The IMF, Domestic Public Sector Banks and Currency Crises in Developing States\footnote{The authors wish to acknowledge the valuable feedback and suggestions that they received from the editor and reviewers of \textit{International Interactions}. A web appendix to the paper appears at: http://www.benjaminbagozzi.com/publications.html}

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\textbf{Abstract:} The International Monetary Fund’s (IMF) stabilization programs—which are often designed to prevent currency crashes and promote exchange rate stability—frequently fail to prevent currency crises in program-recipient developing countries. This leads to the following puzzle: \textit{when} do IMF programs fail to prevent currency crises in developing states that turn to the Fund for assistance? We suggest that the likelihood that a currency crisis may occur under an IMF program depends on the market concentration of public sector banks in program-participating developing countries: the higher the market concentration of public banks in a program recipient nation, the more likely that the IMF program will be associated with a currency crisis. Specifically, if the market concentration of public banks in a program-participating developing country is high, then banks will compel the government to renege on its commitment to implement banking sector reforms. This induces a financial panic among investors that leads to a currency crisis. Statistical tests from a sample of developing countries provide robust support for our hypothesis.
Following World War II, the economies of most developing countries were insulated from financial crises – specifically currency crashes – in the international monetary system. With the advent of financial globalization, however, the frequency of currency crises increased sharply across developing states.\(^2\) Indeed, currency crises have recently occurred in developing states such as Argentina, Brazil, Indonesia, Russia, South Korea, and Turkey. The increased frequency of currency crashes in developing states, and their devastating consequences, has led to substantial academic research on the determinants of currency crises (Chiu and Willett 2009; Eichengreen, Rose, and Wyplosz 1995; Frieden, Ghezzi, and Stein 2001; Leblang and Bernhard 2001; Leblang and Satyanath 2006; Morris and Shin 1998).

While scholars continue to study the domestic causes of currency crises, some academics have focused on another key actor, namely the International Monetary Fund (IMF), whose key objectives include the promotion currency stability (Chwieroth 2010; Dreher and Walter 2010). In particular, the currency crashes that occurred in many developing states during the 1990s led some scholars to publicly ask why the IMF could not prevent currency crises in developing nations.\(^3\) This question stemmed from the fact that the IMF’s intervention failed to prevent currency crises in several prominent cases. For example, the IMF provided financial assistance packages and Stand-by-Arrangement (SBA) programs to South Korea in December 1997 and Turkey in 1999-2000 to forestall currency crises in these two countries. A currency crisis, however, occurred in South Korea three weeks after the Dae-Jung Kim government accepted the Fund’s SBA program (IMF 1999; Radelet and Sachs 1998). A currency crisis also occurred in Turkey just two months after the Fund provided a large financial package for Turkey in December 2000 (Keksin and Alparslan 2002).

\(^2\) IMF (2000); Leblang (2002).
\(^3\) Radelet and Sachs (1998); Stiglitz (2003).
The examples discussed above are not unique. For instance, the IMF did not succeed in preventing a currency crisis in Bolivia (in 1981), Thailand (1998), Indonesia (1998) and Ghana (2000) even though these countries participated in the Fund’s stabilization program to forestall a speculative attack on their currency (Fischer 2004; Lane and Schulze-Ghattas 1999). Our data (described below) also reveals that the rate of currency crisis occurrence among IMF program country-years is approximately double the rate of occurrence for non-IMF program country-years. This should not be taken to mean that the IMF inevitably fails to prevent a currency crisis in program-participating states. In fact, the IMF has for example successfully prevented a currency crisis in the following financially-troubled developing states that turned to the Fund for assistance: Tunisia in 1987, India in 1991-92 and Costa Rica in 1996. (Fischer 2004; IMF 2000). Yet our finding that IMF programs are frequently (but not always) associated with currency crises in developing states is puzzling as the Fund is obliged by Article I (section iii) of its own constitution to promote exchange rate stability and minimize the incidence of currency crashes. Indeed, this puzzle raises the central question addressed here: when are IMF programs more likely to be associated with currency crises in developing states that turn to the Fund for assistance?

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4 We first identify the currency crisis episodes in our pooled sample of developing countries that is described later. To this end, we follow Eichengreen et al (1995) and define currency crises as those periods when Eichengreen et al’s foreign exchange market pressure (EMP) index – this index is defined in the paper’s empirical section – exceeds the country-specific mean by at least two standard deviations. We then checked the frequency with which currency crises occurs in developing states for the years in which they are observed under the following types of IMF programs: Stand-by and extended stand-by arrangement, Supplementary Reserve Facility, Extended Fund Facility, Contingency Funding facility, Buffer Stock Funding Facility, Currency Stabilization Facility, Structural Adjustment Fund, and Poverty Reduction Growth Facility. This empirical exercise led to the finding posited above.

5 In a sample of 67 countries observed between 1975 and 1997, Hutchison (2001) finds that almost two-thirds of “short-term” IMF programs are not associated with a contemporaneous currency crisis. Thus even though many IMF programs are associated with currency crises, we learn from Hutchison’s (2001) study that currency crashes do not always occur in countries observed under an IMF program.
We suggest that IMF programs are associated with currency crises with greater probability in program recipient developing states when the market concentration of public sector banks in these countries is high. While a variety of causal mechanisms could account for this prediction, we propose the following theoretical argument that leads to the main claim posited above. To start, observe that programs offered by the IMF to developing states (that seek the Fund’s assistance) include a financial package plus reform measures (that is, conditions) designed to reduce the financial problems of these states. Although these reform measures vary, we argue that IMF programs often incorporate banking sector reforms—including reductions of non-performing bank-assets and privatizations of public sector banks—to avert a currency crisis.

Note that public banks in program-participating countries have incentives to resist the reform measures listed above as it hurts their economic interests. They will thus exert political pressure on their government to not implement banking sector reforms in IMF programs. Ergo, we argue that if the market concentration of public banks in program-recipient countries is high, then they will credibly exert substantial political pressure on policymakers to not adopt the IMF-mandated reforms delineated above. Governments in program-recipient nations that have highly market concentrated public banks will acquiesce to this pressure and renege on their commitment to implement IMF-reform measures. Reneging on their commitment to the IMF induces a financial panic among investors that leads to a currency crisis. Hence we hypothesize that the likelihood of a currency crisis will increase under IMF programs when the market concentration of public banks in program-participating countries is substantial. Statistical results obtained from a dataset of 113 developing countries (1975-2008) provide robust support for this hypothesis.
This paper proceeds as follows. We first develop our theoretical argument that generates the main hypothesis that is posited in the preceding paragraph. We then present the data, the variables, the statistical methodology that we employ and the empirical results. We conclude by discussing numerous implications that emerge from our findings and provide avenues for future research.

**Theoretical framework**

To develop our theoretical story, we need to first explore when developing states are likely to seek the IMF’s assistance and how the IMF responds to such requests for assistance. To this end, note that developing states select into IMF programs when they suffer from severe domestic economic problems such as a sharp contraction in economic output, failure of domestic banks, high inflation or terms-of-trade shocks (Jensen 2004; Vreeland 2004). Terms-of-trade shocks in particular generate balance of payments crises that drive governments to self-select into IMF programs. The IMF’s decision to assist such countries is determined in part by the magnitude of the borrowing country’s financial troubles and other factors including the exposure of U.S. financial institutions to the country’s markets, the availability of supplementary financing, and levels of trade and finance with “G-5” states (Broz 2005; Copelovitch 2010; Gould 2003; Oatley and Yackee 2000; Pop-Echeles 2009; Stone 2008). As such, the IMF typically responds to severe financial problems in developing states that turn to the Fund for assistance by approving stabilization programs (e.g., the Stand-By-Arrangement program) for these countries (Dreher and Walter 2010; Jensen 2004; Willett 2001).

These programs include a financial package and “a set of economic policy reforms, or conditionality, that the borrower must implement to receive IMF credit” (Copelovitch 2010: 51). The “binding” (i.e. mandatory) reform conditions in IMF programs vary substantially and
include conditions such as fiscal or monetary policy reforms. However, a key mandatory condition in such IMF programs is structural banking sector reforms that include the following three measures: privatization of public sector banks, liberalization of the banking sector and reduction of non-performing loans of public banks (Boockman and Dreher 2003; Giustiniani and Kronenberg 2005; IMF 1998, 1999). Studies by the Fund in fact emphasize that IMF programs for developing states “often include privatization of state-owned banks as an important element” not only because financial problems in developing country public banks engender macroeconomic crisis but also because public bank privatization “restores banking system soundness that is crucial for macroeconomic stability.”

Data that operationalizes the presence of the three specific structural banking sector reform conditions mentioned above (which we focus on here) in each IMF program is hard to obtain. The Fund’s MONA database – which contains information on structural banking and financial sector conditions for a limited number of IMF programs between 1993 and 2005 – reveals that more than three-quarters of structural conditions incorporated in IMF programs was focused on the banking sector (Giustiniani and Kronenberg 2005: 11; IMF 2005). A recent study that examines the “intensity” of a broader set of financial sector program conditions also reports that more than 90% of the Fund’ approved programs contain banking sector reform measures that include, e.g., privatization of state-owned banks (Giustiniani and Kronenberg

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6 IMF (1998: 17)
8 The IMF’s MONA (Monitoring Fund Arrangements) database, established in 1993, provides information on key aspects of Fund programs such as the amount of financial support, the dates of scheduled and actual drawings, conditions for these drawings, and implementation of these conditions. Information on the structural banking sector conditions discussed above are drawn from the Fund’s MONA database.
Some examples further confirm that the Fund incorporates banking sector reform measures in stabilization programs for developing states.

For instance, severe financial problems in Zambia’s public sector banks forced the Zambian government to request the IMF for assistance in early 2001 (Bull, Jerve, and Sigvaldsen 2006; IMF 2006). In response, the IMF approved a PRGF program for Zambia in 2001 that included a “structural reform and governance agenda” that incorporated “conditionalities to pressure for the adoption and implementation of policies to privatize state owned banks” (Bull et al 2006: 38). A US Treasury Department report also reveals that stabilization programs negotiated between the IMF and Egypt in 1996 “stressed the importance of privatizing the four state-owned banks that dominate the Egyptian banking sector,” while in 2001 “Pakistan’s PRGF…called for far-reaching structural reforms, including those in the financial sector.” Structural banking sector conditions were also included in IMF programs during the 1980s. A recent report by the Fund’s staff, in fact, points out that IMF-supported programs for Argentina (in 1983-84) and the Philippines (1985) incorporated banking sector conditions such as public bank privatization, banking system liberalization, and reduction of non-performing loans by state-owned banks (Gola and Spadafora 2009).

Why does the Fund incorporate program conditions such as public bank privatization and banking system liberalization for developing countries? Two reasons help to answer this question. First, extant studies on banking systems show that in developing countries (i) public banks are more common than private banks and (ii) that the financial assets of public banks as well as the number of workers that they employ are significantly greater than private banks.

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9 More specifically, Giustiniani and Kronenberg (2005: 11) state that “only 12 out of 158-supported programs did not include any conditionality on the banking sector” (italics added).


11 Barth, Caprio, and Levine (2006); Mosley and Singer (2009); World Bank (2001).
(Cornett, Ghu, Khaksari, and Tehranian 2010; Hanson, Honohan, and Majnoni 2003; World Bank 2001). The aforementioned studies and the Fund’s research (IMF 1998; 2000) report that state-owned banks in developing countries are often plagued by structural weaknesses such as high shares of non-performing financial assets, non-transparent lending practices and high losses. These structural weaknesses have two deleterious consequences according to the IMF. The first is that “inefficiently operated or insolvent state-owned banks are frequently an important contributing factor to the systemic banking problem” (IMF 1998: 14). As such, financially unstable public banks threaten the sustainability of public finances in developing economies and act as a channel through which shocks are amplified to a full-blown currency crisis (IMF 1998, 1999).

The second consequence is that a crisis of confidence about the financial health of developing countries may emerge among international investors if structural weaknesses in public banks in borrowing countries persist (IMF 1998, 2000). This crisis of confidence is especially acute in the context of public banks in program-participating countries as investors often believe that policymakers in these countries lack the political will to resolve debilitating financial problems in state-owned banks (IMF 1998, 2000). This crisis of confidence increases the risk of a speculative attack on the currency of such developing states, and hence, of a currency crisis (Fischer 2004; IMF 1998). The Fund thus employs its stabilization programs to encourage borrowing country governments – who may use these programs as “political cover”12 – to implement conditions including public bank privatization to restore banking sector stability and thus reduce the risk of a currency crisis in financially-distressed developing states (IMF 1998, 1999).

12 The use of IMF programs as “political cover” by states is discussed in Remmer (1986) and Vreeland (2003).
Second, the IMF encourages borrowing countries to liberalize state-controlled banking systems to signal to international investors that any financial problems arising from inefficient public banks will be solved (Fischer 2004; IMF 1999, 2001). The purpose of sending this signal is to reassure investors that borrowing countries are “a good investment risk….The IMF “seal of approval” is supposed to bring in what has become known as catalytic finance” (Vreeland 2004: 8). The IMF’s ability to promote catalytic finance has been challenged by scholars. However, the Fund claims that the aforementioned signal reduces investors’ concerns about the financial health of borrowing states which decreases the probability of speculative currency attacks (IMF 1998, 2000).

While it is not uncommon for the Fund to include program conditions that target public banks in borrowing countries to forestall a currency crisis, the IMF’s effort to prevent crises in program-recipient countries has been successful in some cases but not others. For example, the Fund included privatization of state-owned banks in Zambia’s PRGF (August 2001) and in SBA programs for the Philippines (April 1985) and Croatia (July 2003) to restore confidence in the banking system of these states and thus prevent a speculative run on their respective national currency. After receiving the Fund’s assistance, the Zambian Kwacha, the Philippines Peso and the Croatian Kuna stabilized in international financial markets and were not subject to a speculative attack. The Fund also included public bank privatization and restructuring conditions in Turkey’s PRGF in 2000 and Pakistan’s PRGF in 2001 to prevent a currency crisis in these two countries (IMF 2005). The Turkish Lira and the Pakistani Rupee, however, collapsed in international financial markets just weeks after these two countries received the Fund’s assistance. The contrast between the Zambian plus Croatian case and other cases of

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13 Bird and Rowlands (2004:129), for example, find that the IMF’s claim that it “plays an important catalytic role by encouraging others to lend…is not compelling.”
failed intervention by the IMF (e.g. Turkey) returns us to the paper’s central question: when are IMF programs more likely to be associated with a higher probability of currency crisis in developing states?

Various causal claims can be put forth to answer this question. Some scholars suggest that program-participating developing nations lack the capacity to implement “harsh” banking sector reform conditions in IMF programs (Buira 2003; Radelet and Sachs 1998). The difficulties that borrowing countries face when implementing harsh banking sector reforms hurts their credibility in financial markets and invites speculative attacks on their currency (Radelet and Sachs 1998). Calomiris (1998) suggests that the Fund’s assistance to financially-distressed developing countries exacerbates moral hazard problems in the banking sector of these states and makes their currency more vulnerable to a speculative attack. Analysts also claim that the IMF’s inability to prevent successive currency crises in Asia during the 1990s damaged the credibility of IMF programs and made it harder for the Fund to forestall currency crashes in other regions (Goldstein 2000). While these arguments all likely have some validity, we propose an alternative theoretical argument to answer the question posited above.

To begin with, we suggest that it is more likely that the Fund will be unable to prevent a currency crisis in borrowing countries when these states renge on their commitment from adopting structural banking sector program conditions that take a longer time to implement relative to policies such as devaluation. It is important to note here that borrowing countries have a mixed record with respect to fulfilling their promises to the IMF that may consequently influence the likelihood of currency crashes. For instance, Zambia and Croatia took concrete

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14 Some analysts claim that IMF programs failed to prevent currency crises in numerous South-East Asian states (e.g. Thailand and Indonesia) in the late 1990s as these programs were not designed to account for the fact that these countries were exposed to volatile capital flows owing to an open capital account (e.g. Fischer 2004; Goldstein 2000).
steps to adopt program conditions that were designed to reform their banking system (IMF 2005, 2006). This curtailed uncertainty about Zambia and Croatia’s commitment to implement the reform measures in their stabilization program and thus helped to avert a currency crisis (IMF 2005, 2006).

In contrast, after the IMF approved stand-by arrangements for South Korea in December 1997 and Russia in July 1998, policymakers in these two states resisted adoption of key banking sector reform measures. This led to a panic in financial markets and a currency crisis subsequently occurred in South Korea in January 1998 and in Russia in August 1998. The variation in the response of policymakers across the countries mentioned above raises the following question that must be addressed to answer this paper’s central puzzle: when are policymakers in borrowing countries more likely to deviate from their commitment to adopt structural banking sector IMF-program conditions? We argue below that the higher the market concentration of public-sector banks in the economy of IMF program recipient nations, the more likely that these states will renege on their commitments to the IMF which in turn affects the likelihood of a currency crisis.

To understand the rationale underlying this claim, first observe that state-owned banks in program recipient nations tend to oppose conditions in IMF programs that include privatization of public banks, banking sector liberalization and demands for more transparency of the financial practices by banks. Liberalization of the banking sector introduces more competition from private and multinational banks. This reduces the market-share of public sector banks, erodes their profits and undermines their ability to extract rent (Barth et al 2006; World Bank 2001). Moreover, workers in state-owned banks in program-participating states have incentives to resist bank privatization as they fear that it can increase their probability of unemployment (Hanson et
Public sector banks in program-participating states thus have incentives to lobby their government to avoid implementation of these reform measures.

Yet the incentives of public banks to lobby their government may not translate to a preferable outcome. Rather, we claim that when the market concentration of public banks in program recipient nations is sufficiently high, these banks can successfully exert significant political pressure on their government to renege from its (the executive’s) commitment to the Fund to implement banking sector reforms. Three reasons account for this claim. First, higher market concentration of public banks in a program recipient nation implies an oligopolistic market structure where a small number of large public banks own a large share of the total financial assets in the country’s banking sector (Bikker 2004) The presence of a few financially-dominant concentrated public banks in a borrowing country minimizes collective action problems (such as free riding) between them when they lobby their government. Consequently, these banks can effectively lobby their government to not adopt IMF-banking sector reform conditions.

Second, workers in public banks in developing states are often unionized—unlike their counterparts in private banks (Hanson et al 2003; World Bank 2001). Higher market concentration of public banks facilitates collective action by unionized workers from these banks which enhances their capacity to conduct strikes at the national level (Hanson et al 2003). This allows workers from concentrated public banks in borrowing states to credibly threaten policymakers that they will paralyze the banking sector via national strikes if policymakers ignore their demands by complying with IMF program conditions (like bank privatization) that adversely affect these workers. The credibility of the workers’ threat to
paralyze the banking sector will compel governments with concentrated public banks to renege on their commitment to implement banking sector reform conditions in IMF programs.

Third, governments in developing states – including program-recipient developing nations – rely on public banks rather than private banks\textsuperscript{15} as a primary revenue source for the following: financing public works programs that creates jobs, providing loans to low-income households at negligible interest rates which reaps political dividends for policymakers, and financing the expansion of the banking system to rural areas (Hanson et al 2003; World Bank 2001). The higher the market concentration of public banks in borrowing countries, the more dependent policymakers will be on these banks to fund these social and political goals, as the financial assets of concentrated public banks will be substantially larger than those of private financial intermediaries. Greater dependence on concentrated public banks increases the political leverage of these banks. Such leverage allows these public banks to credibly coerce policymakers to \textit{not} implement the IMF’s banking sector reform measures.

\textit{Comprehensive} data on compliance by borrowing countries with structural banking sector IMF-program conditions is not (to our knowledge) publicly available. Thus, empirically assessing whether program-recipient countries with concentrated public banks tend to renege on their commitment to implement structural banking sector reforms is challenging. Researchers at the Fund, however, have developed an index of Fund Program Implementation (FPI) that operationalizes on a continuous scale (0=no compliance to 100=high compliance) the degree to which 21 program-participating developing states have (during the 1990s) complied with various

\textsuperscript{15}Private banks that lie outside the domain of state ownership are by definition strictly profit-seeking. Therefore these banks neither have incentives nor are obligated to finance the state’s social and political objectives such as setting up bank branches in rural areas that typically generates high social returns but negligible private returns. Governments thus cannot rely on these banks to finance social projects.
structural financial and banking sector program conditions discussed earlier. A brief evaluation of the relationship between the level of compliance with structural banking sector program conditions by the 21 program-recipient states and each decile of a 0 to 1 continuous Hirschman-Herfindahl index of the market concentration of public banks (described below) in these states reveals important insights. Specifically, it reveals that the mean compliance level with banking sector program conditions (in the 0 to 100 FPI scale) by borrowing countries observed in the highest range of the Herfindahl pubic bank concentration index (i.e. between 0.65 and 1) is almost 78% lower than the mean compliance level by program-participating states whose Herfindahl level of public bank concentration index lies between 0 and 0.40. This finding is preliminary. But it broadly suggests that borrowing countries with concentrated public banks tend to renge from implementing IMF structural banking sector reform measures.

Examples also corroborate our causal claims about compliance or lack thereof with IMF banking sector program conditions. The IMF’s Stand-By Arrangement program for Turkey in 1999-2000 called for restructuring of Turkey’s banking sector via privatization (Keksin and Alparslan 2002). Although the Turkish government promised to adopt this reform measure, highly concentrated state-owned banks in Turkey exerted substantial political pressure on policymakers to not implement. The Turkish government acquiesced to this pressure and reneged on its Fund-commitment to reform the country’s banking system. In 1989-1990, Tanzanian

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16 See Mercer-Blackman and Unigovskaya (2000) for details on this FPI index. This index focuses on the extent of compliance with financial and banking sector program conditions by 21 program-participating states for a total of 46 IMF programs during the 1990s. The types of IMF programs included for the construction of this index includes Stand-by and extended stand-by arrangement programs, Extended Fund Facility programs, and the Structural Adjustment Fund. The FPI index has been operationalized based on information provided in the IMF’s MONA database about program conditions (prior actions, structural benchmarks and performance criteria), test dates, and the degree of implementation of these conditions.

17 Keksin and Alparslan (2002) show that the mean of the 0-1 Hirschman-Herfindahl index of market concentration of public banks in Turkey from 1990 to 2001 was more than 0.5.
policymakers acquiesced to pressure from highly concentrated state banks in Tanzania – that opposed IMF-program conditions such as public bank privatization—and reneged on their commitment to adopt the Fund’s banking sector program conditions (IMF 1998). Additionally, in 1981, the government in Morocco acceded to demands from concentrated public banks to not implement banking sector program conditions in the Fund’s programs (IMF 1998).

The consequences for borrowing countries that renege on commitments to implement IMF-banking sector reforms are two-fold. First, when investors observe the government of a program recipient state capitulating to political pressure from concentrated public banks, they realize that the government is unable to fulfill its pledge to undertake banking sector reforms incorporated in the Fund’s program. They consequently anticipate banking sector problems in the program participating country. This expectation generates serious problems for the borrowing country in question as it is common knowledge among investors that macroeconomic stability and the health of the banking system is closely intertwined (IMF 1998, 1999; World Bank 2001).

Indeed, when investors observe policymakers deviate from their commitment to implement banking sector program conditions, they likely anticipate that key macroeconomic outcomes such as investment and economic growth – that are dependent on the banking system’s financial health – will be adversely affected by severe banking sector factors (Dell’Aricia et al 2008; Fischer 2004). Reneging on banking sector reforms may also, as the Fund (IMF 2000) suggests, influence policymakers to abandon other related program conditions such as lowering budget deficits via reduction of public spending on state-owned enterprises (including public banks) that threaten the interests of concentrated public-sector banks. Since abandoning this condition can generate severe fiscal imbalances, investors also likely anticipate that continuing problems in the borrowing country’s banking sector (resulting from failed banking sector
reforms) may lead to a fiscal crisis and eventually a full-blown macroeconomic crisis (Fischer 2004; IMF 2000). Rational anticipation of a macroeconomic crisis engenders, according to recent theoretical work on currency crises, a loss in confidence among investors that turns “into a self-reinforcing creditors’ panic (where) domestic residents become less willing to hold assets in domestic financial institutions and foreign creditors become less willing to roll over their loans, causing a liquidity squeeze” (Glick 1998:19). This panic leads to currency crises, such as those occurring in Turkey (2001), Tanzania (1989-90), and Morocco (1981).

Second, when policymakers in a borrowing country renege on commitments to adopt IMF-reform measures owing to political pressure from public banks, it exacerbates uncertainty among investors about their (the policymakers) ability to resolve the country’s severe financial problems. As a result, the credibility of the signal provided by the IMF program to investors – i.e. the signal that informs investors that the borrowing country will solve its financial problems – erodes rapidly. This invites a speculative attack against the country’s currency assets that leads to a currency crisis (Morris and Shin 1998). The preceding discussion leads to our hypothesis:

*IMF programs will be less successful in preventing currency crises as the level of market concentration of public sector banks in program-recipient nations from the developing world increases.*

Conversely, we suggest that the Fund will be more likely to successfully prevent a currency crisis in program-recipient states when public bank concentration in these states is low. The rationale that accounts for this claim is as follows. Specifically, we argue that when the market concentration of public banks in a program-recipient state is low, these banks will lack sufficient economic capacity to put pressure on policymakers to renege from IMF-program banking sector conditions. The public banks’ ability to credibly threaten policymakers

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18 For this claim, see Morris and Shin (1998) and Radelet and Sachs (1998).
with nationwide strikes, for example, is also likely to be negligible when the concentration of these banks is low. Policymakers in the program-recipient state will thus have more leverage to resist challenges from public banks in this case. Since policymakers in the borrowing country can resist pressure from public banks when public bank concentration is low, they will thus have greater political capacity to credibly commit themselves *ex ante* to implement banking sector reform conditions in IMF programs. This will serve to reduce financial panic among investors which will help to prevent a currency crisis. We next turn to test the hypothesis posited above.

**Sample and Variables**

We compile a time-series cross-sectional sample of 113 developing countries from 1975-2008 to test our hypothesis. These countries are listed in table 1. The dichotomous dependent variable employed to test the hypothesis (*currency crisis*) is operationalized as follows. First, following Eichengreen *et al* (1995), we construct an exchange market pressure index (*EMP*<sub>i,t</sub>)—defined formally below—which is a weighted average of the depreciation rate of nominal exchange rates (%Δe<sub>i,t</sub>), the percentage change in international reserves (%Δr<sub>i,t</sub>), and the change in the interest rate (Δi<sub>i,t</sub>) relative to the interest rate in a stable reference country:<sup>19</sup>

\[
EMP_{i,t} = \left[ (\alpha \%\Delta e_{i,t}) + (\beta \Delta (n_{i,t} - n_{US,t})) - (\gamma (%\Delta r_{i,t} - %\Delta r_{US,t})) \right]
\]

where \(i=\)country, \(t=\)time (year), and \(\alpha, \beta, \gamma\) are the respective weights that equalize the conditional volatilities of each component. Second, following existing studies, *currency crisis*

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<sup>19</sup> We use the US $ or the Deutsche Mark /Euro as the reference currency for our sample of developing states. The US $ is the reference currency for all states except the Eastern European countries. For Eastern Europe, the Deutsche Mark (until 1998) and the Euro (from 1999 onwards) act as reference currencies.
is coded as 1 for those periods where the EMP index exceeds the country-specific mean by at least two standard deviations, and is coded 0 otherwise (Chiu and Willett 2009; Dreher and Walter 2010). Hence currency crisis equals 1 for country \( i \) at \( t \) when \( EMP_{i,t} > \mu_{EMP_i} + 2\sigma_{EMP_i} \), where \( \mu_{EMP_i} \) and \( 2\sigma_{EMP_i} \) are the mean and standard deviation respectively of country \( i \)’s EMP series.

<<Insert Table 1 about here>>

We use two alternative dependent variables for robustness tests. The first alternative measure (currency collapse) is coded as 1 if the EMP measure for country \( i \) at \( t \) exceeds the country-specific mean by at least three standard deviations (i.e. \( EMP_{i,t} > \mu_{EMP_i} + 3\sigma_{EMP_i} \)); and 0 otherwise. The second alternative measure is Frankel and Rose’s (1996) currency crash measure which is defined as a depreciation of the nominal exchange rate by at least 25 percent that also exceeds the previous year’s depreciation by at least 10 percent. Currency crash is coded as 1 when the aforementioned event occurs and 0 otherwise.

We test our hypothesis, which posits an interactive effect between IMF programs and the market concentration of public banks on currency crisis, by interacting the following two independent variables: a dummy variable for IMF (stabilization) programs and a measure of the market concentration of public sector banks for each country-year. We code the dichotomous variable IMF as 1 when the IMF assists developing states under any of these eight main types of stabilization programs: Stand-by and extended stand-by arrangement, Supplementary Reserve Facility, Extended Fund Facility, Contingency Funding facility, Buffer Stock Funding Facility,
Currency Stabilization Facility, Structural Adjustment Fund, and the Poverty Reduction and Growth Facility; *IMF* is coded as 0 otherwise.  

We employ the Hirschmann-Herfindahl index of market concentration of public (i.e. state-owned) banks in each country’s banking sector to operationalize the market concentration of public banks which is labeled as *concentration*. The *concentration* measure is defined for each country-year (after dropping the parameter *t* for time for notational convenience) as $\sum_{i=1}^{n} s_i^2$ where $s_i$ is the share of each state-owned bank’s financial assets in the total financial assets of the banking sector per year for each country.  

The financial assets of state-owned banks encompass cash assets, non-interest earning assets, customer and short-term funding, loan reserves, government securities and equity investments. Note that deposits are *not* included since bank deposits are liabilities. Hence, the Hirschman-Herfindahl index is the sum of the squared market shares in terms of financial assets of public sector banks in the banking sector. Higher values of the *concentration* measure capture greater market concentration of public sector banks in the country’s banking sector. Data for *concentration* is drawn from several primary and secondary sources including Allen *et al* (2004), Bankscope, Bank for International Settlements (2010), Barth *et al* (2006), CEIC data company limited, Beck *et al* (2005) and Bikker (2004).  

We interact *IMF* with *concentration* and then introduce *IMF* x *concentration* in the specification.

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20 Data for *IMF* are from Vreeland (2004) and IMF Annual Reports.
21 We define banks as “state-owned” (i.e. public sector) if at least 51 percent of their shares are owned by the government.
22 The number of public banks included in the calculation of *concentration* is determined by the availability of the financial assets data for public banks for each country-year.
23 The Bankscope data has been purchased from http://www.bvdep.com/en/bankscope.html.
24 The CEIC data for the banking sector of each country has been purchased from http://www.ceicdata.com/Sector.html
25 Since missing data with respect to the *concentration* measure will affect the consistency and efficiency of the obtained results, we used Amelia II to impute missing values (Honaker and King 2010).
to test our hypothesis, and also control for each individual component. We expect that IMF \( x \) concentration will have a positive effect on currency crisis.

We include several economic controls in the specification. Specifically, we control for log gdp per capita as scholars suggest that countries with higher GDP per capita are less vulnerable to currency crashes (Chiu and Willet 2009). Researchers also find that the following economic variables influence the likelihood of a currency crisis: current account as a percent of GDP (labeled current account), ratio of M2 to reserves (M2/reserves), external debt (% GDP), the government budget balance as a percent of GDP (budget balance), domestic credit growth, capital acct openness (operationalized from Chinn and Ito’s capital account openness index), bank crisis, the rate of export growth (export growth), and real effective exchange rate (reer), and the lag of the dependent variable (i.e. lag currency crisis).\(^ {26} \)

We include political controls as well. Following Leblang and Satyanath (2006), we add the variable “legislative index of electoral competition” (labeled LIEC) as competitive elections can affect the probability of currency crashes. Our results do not change when we replace LIEC with the Polity democracy measure. Since the presence of divided governments in democracies increases the probability of a currency crisis (Leblang and Satyanath 2006), we include the dummy divided government that is coded as one for (i) presidential democracies when the chief executive’s party does not control the legislature and (ii) parliamentary democracies “when the party of the Prime Minister/President rules in coalition with at least one other party” (Leblang and Satyanath 2006: 252). We add turnover to the specification as scholars hypothesize that

\(^ {26} \)Studies that incorporate these economic controls in models of currency crises include Kamin, Schindler, and Samuel (2001); Leblang and Satyanath (2006); Chiu and Willett (2009); Dreher and Walter (2010). Data for these economic controls are drawn from IMF (2009) and World Bank (2011).
government instability – operationalized by the frequency of turnover of governments\textsuperscript{27} – affects the probability of a currency crisis.\textsuperscript{28}

Results

We first present the results from two probit models where the dependent variable is currency crisis. Model 1 in Table 2 presents the baseline probit estimates with few control variables. Model 2 reports the results from the probit model in which we include all controls listed earlier. IMF $\times$ concentration is positive and highly significant in models 1 and 2. This statistically corroborates our prediction that IMF programs in the presence of highly concentrated public banks are associated with a greater probability of currency crisis in developing countries. With respect to the individual components of IMF $\times$ concentration, we find that the individual estimates for IMF is statistically insignificant. Thus the interaction of IMF with concentration—rather than IMF program participation individually—increases the likelihood of a currency crisis.

<<Insert Table 2 about here>>

To derive the substantive effect of IMF $\times$ concentration, we use the estimates from model 2 to compute the average predicted effect of concentration on the probability of currency crisis for IMF program-participating countries, across the entire range of concentration. We also report the 95\% confidence intervals of this predicted effect. The results from this exercise–illustrated in Figure 1–demonstrate that when IMF program is set

\begin{itemize}
\item \textsuperscript{27}See Chiu and Willett (2009) and Leblang and Satyanath (2006). We use information from the STABS (government stability) measure in the World Bank’s (2010) DPI to operationalize turnover. STABS measures the extent of turnover in any one year of a government’s key decision makers; thus following Leblang and Satyanath (2006), turnover is calculated by dividing the number of exits from government between $t-1$ and $t$ by the total number of key decision makers in year $t-1$. This yields a 0-1 scale.
\item \textsuperscript{28}Lastly, to ensure that the missingness commonly associated with many of the variables included in our statistical analysis is not biasing the results, we follow Honaker and King’s (2010) advice and used Amelia II to impute missing values.
\end{itemize}
equal to 1 (indicating a program-participating country)\textsuperscript{29} and all other variables in the specification are held at their sample mean. \textit{concentration} has a sizable positive effect on the probability of observing a currency crisis. Specifically, a one standard deviation increase in \textit{concentration} from its mean approximately yields an 18\% increase in an IMF program-participating state’s probability of experiencing a currency crisis; this predicted effect is statistically significant at the 95\% confidence level which indicates strong statistical \textit{and} substantive support for our hypothesis.

<<Insert Figure 1 about here>>

The probit model results are encouraging, but do not account for a key econometric challenge that emerges when ascertaining the IMF’s effect on economic outcomes. Specifically, the econometric challenge in this case is that an IMF stabilization program itself may be epiphenomenal: factors leading a country to select into an IMF program may also determine the likelihood of a currency crisis. Indeed, our theory suggests that country-participation in IMF programs is not random as states select into IMF programs when they experience severe economic problems. We address this challenge by estimating a bivariate probit model that consists of a selection and an outcome equation. The dependent variable in the selection equation is the IMF program dummy described earlier.

We include four variables in the selection equation to account for our claim that countries participate in IMF programs when they experience serious economic problems. First, we incorporate \textit{output loss}, measured as the magnitude of growth contraction relative to growth trend; this is calculated from the three-year average of the real GDP growth rate. Second, we include the dummy \textit{bank crisis} which equals 1 if the country is experiencing a systemic

\textsuperscript{29} “Program-participating countries” refers to all country-years in our sample wherein countries are observed as participating in an IMF program. We set the IMF variable equal to 1.
banking crisis and is zero otherwise. This variable treats systemic banking crises as situations where non-performing loans reach at least 10% of total financial assets and when emergency measures—such as bank holidays and deposit freezes—are taken to assist the banking system.\(^{30}\) Third, we include terms-of-trade-shocks (\textit{trade shock}) in the selection equation since they engender macroeconomic imbalances that encourage governments to self-select into IMF programs. Fourth, we add \textit{log inflation} to the selection equation as countries that experience high inflation often turn to the Fund for assistance (Jensen 2004). Following research on IMF program participation,\(^{31}\) we incorporate the following controls in the selection equation: \textit{lag IMF program}, \textit{log GDP per capita}, \textit{current account (%GDP)}, \textit{log (foreign exchange) reserves}, and \textit{veto players}.\(^{32}\)

The dependent variable in the outcome equation is the dichotomous \textit{currency crisis} measure. We introduce \textit{IMF x concentration} in the outcome equation to test our hypothesis, control for the individual components of this interaction term, and include all aforementioned control variables in the outcome equation. \textit{IMF x concentration} is positive and highly significant in the outcome equation of the bivariate probit model (see model 3, Table 1). Hence our main result remains robust after accounting for potential selection bias problems via a bivariate probit model. The rho parameter in the outcome equation in model 3 is statistically significant which indicates that econometrically accounting for the nonrandom participation of countries in IMF programs is necessary when testing our hypothesis.

The selection equation results from the bivariate probit model (column A, Table 3) reveal that previous IMF program participation is the strongest predictor of current

\(^{30}\) We operationalize \textit{banking crisis} with data from Dell'Ariccia \textit{et al} (2008).
\(^{31}\) See e.g., Jensen (2004); Vreeland (2004).
\(^{32}\) Data to operationalize \textit{output loss}, \textit{trade shocks} and the economic controls in the selection equation are drawn from the IMF (2009) and World Bank (2011). Veto players variable is coded from the checks measure in the World Bank’s (2010) \textit{Database of Political Institutions} (hereafter DPI).
participation in IMF programs. Our expectation that countries will participate in IMF programs when they experience serious economic problems finds support as the positive estimate of \textit{log inflation} is significant in each selection equation in Table 3, while the positive coefficients on \textit{bank crisis} and \textit{output loss} are significant in all but one selection equation. \textit{Trade shock} is positive but is significant in only one of the selection stages. Apart from \textit{log reserves}, the remaining controls (including \textit{current account}) are consistently insignificant in each selection equation.\textsuperscript{33}

<<Insert Table 3 about here>>

As an initial robustness test, we checked whether the main results remain robust when we employ the first alternative measure of the dependent variable described earlier: \textit{currency collapse}. Note that the effect of \textit{IMF x concentration} on \textit{currency collapse} is positive and significant in the probit specification (see model 4, table 2) and the outcome equation of the bivariate probit model (see model 5) in which \textit{currency collapse} is the dependent variable. The estimate from the selection equation of the aforementioned bivariate probit model – the estimates from this selection stage equation is reported in column B table 3 – are similar to the selection equation results reported in column A.

We find mixed evidence for the remaining controls in the estimated models. For example \textit{reer, M2/reserves, credit growth} and \textit{LIEC} are statistically insignificant across all the models in Table 2. \textit{Export growth, current account, capital account openness} and \textit{budget balance} are each statistically significant in the probit and the outcome equation of the bivariate probit models but are insignificant in the SAE bivariate probit models. \textit{Divided government} and \textit{external debt} are, however, consistently insignificant in the empirical models. The positive estimate of \textit{turnover}

\textsuperscript{33} The insignificance of \textit{current account} in the selection equation is consistent with other studies which find that this variable has an insignificant impact on IMF program participation (see e.g. Vreeland 2003: 93).
and bank crisis is significant across all the models. The result for turnover supports Leblang and Satyanath’s (2006) claim that government turnover increases the probability of a currency crisis. The lag of the dependent variable is positive and significant in models 4 and 5 in table 2.

Robustness tests and diagnostic checks

We conduct a battery of specification and sample robustness tests as well as diagnostic checks. For the first specification robustness test, we include the dummy variable fixed exchange rate which is coded as 1 for countries with a de facto fixed exchange rate regime (labeled as fixed exchange rate). This is because some scholars hypothesize that the presence of a fixed exchange rate regime affects the probability of currency crises (see, e.g. Chiu and Willett 2009). We employ Reinhart and Rogoff’s (2004) coarse 5-point scale of de facto exchange rate regimes, which has been updated till 2007 by Reinhart and Rogoff, to operationalize fixed exchange rate.\textsuperscript{34} IMF x concentration remains positive and significant in the probit and bivariate probit models after adding fixed exchange rate to the specification (see models 6 and 7 respectively in table 4). The fixed exchange rate dummy is significant as well in these two models.

We add the following controls to the specification for the second robustness test: real GDP growth and reserves/debt. These two control variables are included in the specification as Frankel and Rose (1996) and Kamin \textit{et al} (2001) suggest that these variables affects the probability of currency crashes. IMF x concentration is positive and significant in the probit and the bivariate probit model with the additional controls mentioned above (see models 8 and

\textsuperscript{34} From this 5-point scale, we discard observations that are classified as “freely falling” and those for which parallel market data are missing. We then classify the remaining observations as “fixed” (pegs and limited flexibility) or “floating” (managed float and free floating); the dummy variable fixed exchange rate is coded as 1 for observations that are classified as “fixed”.}
9). Real GDP growth and reserves/short-term debt are, however, each statistically insignificant in these models.

<<Insert Table 4 about here>>

We conducted additional specification robustness tests. For instance, the effect of IMF x concentration on currency crash – the second alternative measure of the dependent variable – is positive and significant in the probit model, and in the outcome equation of the bivariate probit specification (see model 10). We also estimated an additional bivariate probit model in which the concentration measure is added to the selection equation. Statistical support for our hypothesis remains robust in the outcome equation of the bivariate probit model after controlling for concentration in the selection equation (results from this model are not reported to save space but are available on request).

We next check whether our results remain robust for the post-1990 sample (that is, from 1991 to 2008). We conduct the sample robustness exercise mentioned above because some researchers argue that the Fund exerted more pressure on program-participating countries to adopt banking sector reforms especially from the 1990s onwards (Giustiniani and Kronenberg 2005). If this is indeed the case, then it is plausible – based on our theoretical arguments – that program-participating countries with concentrated public banks may have been more vulnerable with respect to experiencing currency crashes during the post-1990 period. Note that the estimate

35 Results from this probit model (where currency crash is the dependent variable) are available from the authors on request.
36 We did so since it is plausible that public bank concentration may also affect the strategic calculus of developing country governments that select into IMF programs.
37 For robustness tests, we also evaluated our hypothesis in a statistical model called the spatial-autoregressive error (SAE) bivariate probit model. This model has been recently developed by Wang, Iglesias and Woolridge (2009). The SAE-bivariate probit model helps us to account for potential spatial dependence in the dependent variable in the outcome equation (i.e. currency crisis) and the selection equation (the IMF program dummy) of the bivariate probit model. Results from the SAE-bivariate probit model (available on request) corroborate our hypothesis.
of $IMF \times concentration$ remains positive and significant in the probit model and in the outcome equation of the bivariate probit model for the post-1990 sample (see models 11 and 12 respectively).

Diagnostic tests reveal that none of the models suffer from severe multicollinearity or serial correlation, and that the residuals are normally distributed. For instance, variance-inflation-factor (VIF) values indicate that multicollinearity is not a problem. The Breusch-Godfrey LM test fails to reject the null of no serial correlation, the Jarque-Bera test shows that the residuals are distributed normally. Finally, F-statistics from granger causality tests for panel data reveal that there is no endogeneity problem between the dependent variable, currency crisis and each of the two independent variables: IMF and concentration.

Conclusion

The main hypothesis presented here is that IMF programs in the presence of highly concentrated public banks are associated with a greater probability of currency crisis in developing countries. Our statistical results provide robust support for this hypothesis. But these results are not sufficient to assess our full causal argument. Indeed, numerous causal claims that were briefly discussed earlier likely contribute to our key statistical result. We simply suggest that one of the more important causal explanations that may account for our main empirical finding is that governments in program-participating countries where concentration of public banks is high tend to renege from structural banking sector program conditions due to the public banks’ political power. This generates a financial panic among investors that leads to a currency crisis. While our study provides some anecdotal evidence to support our main causal arguments,

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38 The lagged dependent variable is dropped from these robustness tests as it lacks sufficient variation in our post-1990 sample.
empirically assessing our causal claims is difficult given that data on compliance with structural banking sector program conditions by borrowing countries is extremely hard to obtain.

Notwithstanding this limitation, our findings contribute to the literature in two main ways. First, our paper builds on extant research that explores either how domestic politics or IMF programs affects the likelihood of currency crashes (Chiu and Willett 2009; Dreher and Walter 2010; Leblang and Satyanath 2006). Yet we focus on how political pressure exerted on governments by concentrated public banks in program participating countries hinders the IMF’s ability to forestall a currency crisis in borrowing countries. This is important insofar that few studies to our knowledge explore the critical role that public banks may play in program recipient nations and how this may engender currency crashes. Second, we believe that our findings presented here take an important step forward in exploring the effects of international institutions conditional upon domestic considerations. This follows from Martin and Simmons (1998) suggestion who argue (p.749) that scholars should “move toward genuinely interactive theories of domestic politics and international institutions.”

Two key policy lessons emerge from this study. Drawing on recent scholarly suggestions that the IMF take political feasibility into better account when designing its programs (e.g. Bird and Willett 2004), the first is that governments in program-participating developing states should at least adopt incremental policy measures – such as reducing the financial liabilities and non-performing financial assets of state-owned banks to some extent – that improve the efficiency of public banks in the economy. While we acknowledge that a tradeoff exists between this recommendation and the need to address economic problems before they spread, adopting such incremental policy measures may not only be more
politically feasible but may also restore the banking system’s financial health that is crucial for preventing a macroeconomic crisis.

Second, the IMF should encourage program-recipient governments to compensate domestic groups that “lose” from banking sector reforms. Public sector banks may continue to resist structural banking sector program conditions (after receiving compensation) or accept a restricted set of reforms that limits the efficacy of these reforms. Yet we suggest that providing compensation to “losers” from banking sector reforms will give governments more agency to implement the reform measures required to prevent a financial panic among investors. We, however, acknowledge that such a compensation strategy will be difficult to implement and will require careful political-economic analysis and planning.

Although our study provides some important policy lessons, more work needs to be done to fully understand the issue-area analyzed in this paper. For instance, further research should develop a detailed and comprehensive dataset on structural banking sector program conditions by borrowing states. Analyzing these data will permit us to better understand the causal link between IMF programs, domestic politics in the banking sector of program recipient nations and economic (including crisis) outcomes. Apart from public banks, domestic private-sector banks have also enjoyed considerable political clout in some developing countries that have experienced a currency crisis under IMF programs (e.g. Indonesia). Valuable theoretical insights may be gained by examining whether the interaction between the IMF and the government in borrowing states with powerful private banks influences the likelihood of a currency crisis in these states.

Additionally, recall from the introduction that intervention by the IMF in numerous financially-distressed developing countries (that turn to the Fund for assistance) has
successfully prevented currency crashes in these states. While our study explores the conditions under which the Fund will be less likely to successfully prevent a currency crisis in borrowing countries, it is worth studying when IMF programs will be *more likely* to successfully prevent a currency crisis in financially-distressed program-participating states. The analysis presented in this paper, in fact, suggests that the Fund will be more likely to successfully prevent a currency crisis in program-recipient states when public bank concentration in these states is low. As mentioned earlier, this is because low public bank concentration may make it politically easier for borrowing country governments to credibly commit themselves ex ante to implement banking sector reform conditions in IMF programs. As such, this will help to reduce financial panic among investors which, in turn, will help to prevent a currency crisis. Our analysis also suggests more broadly that program-recipient governments may be in a better political position to implement banking sector reform conditions in IMF programs if they are able to garner sufficient domestic political support for such conditions. Whether or not the claims posited above are logically consistent and empirically valid requires further research.
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**Notes:** ***, **, *: 1%, 5%, 10% significance levels. Heteroskedastic-robust standard errors in parentheses.
TABLE 3: Selection equation results

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<td>0.272***</td>
<td>0.293***</td>
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<td>ln GDP per capita</td>
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<td>0.0111</td>
<td>0.00953</td>
<td>0.0114</td>
<td>-0.001</td>
</tr>
<tr>
<td></td>
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<td>(0.0240)</td>
<td>(0.036)</td>
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<tr>
<td>current account</td>
<td>0.000584</td>
<td>0.000567</td>
<td>0.000446</td>
<td>0.000609</td>
<td>0.004</td>
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<td>(0.00332)</td>
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<td>(0.00332)</td>
<td>(0.005)</td>
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<tr>
<td>output loss</td>
<td>0.000263</td>
<td>0.000263</td>
<td>0.000265</td>
<td>0.000264</td>
<td>0.002</td>
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<tr>
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<td>(0.000253)</td>
<td>(0.000253)</td>
<td>(0.000254)</td>
<td>(0.000253)</td>
<td>(0.001)</td>
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<tr>
<td>trade shock</td>
<td>0.000223</td>
<td>0.000239</td>
<td>0.000247</td>
<td>0.000227</td>
<td>0.002</td>
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<td></td>
<td>(0.000713)</td>
<td>(0.000713)</td>
<td>(0.000713)</td>
<td>(0.000714)</td>
<td>(0.001)</td>
</tr>
<tr>
<td>bank crisis</td>
<td>0.400**</td>
<td>0.405**</td>
<td>0.396**</td>
<td>0.403**</td>
<td>0.679**</td>
</tr>
<tr>
<td></td>
<td>(0.168)</td>
<td>(0.168)</td>
<td>(0.167)</td>
<td>(0.168)</td>
<td>(0.264)</td>
</tr>
<tr>
<td>lag IMF</td>
<td>2.049***</td>
<td>2.049***</td>
<td>2.048***</td>
<td>2.048***</td>
<td>2.300***</td>
</tr>
<tr>
<td></td>
<td>(0.0548)</td>
<td>(0.0548)</td>
<td>(0.0549)</td>
<td>(0.0549)</td>
<td>(0.084)</td>
</tr>
<tr>
<td>Constant</td>
<td>-2.271***</td>
<td>-2.270***</td>
<td>-2.332***</td>
<td>-2.291***</td>
<td>-3.311***</td>
</tr>
<tr>
<td></td>
<td>(0.461)</td>
<td>(0.458)</td>
<td>(0.458)</td>
<td>(0.461)</td>
<td>(0.759)</td>
</tr>
</tbody>
</table>

Notes: ***, **, *: 1%, 5%, 10% significance levels. Robust standard errors reported in parentheses.
TABLE 4: Robustness tests

<table>
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<th>Full sample, 1975-2008</th>
<th>Post-1990 sample</th>
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<tr>
<td></td>
<td>Probit biv-probit</td>
<td>Probit biv-probit</td>
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<tr>
<td></td>
<td>outcome eq</td>
<td>outcome eq</td>
</tr>
<tr>
<td>lag dependent variable</td>
<td>-1.448*** (-0.406)</td>
<td>-1.472***</td>
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<tr>
<td>log GDP per capita</td>
<td>0.00341 (0.0389)</td>
<td>0.00632 (0.0382)</td>
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<tr>
<td>external debt</td>
<td>0.000127 (0.000463)</td>
<td>1.53e-05</td>
</tr>
<tr>
<td>current acct</td>
<td>0.0214*** (0.00512)</td>
<td>0.0260***</td>
</tr>
<tr>
<td>IMF</td>
<td>0.0280 (0.123)</td>
<td>-0.241</td>
</tr>
<tr>
<td>Concentration</td>
<td>0.420 (0.263)</td>
<td>0.452*</td>
</tr>
<tr>
<td>Reer</td>
<td>-3.32e-08 (2.17e-07)</td>
<td>-9.68e-08</td>
</tr>
<tr>
<td>bank crisis</td>
<td>0.445*** (0.171)</td>
<td>0.482***</td>
</tr>
<tr>
<td>cap acct open</td>
<td>-0.0311 (0.0352)</td>
<td>-0.104***</td>
</tr>
<tr>
<td>M2/reserves</td>
<td>-1.41e-08 (2.76e-07)</td>
<td>6.32e-08</td>
</tr>
<tr>
<td>budget balance</td>
<td>-0.0824*** (-0.0116)</td>
<td>-0.0775***</td>
</tr>
<tr>
<td>export growth</td>
<td>-0.00482*** (-0.00245)</td>
<td>-0.00413*</td>
</tr>
<tr>
<td>credit growth</td>
<td>-0.000454 (0.000067)</td>
<td>-0.000211</td>
</tr>
<tr>
<td>LIEC</td>
<td>0.0356 (0.0218)</td>
<td>0.0349</td>
</tr>
<tr>
<td>Turnover</td>
<td>0.287** (0.122)</td>
<td>0.269**</td>
</tr>
<tr>
<td>divided gov</td>
<td>-0.0681 (0.0919)</td>
<td>-0.0590</td>
</tr>
<tr>
<td>reserves/debt</td>
<td>-9.19e-05 (0.000153)</td>
<td>-9.88e-05</td>
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<tr>
<td>real GDP growth</td>
<td>-0.0250*** (-0.00672)</td>
<td>-0.0246***</td>
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<tr>
<td>fixed ex rate</td>
<td>-0.767*** (-0.0851)</td>
<td>-0.739***</td>
</tr>
<tr>
<td>Constant</td>
<td>-1.951*** (0.306)</td>
<td>-2.697***</td>
</tr>
<tr>
<td>$\rho$</td>
<td>0.232*** (0.305)</td>
<td>0.227**</td>
</tr>
</tbody>
</table>

Note: All coefficients are statistically significant at the 1% level.
Notes: ***, **, *: 1%, 5%, 10% significance levels. Robust standard errors reported in parentheses. The dependent variable in model 10 is currency crash.

FIGURE 1: Effect of Bank Concentration on currency crisis for Countries in IMF programs

References


International Monetary Fund. *IMF Annual Reports*. Washington, DC: IMF


Radelet, Steven and Jeffrey Sachs. (1998) The East Asian Financial Crisis: Diagnosis, Remedies,


