depreciations wears out, we re-estimate our regression in column (3) of Table 3 with monthly rather than annual dummy variables for the lagged effects of depreciations. We also include 12-month leads to control for simultaneity and expected currency crises. The estimates and their individual 5 percent confidence intervals are presented in Fig. 2. We can see that the decline in credit seems to last for two years, which is confirmed by the F-test, presented below the graph, although it is larger in the first five months after the currency crisis. We also find a significant decline of about 15 percent before the currency crisis, suggesting that either the currency crisis is expected or there is a

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21 One must note, however, that the differences in coefficients across specifications are not statistically significant.

22 In a separate regression we include only the lagged dependent variable, without interactions. The results are very similar and are not reported.
Table 5
Effects of large depreciation on demand and supply of funds.

<table>
<thead>
<tr>
<th></th>
<th>Model 1</th>
<th>Model 2</th>
<th>Model 3</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Price (1)</td>
<td>Quantity (2)</td>
<td>Price (3)</td>
</tr>
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<td>Price</td>
<td>0.46***</td>
<td></td>
<td>0.44***</td>
</tr>
<tr>
<td>1–3 months before depreciation</td>
<td>-7.55 (7.50)</td>
<td>-26.57 (23.91)</td>
<td>-5.57 (7.22)</td>
</tr>
<tr>
<td>Month of depreciation</td>
<td>-19.06* (9.97)</td>
<td>-11.86 (31.78)</td>
<td>-18.94* (9.62)</td>
</tr>
<tr>
<td>1–5 months since depreciation</td>
<td>-26.45*** (4.80)</td>
<td>-41.15*** (15.32)</td>
<td>-23.65*** (4.81)</td>
</tr>
<tr>
<td>6–12 months since depreciation</td>
<td>-22.64*** (4.27)</td>
<td>-22.59 (14.07)</td>
<td>-16.13*** (4.54)</td>
</tr>
<tr>
<td>Year 2 since depreciation</td>
<td>-11.61*** (3.42)</td>
<td>-14.68 (10.45)</td>
<td>-11.38*** (3.39)</td>
</tr>
<tr>
<td>Index 1</td>
<td>-8.33 (20.33)</td>
<td>-33.82*** (7.19)</td>
<td>-0.13 (2.97)</td>
</tr>
<tr>
<td>Index 2</td>
<td>3.80 (2.97)</td>
<td>7.49*** (1.12)</td>
<td>2.88 (2.97)</td>
</tr>
<tr>
<td>Index 3</td>
<td>3.36** (1.64)</td>
<td>3.55*** (0.54)</td>
<td>2.51 (1.64)</td>
</tr>
<tr>
<td>Index 4</td>
<td>-1.42 (2.74)</td>
<td>-2.91*** (0.95)</td>
<td>-1.22 (2.75)</td>
</tr>
<tr>
<td>Index 5.1</td>
<td>3.22*** (0.58)</td>
<td>2.78 (0.57)</td>
<td>2.87*** (0.57)</td>
</tr>
<tr>
<td>Index 5.2</td>
<td>19.95*** (1.04)</td>
<td>17.99*** (1.08)</td>
<td>17.12*** (1.09)</td>
</tr>
<tr>
<td>IMF agreement indicator</td>
<td>28.34*** (2.69)</td>
<td>27.28*** (2.64)</td>
<td>27.07*** (2.64)</td>
</tr>
<tr>
<td>Banking crisis indicator</td>
<td>-18.34 (12.26)</td>
<td>18.55*** (3.29)</td>
<td>-21.94* (12.27)</td>
</tr>
<tr>
<td>Debt crisis</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Year 1 since debt crisis</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Year 2 since debt crisis</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Country fixed effects</td>
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</tr>
<tr>
<td>Year fixed effects</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
</tr>
</tbody>
</table>

Robust standard errors clustered on country are in parentheses. *Significant at 10 percent; **significant at 5 percent; ***significant at 1 percent.

4.2. Demand and supply effects

We now turn to demand and supply effects. Since we discovered that there is some decline in credit in the three months prior to currency depreciation, we include an indicator for three months before the event. In addition, we split the effects of the first year into two half-year indicators, in order to analyze how fast the effects subside. The results are presented in Table 5. The number of observations is smaller due to the fact that price data only go back to 1994.

First we note, reassuringly, that the coefficient on the price in the demand equation (labeled “Quantity”) is positive and statistically significant. Since the price is measured as a market value of the debt, it is the inverse of the cost of credit, and therefore we would expect the demand for credit to positively depend on the market value of debt. Our estimated elasticity

23 We will address this simultaneity problem in the robustness tests section.

24 In addition, consistent with the literature, we find some evidence of a “lending boom” 9–12 months prior to the crisis.

25 Including instead the same set of dummy variables as in Table 4 gives us the same results. We proceed with the more detailed period dummies, however, because they give us more information.
of demand suggests that a 10 percent increase in the market value of the debt would increase the demand for credit by 3–4 percent. Moreover, the decline in the market value of the debt means an increase in the cost of borrowing and thus can be interpreted as a decline in the supply of credit.

In Model 1, presented in columns (1) and (2), the supply equation, labeled “Price,” does not include controls for fundamentals. As column (1) shows, we observe a large decline in the market value of the debt that persists for two years: a decline of over 20 percent in the first year and over 10 percent in the second year. Once we control for fundamentals (Model 2, column (3)), we find that a reduction in the supply of credit is partly due to worsening fundamentals: the fall in the price of bonds is now about 16 percent in the second part of the first year. However, it is still persistent.

In both Models 1 and 2, we observe a dramatic drop in the demand for credit, on the order of 40 percent in the first five months after a currency depreciation. However, this demand effect is very short-lived—it is only borderline significant in the next half a year, and is no longer statistically significant in the second year in both models.

Controlling for the effects of debt crises, as in Model 3, does not bring about many changes, especially not in the supply regression (column (5)). Once we control for the effects of debt crises, we can see even more clearly that the decline in the demand for credit does not persist after the first five months following the currency crisis.

We can also see in these regressions that neither decline in supply nor decline in demand are statistically significant in the three months prior to the currency crisis. This observation gives us comfort in a sense that simultaneity due to sudden stops is likely not important, as we will see in the robustness tests as well.

Thus, we can conclude from this section that we observe a credit crunch in the aftermath of currency crises, or large depreciation episodes in general, which is consistent with the view that balance sheets worsen due to currency depreciation. However, only about one-third of the total decline in credit is due to the credit crunch—the rest is accounted for by the decline in demand, even when we control for fundamentals. This finding provides a potential explanation for the decline in investment associated with currency crises.

4.3. Robustness tests and further analysis

In this section we conduct some additional tests. The tables of results are not reported, but can be obtained from the authors upon request.

Definition of a currency crisis. First of all, we test whether our results are sensitive to the definition of the large depreciation event. We construct a variable for currency crisis based on the bilateral exchange rate vis-à-vis the U.S. and the CPI in the U.S. and the country of interest. Not surprisingly, the set of events we define through the use of this variable is almost identical to the one presented in Table 1 and therefore all the results remain the same. We also alter the length of the tranquil period required before the new crisis can occur, which we initially set to three months. Setting it to one, two, or four months only alters our set of crises very slightly and therefore does not affect the results of the regression analysis.

Next, we re-estimate all our models with a new threshold of the change in the real exchange rate set to 15 percent (39 episodes in our sample). We find results to be very similar to our baseline specification for our reduced-form and supply equations, while the decline in demand in the regression reported in column (6) of Table 5 is no longer significant even in the first five months after the currency crises. Overall, the basic message of the paper and the estimated magnitudes of the decline in credit remain unchanged.

We re-estimate our model replacing the large depreciation indicators with a continuous variable that measures percentage change in the real effective exchange rate in each month. We find no significant effects of this variable, whether contemporaneous or lagged, in a reduced-form specification or in the demand equation, which suggests that our results are indeed driven by large depreciations. We do find a significant decline in the supply of credit due to contemporaneous or lagged real depreciation. This finding is consistent with our evidence of the credit crunch.

We re-estimate our model, separating depreciation episodes in two categories: (i) devaluations or switches from pre-announced peg to floating regime; and (ii) depreciations under floating regime. We find that the decline in credit occurs in both cases but is larger and more persistent in the case of a regime switch, as we would expect. We further find that while the supply of credit falls in both types of currency crises, which is again consistent with the balance-sheet-driven credit crunch, the decline in demand for credit only occurs after regime switches.

Twin crises. In our treatment of currency crises and debt crises as separate events, we implicitly assume that when the two occur at the same time, their effects are additive. To test whether this assumption is appropriate, we create the indicators to describe three types of crises: twin crises (both currency and debt), currency crises not accompanied by debt crises, and debt crises not accompanied by currency crises. We define crises as twines when currency crises and debt crises occur within three months of each other, which amounts to 23 twin crises in our overall sample and only three crises in our smaller sample (for which we can analyze demand and supply).

Consistent with our findings here and in Arteta and Hale (2008), we find that credit falls by about 25 percent in the first year and by 15 percent in the second year after the currency crisis, and by 30 percent for over two years after a debt crisis. However, when both types of crises occur at the same time, credit falls by about 35 percent in the first year and about 25 percent in the second year after the twin crises. Furthermore, the decline in credit that is due to a credit crunch appears to be almost exactly additive: in the first year after a currency crisis, the decline in supply is about 20 percent, in the first year after a debt crisis, it is about 10 percent, while in a first year after twin crises, it is 29 percent. The decline in the demand for
credit after twin crises, on the other hand, appears to be driven mostly by the debt crises, which have a larger effect on demand.\footnote{This latter result should be interpreted with care, of course, since in this shorter time period we only have three twin crises.}

This implies that adding debt crisis indicators as we did in the benchmark specification was appropriate in the reduced-form regressions as well as in price regressions, but was not quite appropriate in the demand (quantity) regressions. In particular, forcing the effect of debt and currency crises to be additive in the case of twin crises would bias upward our estimates of the currency crisis effect and would bias downwards our estimates of the debt crisis effect. However, since in the shorter sample for which we can estimate the demand equation there are only three twin crises, and because Sy (2004) demonstrated that “currency and debt crises are not closely linked in emerging markets,” the bias is unlikely to be substantial.

Measure of credit. Since our measure of fluctuations in credit is constructed from the micro-level data, we are concerned that we might be missing an important chunk of the private sector borrowing. From the Global Development Finance (GDF) we gathered series on private nonguaranteed disbursements and repayments (of principal and interest). Unfortunately, GDF series are only of annual frequency. We compared the gross disbursement series to our total amount borrowed, aggregated by year, and found that they are very similar, with the overall correlation coefficient of 0.63 and the mean about twice as large as our measure.
First, we replicated our results using the percentage deviation from the country mean in gross disbursements (sum of bonds and bank loans), deflated by U.S. CPI. We find that both the reduced form and the demand–supply results are completely unaffected by the use of this measure instead of the original one. Because the GDF measure does not vary month-to-month and because we lose five countries, for which GDF data are not available, some of the coefficients are estimated less precisely. However, the coefficients that are significant in our benchmark regressions remain significant with the alternative measure of credit.

Next, we test whether our results are sensitive to using a measure of net borrowing (disbursements minus repayments), rather than gross borrowing. We construct the measure of percentage deviations from net borrowing in the same way as above and use it as our dependent variable. In the reduced-form regression, the only change is that there is no longer a reduction in credit two years after a currency crisis. The coefficient now is small and positive, although, as before, it is not significantly different from zero. In the demand–supply regressions, we find that the supply results are not affected (unsurprisingly, since nothing is altered in the supply equation), while the decline in demand in the first five months after a currency crisis is a lot larger (about 60 percent), persists for the next six months (a 20 percent decline), and is reversed to 20 percent increase in demand in the second year. This suggests that not only do firms demand less credit after currency crises, but they also increase their repayments of existing debt in the first year after a crisis.

To investigate this further, we revert to using the original measure of credit on the left-hand side and add a measure of repayment (in percentage changes from the country mean) as a control variable. We find that our reduced-form results are largely unaffected, while one percent increase in repayment increases borrowing by 0.12 percent. In the demand–supply model, where we include the measure of repayment in both equations, both supply and demand are basically unaffected, while one percent increase in repayment increases the price of bonds by 0.12 percent and lowers the demand for credit by 0.14 percent.

Other tests. We are aware of the simultaneity problem that could arise due to sudden stops in capital flows (Calvo, 1998). To address it, we include the indicator for a sudden stop year in our regressions to see whether our results are robust to such a control. Since a simple sudden stop indicator would be endogenous with respect to our left-hand side variable, we use the “systemic sudden stop” indicator constructed by Calvo et al. (2006) that relies less on country-specific information. For the countries not covered in Calvo et al. (2006), we use the sudden stop indicator from Frankel and Cavallo (2004). We find that adding such an indicator does not alter our coefficients of interest at all.\(^\text{27}\)

To see whether the appearance of the international bond market in the early 1990s had an important effect, we re-estimate the regressions in Table 4 splitting the sample into 1980–1989 and 1990–2004 time periods. We find that the decline in credit in the 1980s (32 episodes of currency depreciation) was less than 10 percent and only lasted one year, while the decline in the 1990s (31 episodes) was about 28 percent in the first year and 17 percent in the second year.\(^\text{28}\) This leads us to suspect that our results might be driven mainly by bond issuance. Thus, we re-estimate our model with just loans and just the bond issuance on the left-hand side. We find, however, that our main results are driven primarily by the loan market, as the decline in bond credit is smaller and not statistically significant.\(^\text{29}\)

Because firms in different sectors are likely to have different exposure to currency risks, we were interested in estimating whether all the sectors are equally affected by the currency crises. In contrast to the effects of debt crises that are different for financial, exporting, and non-exporting sectors (Arteta and Hale, 2008), we find that the effects of currency crises are roughly the same across these sectors.

We re-estimated our model, adding 12-month fixed effects to control for any possible seasonality. While we find that credit in the months of January and February tends to be lower, this effect does not change our results at all.\(^\text{30}\)

When the political situation in a country is unstable, it introduces uncertainty and leads to a decline in firms’ investment and their demand for credit; furthermore, it may lead to foreign investors’ concerns about their ability to collect their assets in the future. We used the measure of political risk from the International Country Risk Guide (ICRG). While this index does enter significantly with the correct sign in most regressions, it does not affect our qualitative or quantitative conclusions. It does limit our sample size and therefore reduces the significance level of some coefficients.

We experimented with lagging our indexes by 3, 6, and 12 months and found that, while the coefficients on indexes do change, our main results are not affected.

Finally, given the large degree of heterogeneity in the data, we re-estimated the model by estimating time-series regressions for each country and taking a simple average of the coefficients across countries. The coefficients of interest obtained in this manner are very close to those we estimate in our fixed-effects specifications, thus confirming that the effects we find are indeed systematic and robust.

5. Conclusion

We analyze a data set built on firm-level data in order to examine the effects of large currency depreciations on foreign credit to the private sector. Controlling for fundamentals and the effects of sovereign debt crises, we find that foreign credit

\(^{27}\) Moreover, the sudden stop indicator does not enter significantly in our supply equation, while it enters positively in our reduced form and demand equation, suggesting that endogeneity of this indicator can indeed be a problem.

\(^{28}\) Our demand and supply estimation is limited to the sample of 1994–2004, due to price data availability.

\(^{29}\) This is not a surprise given a much smaller number of bond issues compared to loan contracts.
to the private sector declines by about 25 percent in the first year after a currency crisis, and that this decline is especially large in the first five months after the crisis. This decline is persistent, substantial, and robust.

We find that both demand and supply take a substantial hit after large depreciations. However, only the decline in supply is persistent and lasts for over two years, while the decline in demand, although large in the first five months after a crisis, wears out quickly. These results are consistent with the view that currency crises lead to the balance-sheet effects that in turn can worsen credit rationing. Since balance-sheet problems take a while to resolve, the decline in supply of credit is persistent.

Thus, we provide evidence that helps explain the large scale of economic downturn as well as the decline in investment activity in the aftermath of currency crises. We also show that external factors, such as foreign credit crunch, do not fully account for the overall decline in credit.

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