



Dollar illiquidity and central bank swap arrangements during the global financial crisis[☆]

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ABSTRACT

While the global financial crisis was centered in the United States, it led to a surprising appreciation in the dollar, suggesting global dollar illiquidity. In response, the Federal Reserve partnered with other central banks to inject dollars into the international financial system. Empirical studies of the success of these efforts have yielded mixed results, in part because their timing is likely to be endogenous. In this paper, we examine the cross-sectional impact of these interventions. Theory consistent with dollar appreciation in the crisis suggests that their impact should be greater for countries that have greater exposure to the United States through trade and financial channels, less transparent holdings of dollar assets, and greater illiquidity difficulties. We examine these predictions for observed cross-sectional changes in CDS spreads, using a new proxy for innovations in perceived changes in sovereign risk based upon Google-search data. We find robust evidence that auctions of dollar assets by foreign central banks disproportionately benefited countries that were more exposed to the United States through either trade linkages or asset exposure. We obtain weaker results for differences in asset transparency or illiquidity. However, several of the important announcements concerning the international swap programs disproportionately benefited countries exhibiting greater asset opaqueness.

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1. Introduction

The recent global financial crisis originated and was centered in the United States. When difficulties arose in sub-prime mortgages in early 2007, investors became concerned about a wide set of U.S. assets, resulting in fire sales and the failure or near-failure of a number of

systemically important U.S. financial firms (Bernanke, 2009). Between October 2007 and October 2008, there was a \$8 trillion sell off in U.S. equity values (Brunnermeier, 2009). A surprising feature of the recent financial crisis is that at its peak the American dollar actually rose in value. Going into the crisis, most thought that the adjustment process to undo the large global imbalances that had built up during the boom would include a sharp dollar depreciation (e.g. Krugman, 2007).

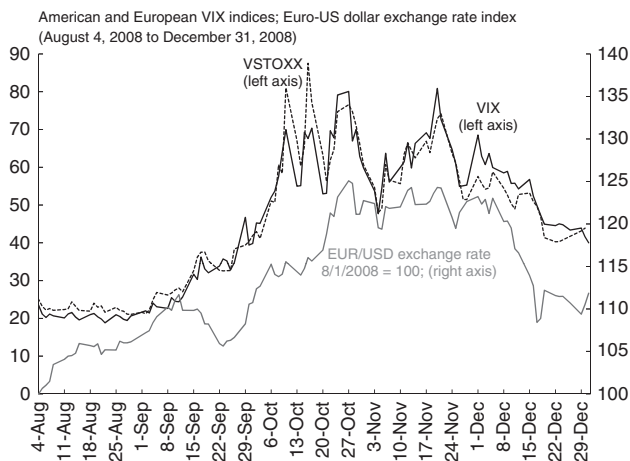
Instead, the crisis country currency appreciated (Engel, 2009). For example, see Fig. 1, which plots the VIX and VSTOXX measures of US and European equity market volatility respectively against the dollar–euro exchange rate during late 2008. The dollar exchange rate moved quite closely with volatility in equity markets, as can be seen by examining plots of the VIX and VSTOXX indices. This leads us to the view that the appreciation of the dollar resulted from a flight to liquidity rather than solely a flight to safety.

While there probably was some movement towards safety (e.g. Fratzscher, 2009; McCauley and McGuire, 2009), we concentrate on the liquidity issue here. Many studies (e.g. Baba and Packer, 2009b) characterize the illiquidity as a shortage in dollar funding suffered by financial institutions. Viewed from the prism of a global dollar

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Sources: Bloomberg and Federal Reserve DistFAME
 VIX and VSTOXX indices of equity market volatility in United States and European exchanges respectively. Daily frequency.
 Dollar-euro exchange rate indexed to 100 on August 1, 2008.

Fig. 1. Stock market volatility and bilateral exchange rate. Sources: Bloomberg and Federal Reserve DistFAME. VIX and VSTOXX indices of equity market volatility in United States and European exchanges respectively. Daily frequency. Dollar-euro exchange rate indexed to 100 on August 1, 2008.

liquidity shortage due to the unique role played by the dollar in global financial markets, the temporary appreciation of the dollar is unsurprising.¹

At the height of the crisis, the Federal Reserve extended dollar assets to major industrial countries, and several emerging markets' central banks to alleviate these dollar shortages.² Obstfeld et al. (2009) note that desirable alternatives to the swap arrangements did not exist, as increased domestic currency extensions from local central banks could have led to undesirable currency depreciation, and the use of foreign central bank dollar reserves would have reduced their holdings, raising anxiety.³ They argue that the broad injection of dollar liquidity was "... one of the most notable examples of central bank cooperation in history ..."

The swaps were short-term arrangements, never exceeding 30 days, and were thus unlikely to affect default risk. Rather, they were explicitly intended to address liquidity problems. Indeed, the first FAQ on the Federal Reserve web page [Federal Reserve (2011)], answers the question "What was the purpose of the dollar liquidity swap lines?" with "The dollar liquidity swap lines were designed to improve liquidity conditions in U.S. and foreign financial markets by providing foreign central banks with the capacity to deliver U.S. dollar funding to institutions in their jurisdictions during times of market stress."

¹ Goldberg and Tille (2008) show that the dollar plays a prominent role in invoicing in international transactions, even in many that do not involve agents from the United States. Similar concerns drive currency invoicing decisions in debt issuance (Chinn and Frankel, 2007). The impact of scale effects has been demonstrated in the case of the advent of the euro, where the increased volume of existing issuance in euro relative to national currencies resulted in a substantial move towards the euro in new issuance (Hale and Spiegel, forthcoming).

² Some have also suggested that the swaps were motivated by a desire to mitigate the aforementioned exchange rate pressures.

³ Some emerging market country swap arrangements reflected their desire to avoid obtaining funds from the International Monetary Fund, and may have more reflected the need for hard currency reserves (e.g. Engel, 2009).

The evidence on the impact of central bank interventions is mixed. Some of the studies (e.g. Taylor and Williams, 2009) find no impact, while others, such as McAndrews et al. (2008), find significant but small impacts. More recent studies, such as Baba and Packer (2009b), concentrate on the most turbulent portion of the crisis and find larger effects. However, the endogeneity of these injections, which were provided when and where they were most needed, poses a challenge in evaluating their impact.

Given these difficulties, we examine the cross-sectional impacts of central bank efforts to address dollar-funding shortages. We begin with a descriptive overview of the central bank responses to the global financial crisis, reviewing a number of the relevant empirical regularities that have been found in the literature. We then discuss the implications of a theoretical model derived in a companion paper (Rose and Spiegel, forthcoming-b) that describes the crisis as stemming from toxic American assets but still predicts the observed dollar appreciation.

We then bring the cross-sectional predictions of that model to the data to reassess the impact of the attempts by the Federal Reserve and others to inject dollar liquidity into the global financial system. Theory suggests that the impact of these injections should be greater among countries that have greater exposure to the United States through trade and financial channels, less transparent holdings of dollar assets, and greater illiquidity difficulties. We test these hypotheses by examining the impact of announced U.S. dollar auctions by foreign central banks, weighted by the size and average maturity of auctioned assets, on CDS spreads for a large cross-section of countries. We find robust evidence that the auctions disproportionately benefited countries that were more exposed to the United States, either through trade or financial channels, as the theory predicts. We obtain weaker or incorrect results for national differences in the impact of the auctions by the transparency of their dollar holdings and measures of illiquidity.

We also examine the impacts of the major announcements concerning the international swap arrangements. For several of the most important announcements, such as the one that removed the ceilings on swaps with major foreign central bank partners and the announcement initiating swap arrangements with a broader set of countries, our results for announcements roughly match those for the actual auctions. However, for others, such as the actual launch of the program, we find disproportionate benefits among countries exhibiting greater illiquidity.

The following section reviews the evidence in the literature on the impact of the central bank swap lines on global financial conditions. Section 3 discusses our base empirical specification. Section 4 subjects our results to a battery of robustness tests. Lastly, Section 5 concludes.

2. Evidence on the impact of the swap arrangements

Major announcements concerning international swap lines by the Federal Reserve during this period are shown in Table 1. The first is December 12, 2007, when the Federal Reserve announced its swap arrangements with the European Central Bank (ECB) and the Swiss National Bank (SNB). These were initially capped at \$20 and \$4 billion respectively. With the increased turmoil in global financial markets in the fall of 2008, swap lines were extended and expanded. On September 18, 2008, lines were introduced for the Bank of England (BOE), the Bank of Japan (BOJ) and the Bank of Canada, while lines with the ECB and the SNB were increased. Less than a week later, on September 24, swap facilities were introduced for the Reserve Bank of Australia, the Swedish Riksbank, the Denmark National Bank, and the Norwegian Central Bank. In October of the same year, existing lines were "uncapped," on October 13 for the BOE, the ECB and the SNB, and on October 14 for the BOJ. Finally, on October 28, 2008, lines were introduced for New Zealand, and on October 29,

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