Where are all the banking crises?

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Abstract

Emerging market banking crises have been exceedingly *rare* since the turn of the millennium. This stylized fact has largely flown under the radar in international political economy. This article develops and tests a formal model of domestic financial safety nets that resolves this puzzle. Key results include that domestic financial safety nets are a political response to the perpetually weak global financial safety net and the deepening of financial globalization. Quantitative results using a newly developed index of domestic financial safety net strength confirm: (i) the political origins of domestic financial safety nets; and, (ii) their role in reducing the probability of emerging market banking crises, including following a tightening of global monetary conditions. These results imply that financial safety nets are not mere conduits of moral hazard promoting financial instability as they equip emerging market governments with a greater capacity to self-insure against imported financial shocks.

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In an influential 2001 article, economist Barry Eichengreen and colleagues presented clear evidence that the frequency of financial crises, and emerging market banking crises in particular, increased markedly in the last quarter of the twentieth century. Standing at the turn of the millennium, one could have hardly concluded otherwise. Between 1980 – 2003, there were on average nearly five emerging market banking crises per year and a total of *seventy* during the decade of the 1990s alone. For many, their downbeat conclusion that "...there is something different and disturbing about our age"[2] seemed apt and even prescient given the events of the global financial crisis.[3] Yet, against all expectations, between 2004 – 2017 there was a striking reduction in the frequency of emerging market banking crises. During this fourteen-year period only eleven emerging market banking crises occurred, nearly all of which were associated with the global financial crisis.[4] Therefore, if our age remains especially prone to financial instability, where are all the banking crises?

This article develops and tests an original formal model on the political motivations to strengthen domestic financial safety nets and why these financial safety nets explain the declining incidence of emerging market banking crises.[5] In the first part of the model, financial globalization and the perpetual weakness of the global financial safety net motivate emerging market governments to develop robust domestic financial safety nets. In the second part of the model, domestic financial safety nets provide a measure of self-insurance against banking crises by reducing the likelihood of damaging liquidity shocks and lowering the riskiness of the commercial bank's investment portfolio.[6] Importantly, these results hold even when moral hazard concerns are binding. Indeed, one of the implications of the model is that finan-

[2]Bordo et al. (2001), p.72.

[3]On the persistence of banking crises from a historical perspective, see also Reinhart and Rogoff (2009) and Calomiris and Haber (2014).

[4]Banking crisis frequency comes from Laeven and Valencia (2018).

[5]A state's financial safety net is the umbrella term used to describe such policies and includes deposit insurance, lender of last resort facilities, the stock of foreign currency reserves, and payment system liquidity provision, among others.

[6]In some respects, while still controversial, the capacity of financial safety nets to prevent certain types of banking crises is not a new finding. The ability of deposit insurance to prevent bank runs is the most well-known example. See Diamond and Dybvig (1983).

cial safety nets are not a one-way street towards moral hazard induced financial instability. Rather, moral hazard is a second order effect that is entirely predicated on the existence of a first order effect that promotes financial stability. Political economy accounts of financial safety nets that ignore one of these two effects will therefore be incomplete.

The quantitative analysis begins with the development of an original index of domestic financial safety net strength. After documenting the steady expansion in emerging market domestic financial safety nets over the past two decades, the index is used to confirm four predictions from the model. The first three concern the politics of domestic financial safety net provision and show that they strengthen when: (i) a state's degree of financial globalization deepens; (ii) a state's access to the global financial safety net weakens; and (iii) a state has a high frequency of past crises. The fourth hypothesis uses a large sample of emerging market banking crises to test whether domestic financial safety nets reduce the probability of banking crises. Results not only confirm this hypothesis, but also that a tightening in global monetary conditions, due to either an increase in American interest rates or a contraction in global liquidity, increase the probability of banking crises only in emerging market states with weak domestic financial safety nets.

These results have two important implications for the international political economy literature. First, more effective domestic financial safety nets give emerging market governments the capacity to wrestle their financial fate away from adverse movements in global monetary policy and poor decision making by past governments.[7] Contemporary emerging market governments may therefore have a greater capacity for self-insurance than is commonly believed and a tool kit that extends beyond standard measures such as holding ample foreign currency reserves. Second, the recent period of emerging market financial stability implies that emerging market contributions to global financial governance are collectively significant

[7]Studies that cite primarily global factors as key cause of banking crises include Eichengreen and Rose (1998); Borio and Disyatat (2011); Bruno and Shin (2015); Bauerle Danzman et al. (2017). Crises rooted in past political decisions include Rochet (2009); Reinhart and Reinhart (2008); Amri and Kocher (2012); Copelovitch and Singer (2017).

and increasing. However, these effects are mostly an emergent property of emerging market states looking inward towards their own domestic financial stability rather than efforts to wield influence within existing international financial institutions.

Politics and the onset of banking crises

A minimal definition of a banking crisis includes the occurrence of a widespread panic resulting in the sudden withdrawal of bank funding.[8] The list of plausible political variables that render emerging market banking systems vulnerable to crises is long. Domestic variables include weak regulatory and supervisory regimes,[9] undisciplined fiscal authorities,[10] premature financial liberalization and internationalization,[11] excess competition for banks from non-bank financial intermediaries,[12] and the moral hazard embedded in the subsidization of bank risk.[13] While a lengthening list of plausible candidates for banking crises may indicate a slow progression in our understanding, it may equally signal, that despite significant efforts, the literature remains unsettled and cannot point to a basic set of political predictors of these highly consequential events. Indeed, absent an apparent robust link between domestic variables and banking crises, some scholars have downgraded domestic politics as idiosyncratic to the onset of banking crises.[14]

Banking crises are complex events and it is not surprising that the literature remains open to debate on their fundamental drivers. Yet it is equally surprising that the frequency of emerging market banking crises has fallen sharply since the turn of the millennium despite the continued presence of many of the above mentioned "determinants." For example, banking sector regulation, while having made some strides in recent decades, remains a work in

[8] Schwartz (1987); Gorton (2012).
[9] Rochet (2009); Amri and Kocher (2012).
[10] Reinhart and Reinhart (2008).
[11] Kaminsky and Reinhart (1999); Komulainen and Lukkarila (2003); Crotty (2009); Stiglitz (2010)
[12] Copelovitch and Singer (2017).
[13] Demirgüç-Kunt and Detragiache (1998, 2002); Dowd (2009); Lipscy and Lee (forthcoming).
[14] Bauerle Danzman et al. (2017).

progress in terms of acting as a robust bulwark against a recurrence of the types of crises seen in the 1990s.[15] Global capital markets have also not become more benign over this period. Most importantly, "sudden stops" in global capital flows, which are particularly risky for emerging market banking systems and are widely agreed to be a trigger for many emerging market banking crises,[16] continue to occur at the same frequency as in past decades.[17] Combined with the apparent strengthening of the global financial cycle and the constraints this imposes on national monetary policy autonomy,[18] it is puzzling why emerging market banking crises have been exceedingly *rare* over the last decade and a half.

While the reduced frequency of emerging market banking crises no doubt has many causes, this paper considers a factor that has largely flown under the radar in international political economy: the expanded capacity of emerging market states to self-insure against crises. Measures used for this purpose collectively comprise a state's financial safety net whose components include deposit insurance, lender of last resort facilities, a state's stock of foreign currency reserves, sponsorship of international and domestic payment systems, the orderly resolution of failed banks, and nationalization of troubled institutions. While each of these financial safety net components mitigates specific risks to the financial system, they share a common feature of effectively tempering system-wide surges in liquidity demand. Yet the link between financial safety nets and financial stability is contested, with the literature having identified first order and second order effects that push in opposite directions.

The first order effects of financial safety nets push towards enhanced financial stability. History is replete with examples of states calming financial markets, at least in the short-run, by throwing a lifeline to troubled financial institutions.[19] For example, recent studies have shown that the judicious use of lender of last resort facilities can arrest a banking panic.[20] But

[15] Čihák et al. (2012).
[16] Calvo (1998).
[17] Eichengreen and Gupta (2016).
[18] Rey (2015); Nier et al. (2014).
[19] Pauly (2009); Drezner (2014); Helleiner (2014).
[20] Schinasi (2003); Carlson et al. (2011); Gorton and Metrick (2013).

financial safety nets are more than tools for crisis management as a credible commitment to supply a robust financial safety net also comprises a well-known plank in a state's long-term crisis prevention strategy. The most well-known examples are deposit insurance and ample foreign currency reserves, which are widely regarded to have a role in crisis prevention.[21] Moreover, many have attributed the inauguration of a new era of banking sector stability to innovations in financial safety nets. Grossman (2010) cites the maturation of the Bank of England into a modern lender of last resort as a key development that moved English banking past the regular crises it experienced in the nineteenth century.[22] Likewise, Gorton (2010) attributes the "quiet period" in American banking between 1934 – 2007 to the innovation of national deposit insurance.[23] These views are a corollary to well-regarded explanations of the 1930s, where the *absence* of a state-supplied financial safety net, especially from the Federal Reserve, was found to have significantly deepened and lengthened the Great Depression.[24]

These first order benefits notwithstanding, their very effectiveness has led many to highlight their potentially negative second order effects, which is to promote moral hazard.[25] In this view, because financial safety nets lower the consequences of irresponsible risk taking, they also encourage future negligence. It is perhaps unfortunate that the first and second order effects of financial safety nets on financial stability are inseparable. Indeed, it appears to be little noticed that the second order moral hazard effects are predicated on financial safety nets being effective tools for financial stability in the first place. Were financial safety nets ineffective in moderating the cost to bankers from their past risk taking, their effect in promoting future risk taking would be nil. Nevertheless, while scholars will continue to debate the op-

[21]Diamond and Dybvig (1983); Gorton and Pennacchi (1990); Maxfield (1998); Feldstein (1999); Chin (2010); Cecchetti and Disyatat (2010); Jeanne and Ranciere (2011).

[22]Grossman (2010), p. 195.

[23]Gorton (2010), p. 4. See also Friedman and Schwartz (1963), p. 434.

[24]Kindleberger (1986); Friedman and Schwartz (1963); Eichengreen (2014). In an echo of history, Ball (2018) attributes the denial of a Federal Reserve financial safety net to Lehman Brothers in September 2018 as significantly worsening the global financial crisis.

[25]Calomiris (1997); Demirgüç-Kunt and Detragiache (2002); Alessandri and Haldane (2009); Congleton (2012) See Rogoff (2002); Kamin (2004) for arguments on why moral hazard concerns, at least with respect to the IMF, are overrated.

timal balance between fostering financial stability and encouraging moral hazard, emerging market governments will continue to have strong political motivations to provision a robust financial safety net, given the greater susceptibility of emerging market banking systems to global capital markets[26] and their low initial fiscal costs.[27] In this regard, the salient political economy question concerning financial safety nets is one of variation in their use and their effects on banking crisis onset, rather than one of efficiency. The following section presents a model of the global and domestic politics that factor into this process.

A model of financial safety nets and banking crises

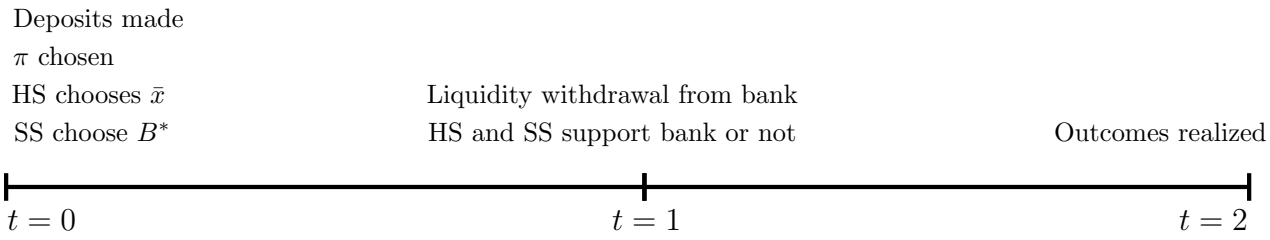
The model developed here builds upon insights from Repullo (2005) and Goodhart and Huang (2000). In Repullo (2005) a domestic central bank supports a commercial bank facing a liquidity shortfall in order to study how the existence of a lender of last resort alters the propensity of the commercial bank to take risk. Focusing on the international dimension of liquidity provision, Goodhart and Huang (2000) show that banks facing liquidity shortfalls in the global reserve currency are more likely to spark currency and banking crises when they do not have access to an international lender of last resort. The model developed below extends these by distinguishing between global and domestic financial safety nets and the different political logics that underpin each.

The model is a complete, but imperfect information three period game consisting of interactions between three risk-neutral agents: a large hegemonic state (HS), a small representative state (SS), and a representative commercial bank in the SS. Each state is assumed to maximize the financial interests of its own citizens and does so by provisioning either a domestic or global financial safety net. In practice, these operations would be undertaken by a central bank or Treasury department. While the SS provisions its own domestic financial safety net,

[26] Bluedorn et al. (2013).
[27] Moss (2004).

as the monopoly supplier of the global reserve currency, the HS has the opportunity, but not the obligation, to provision a global financial safety net. In this regard, the model below also builds on recent work by Gavin (2018), who shows that financial safety nets are the political provision of a non-rival, but excludable global club good. An outline of the timing of the game is shown in Figure 1.

Figure 1: Game Timing



The three period model begins in period 0 with the commercial bank collecting a unit of deposits from households in the SS and the HS. These deposits consist of local currency deposits and foreign currency deposits, which are liabilities of the SS and HS, respectively. For simplicity, assume that the local and foreign currency have a fixed one-to-one exchange rate.[28] The fraction of deposits held in local currency is α and the fraction of foreign currency deposits is $1-\alpha$. While all local currency deposits are owned by residents of the SS, the model incorporates international financial integration through the ownership of foreign currency deposits. Specifically, the fraction of foreign currency deposits owned by foreigners who are citizens of the HS, is Ω. This implies that the total foreign currency deposits in the SS claimed by foreigners equals $\Omega(1-\alpha)$. This term also represents the international exposure of the SS's banking system. Total foreign currency deposits claimed by local residents equals $(1-\Omega)(1-\alpha)$.

[28]This assumption is also made by Goodhart and Huang (2000).

In period 0 the bank invests its local and foreign currency deposits in separate projects. The local currency deposits are invested in a riskless asset and earn a return of 1 with certainty. Foreign currency deposits are invested in an illiquid asset that earns foreign currency export revenues of $R(\pi)$, where π is the probability of success. The model allows for two types of banking crises. With probability $1-\pi$ the foreign currency investment fails in period 2 and sparks an *insolvency crisis*. Because the bank has limited liability, it receives a payoff of 0 when it fails. Limited liability is one source of moral hazard in the model. Once invested, the foreign currency investment is sunk and has a liquidation value of 0. Interest on all deposits are normalized to zero. Following Repullo (2005), the following simplifying assumption is made about the behavior of the bank's foreign currency investment returns.

Assumption 1: $R = R(\pi)$, where R(π) is decreasing and concave, with $R(1) \geq 1-\alpha$ and $R(1) + R'(1) < 0$.

Assumption 1 says that safer foreign currency investments yield a lower expected return but that the safest investment still yields a positive profit for the bank. However, the condition $R(1) + R'(1) < 0$ ensures that choosing the safest investment is not optimal for the bank, which maximises its expected profit when $R(\pi) + \pi R'(\pi) = 0$. Together these restrictions on R ensure that the bank's expected profit is maximized when $\hat{\pi} \in (0,1)$ and that the bank's expected profit is decreasing in π when $\pi^* > \hat{\pi}$ and increasing in π when $\pi^* < \hat{\pi}$.

The SS can supply liquidity assistance to their commercial bank. Liquidity shortfalls in local currency are covered by printing new money. Foreign currency reserves of $B \geq 0$ in the currency of the HS are purchased on the open market by the SS in period 0. Since foreign currency reserves are purchased with newly printed money, the opportunity cost of holding B is the chance that this new money may be lost in the event of a crisis. It is from this stock of foreign currency reserves that the SS may support its bank in the event of a foreign

currency liquidity shortfall. Loans to the bank from the SS are charged an interest rate equal to that of the bank's foreign currency deposits (i.e., 0). Liquidity assistance may also come from the HS. The HS faces no constraints on the amount of liquidity it can supply. Loans of x from the HS incur a cost $\delta \geq 0$ per unit of borrowing. This cost may include interest costs incurred by the commercial bank, loan conditionalities, or other constraints imposed by the HS. To simplify the presentation of the model, the HS is assumed to be the international counterpart to the SS in that it lends directly to banks and not states.

In period 1 the commercial bank faces a foreign currency liquidity shortfall equal to $v \in [0, 1-\alpha]$. This liquidity shortfall is assumed to be general and may take the form of withdrawn deposits, an unexpected disruption in the flow of payments, or a temporary refusal of foreign creditors to rollover existing debt. Irrespective of the ultimate cause of the liquidity shortfall, since the bank's foreign currency assets are illiquid, if it cannot secure a loan of v from either the SS or the HS, the second type of banking crisis, a *liquidity crisis*, occurs in period 1 because the bank does not have enough hard foreign currency to meet its foreign currency liabilities. The run on the bank will also ultimately lead the SS to break the currency peg and supply households with domestic currency instead. Note that with a liquidity crisis in period 1, the bank collapses before the return on the bank's investments are known. Therefore, although the bank may in fact be solvent in period 2, it fails in period 1 because it is illiquid.

The global financial safety net

The strategy of the HS is to maximize the expected financial asset holdings of its economy. For simplicity, assets held by the HS and its residents are assumed to be weighted equally. To accomplish this the HS supplies liquidity internationally when the expected aggregate benefits of doing so are at least as great as the expected aggregate costs of not doing so. Since the HS earns a return δ on its loans and the SS does not, the bank will prefer to borrow from the SS before turning to the HS. That is, the HS lends only if $v > B$. When

the liquidity shock exceeds the stock of foreign currency reserves of the SS, B, the loan from the HS, x, equals $v - B$.

When the HS lends x to the bank and the bank's investment is successful, the HS's net payoff equals the return on its loan x. Households in the HS also receive their deposit equal to $\Omega(1-\alpha)$ back. If the commercial bank fails, it is rendered insolvent and the HS loses its loan x. Households also lose when the bank fails. Irrespective of how the bank fails, households of the HS lose their deposit $\Omega(1-\alpha)$ but receive their share of remaining foreign currency deposits in the failed bank, equal to ΩB. Therefore their total payoff is $\Omega B - \Omega(1-\alpha) = -\Omega(1-\alpha-B)$ when the bank fails. Under these conditions the HS will lend if the expected payoff from lending up to a threshold x is greater than or equal to the certain loss from not lending.

While the payoffs to the HS from the various possible scenarios are straightforward, the model assumes that the bank's choice of risk, π, is not observable to either financial safety net provider. Rather, both the HS and the SS leverage two pieces of information to subjectively infer the bank's choice of risk. These pieces of information are: (i) the history of crises in the jurisdiction of the commercial bank; and, (ii) the value of a supervisory signal. Let the supervisory signal, s, be a function of the true level of bank risk plus some noise. That is, let the signal observed by both the HS and the SS be $s = \pi + \epsilon$, with $\epsilon \sim N[0,1]$. For simplicity, crises in a particular state are assumed to follow a Beta distribution, meaning that the probability of a crisis in a given state can be modelled as a function of its past frequency of crises, suitably updated according to the contemporary supervisory signal.[29]

Formally, the subjective probability of a banking crisis, which is a common belief held by the HS and the SS, equals the expectation of the banks' choice of risk conditional on observing the signal s. Given that crises follow a Beta distribution, this expectation equals

[29] For an accessible introduction to the use of Bayes' rule to update beliefs derived from a Beta distribution, see Hoff (2009).

$$E[\pi|s] = \frac{g+s}{g+h+n} \tag{1}$$

where g is the number of past non-crisis periods (i.e., "successes"), h is the number of past crisis periods (i.e., "failures"), and n is the number of new observations. In this model, $n = 1$. Equation (1) can be rewritten into a more intuitive form as

$$\lambda = E[\pi|s] = \left(\frac{g+h}{g+h+1}\right)\frac{g}{g+h} + \left(\frac{1}{g+h+1}\right)(\pi^* + \epsilon) \tag{2}$$

where $\frac{g}{g+h}$ is the frequency of past periods of financial stability and $\pi^* + \epsilon$ is the current periods supervisory signal. The fractions $\frac{g+h}{g+h+1}$ and $\frac{1}{g+h+1}$ are weights placed on each piece of information, with the weight placed on the current supervisory signal declining with the length of history considered by the HS and the SS. Using this belief structure, the HS's period 0 decision rule is made as follows

$$\lambda[-x + x(1+\delta) - \Omega(1-\alpha) + \Omega(1-\alpha)] + (1-\lambda)[-x - \Omega(1-\alpha-B)] \geq -\Omega(1-\alpha-B)$$

which simplifies to the decision rule

$$\bar{x}^* \leq \frac{\lambda^*\Omega(1-\alpha-B^*)}{1-\lambda^*-\lambda^*\delta} \tag{3}$$

Equation (3) is the first equilibrium condition of the model. The HS lends up to a threshold $\bar{x}$ and this decision is a function of five variables. The expected probability of a successful bank investment, λ, enters positively since it raises the probability that the HS will be paid back. Ω also enters positively, implying that when households in the HS have more resources at risk in the SS, the HS is more willing to supply international liquidity assistance in the hopes of avoiding losing those assets in a banking crisis. Note also that the HS will supply no international liquidity if its citizens have no deposits in the bank (i.e., $\Omega = 0$).[30] The level

[30] Alternatively, if $\Omega \neq 0$, but the failure of the bank appears certain (i.e., $\lambda = 0$), the HS will also not lend. However, assumptions on $R(\lambda)$ preclude this in equilibrium.

of foreign currency reserves held by the SS, B, enters negatively, implying that higher levels of self-insurance reduce the need for an HS. Finally, the interest rate charged by the HS, δ, also enters positively since this increases the expected return on the loan.

The domestic financial safety net

Like the HS, the SS also seeks to maximize the financial asset holdings of its economy and incorporates the payoff of its banks into its strategy. However, a key difference for the SS is that it cannot print new global reserve currency. Rather, if the SS wants to provision a domestic financial safety net in foreign currency, it must acquire the resources to do so before the liquidity shock occurs. Thus, the strategy for the SS is to choose an optimal level of reserves consistent with this objective. Like the HS, the lending decision of the SS is made under conditions of imperfect information. Three pieces of information are pertinent to the SS when choosing its optimal level of B and include the lending decision rule of the HS, $\bar{x}$, the fraction of foreign currency deposits, $1-\alpha$, and the subjective assessment of the bank's level of risk, λ.

Formally, the expected payoff for the SS is a function of probabilities and payoffs under three possible values of v. The three probabilities are $\frac{B}{1-\alpha}$, $\frac{\bar{x}}{1-\alpha}$, and $\frac{1-\alpha-B-\bar{x}}{1-\alpha}$, which correspond to the probabilities that $v \in [0, B]$, $v \in (B, B+\bar{x})$ and $v \in (B^* + \bar{x}, 1-\alpha]$, respectively. Attaching payoffs to each probability yields the expected payoff of the SS.

$$\frac{B}{1-\alpha}(\lambda[R(\lambda)-1](1-\alpha)+(1-\lambda)(-B)) + \frac{\bar{x}}{1-\alpha}(\lambda([R(\lambda)-1](1-\alpha)-\delta\bar{x}) \\ +(1-\lambda)(-B)) + (-B)(\frac{1-\alpha-B-\bar{x}}{1-\alpha})$$

which simplifies to

$$B\lambda[R(\lambda)-1] + \frac{B^2\lambda}{1-\alpha} + \bar{x}\lambda[R(\lambda)-1] - \frac{\bar{x}^2\lambda\delta}{1-\alpha} + \frac{B\bar{x}\lambda}{1-\alpha} - B \tag{4}$$

The second equilibrium condition of the model is derived by differentiating (4) with respect to B. Doing so reveals that the SS sets B according to

$$B^* = \frac{1-\alpha}{2\lambda^*}(1-\lambda^*[R(\lambda^*)-1]) - \frac{\bar{x}^*}{2} \tag{5}$$

Visually inspecting B^*, we see that $B^* = 0$ when $\alpha = 1$.[31] That is, the SS will choose to hold no foreign currency reserves if its banks do not hold any foreign currency deposits. The effect of λ^* on B^* is negative. This is more easily see by rearranging (5) to be $B^* = \frac{(1-\alpha)}{2\lambda^*} - \frac{(1-\alpha)[R(\lambda^*)-1]}{2} - \frac{\bar{x}^*}{2}$. Although λ enters twice, in both cases it pushes B^* down, first by appearing in the denominator of the first term, and second, by assumption 1, because $\lambda^* R(\lambda^*)$ is increasing in λ when the bank takes too much risk in equilibrium.[32] Intuitively, this result implies that the SS will provision a smaller domestic financial safety net when it believes that the bank chooses a less risky investment. B^* is also decreasing in $\bar{x}^*$, implying that when the HS is willing to supply more liquidity, the SS pulls back its own domestic financial safety net. Or conversely, states that find themselves increasingly disappointed with the size of the global financial safety net (i.e., $\bar{x}^* \to 0$) will boost their domestic financial safety net as a means of self-insurance.

Bank Risk Decision

The expected payoff for banks is a function of the probability of the investment's success, the level of foreign currency deposits invested, and the probability that its liquidity shortfall v will be covered by borrowing from the SS and the HS. The bank's choice of π also determines the risk of an insolvency crisis. As with the payoff for the SS, with v uniformly distributed on $[0, 1-\alpha]$, the bank's expected payoff is a function of three probabilities and three associated payoffs. With probability $\frac{B}{1-\alpha}$ the bank receives a payoff of $(1-\alpha)[R(\pi)-1]$ when the

[31] By assumption, $B^* \geq 0$.

[32] See Equation (7) and accompanying discussion below showing that the bank assumes too much risk in equilibrium.

investment is successful and zero otherwise. If $B < v \leq B + \bar{x}$, the bank borrows B from the SS and the remaining $v - B$ from the HS. With probability $\frac{\bar{x}}{1-\alpha}$ the bank receives a minimum payoff of $(1-\alpha)[R(\pi) - 1 - \delta\bar{x})]$ when the investment is successful and zero otherwise.[33] Lastly, if $v > B + \bar{x}$, the result is a liquidity crisis and the bank fails and receives a payoff of zero. This occurs with probability $\frac{1-\alpha-B-\bar{x}}{1-\alpha}$. Together the expected payoff of the bank is

$$\frac{B}{1-\alpha}\pi[R(\pi)-1](1-\alpha) + \frac{\bar{x}}{1-\alpha}\pi([R(\pi)-1](1-\alpha) - \delta\bar{x}) + \frac{1-\alpha-B-\bar{x}}{1-\alpha} * 0$$

which simplifies to

$$(\bar{x} + B)\pi[R(\pi) - 1] - \frac{\bar{x}^2\delta\pi}{1-\alpha} \tag{6}$$

From this equation the final equilibrium condition of the model is derived, which consists of a choice of π^* by the bank. This is derived by differentiating (6) with respect to π.

$$(\bar{x}^* + B^*)[R(\pi^*) - 1] + (\bar{x}^* + B^*)\pi^* R'(\pi^*) - \frac{\delta\bar{x}^{*^2}}{1-\alpha} = 0$$

which implies the following equilibrium choice of risk

$$R(\pi^*) + \pi^* R'(\pi^*) = 1 + \frac{\delta\bar{x}^{*^2}}{(\bar{x}^* + B^*)(1-\alpha)} \tag{7}$$

Given that the bank's expected payoff is maximized at $R(\hat{\pi}) + \hat{\pi}R'(\hat{\pi}) = 0$, from (7) we see that the bank takes a higher than optimal amount of risk irrespective of whether an HS exists or not.[34] However, when $x > 0$ we see that the bank takes an even higher level of risk, implying that insolvency crises are more likely with an HS. The choice by the bank to

[33] $(1-\alpha)[R(\pi) - 1 - \delta\bar{x})]$ is a payoff the bank uses to calculate its optimal risk choice. However, its actual payoff will be $(1-\alpha)[R(\pi) - 1 - \delta(v - B)]$ (i.e., the loan from the HS will equal $(v - B)$, not $(\bar{x} - B)$). However, since the bank does not know v when it makes its risk choice, the bank must choose based upon the equilibrium value of $\bar{x}$.

[34] $R(\pi) + \pi R'(\pi)$ is the first derivative of the expected payoff for the bank (i.e., $\pi R(\pi)$).

assume more risk under an HS can be decomposed into three effects. The first effect comes from the cost of the loan from the HS, equal to $\delta\bar{x}^*$. This implies that if the HS charges a penalty rate, the bank responds by increasing its risk profile to compensate for this extra cost. This effect is also found in Repullo (2005). The second effect comes from $\frac{\bar{x}^*}{\bar{x}^*+B^*}$, which is the fraction of the bank's financial safety net that comes from the HS. This follows from increases in $\bar{x}^*$ resulting in a less than disproportionate decrease in B^*. This implies that when a larger fraction of the bank's financial safety net comes from the HS, the financial safety net is larger overall. This increases the risk taking by the bank as one would expect under moral hazard. Lastly, the bank's risk taking is decreasing in $1-\alpha$, implying that the bank takes fewer risks if more of its foreign currency funding is obtained abroad.

Testable implications

Four testable hypotheses are derived from the model. The first three concern the politics that explain variation in the provision of domestic financial safety nets. The final hypothesis considers the effect domestic financial safety nets have on the probability of emerging market banking crises.

1) Financial globalization and domestic financial safety nets

The first hypothesis considers the effect of financial globalization on the size of a state's domestic financial safety net. As mentioned in the literature review, previous studies have noted that emerging markets states have incentives to build up a stock of foreign currency reserves as a precaution against the downsides of financial globalization. The model extends this idea to other aspects of a state's domestic financial safety net. In the model, this effect can be seen in Equation (5) where B^* is an increasing function of $1-\alpha$, the share of foreign currency bank deposits. The first hypothesis can therefore be stated as follows.

H1: States expand their domestic financial safety net as their ties to financial globalization deepen.

2) Domestic and global financial safety nets

The second hypothesis considers the interaction between global and domestic financial safety nets. To date, discussions of the global financial safety net have been limited to studies of its aggregate size[35] and not how its constituent components interact with one another. The model developed above suggests one possible interaction. In Equation (5), we see that global and domestic financial safety nets are inversely related to one another as an increase in $\bar{x}^*$ decreases B^*. Equivalently this implies that emerging market states will respond to a weak global financial safety net by building up their own domestic financial safety net as a substitute.

H2: Domestic financial safety nets and the global financial safety net are substitutes.

3) Banking crisis history and domestic financial safety nets

The third hypothesis concerns a state's past crisis history. Crisis history is incorporated into the model through λ, the subjective belief financial safety net providers have regarding the bank's choice of investment risk. From Equation (2) we see that λ is a decreasing function of a state's past number of crises (i.e., λ is decreasing in h). From Equation (5) if follows that, for a given supervisory signal, a higher number of past crises increases the size of the domestic financial safety net (i.e., $h \uparrow \rightarrow \lambda^* \downarrow \rightarrow B^* \uparrow$).

The history of past crises also increases the size of the domestic financial safety net indirectly through its effect on reducing the size of the global financial safety net. From Equation (3)

[35]For example, see Scheubel and Stracca (2016).

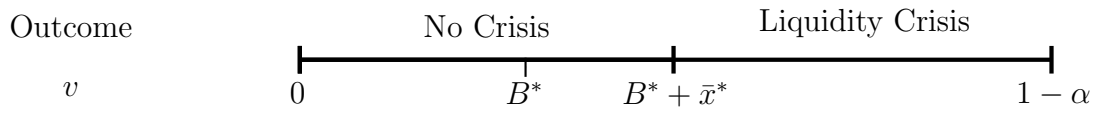
we see that $\bar{x}$ is an increasing function of λ, implying that a commercial bank assessed to have a safer investment portfolio will have greater access to the global financial safety net. And the inverse relationship between domestic and global financial safety nets implies that when the HS curtails $\bar{x}$, the SS will compensate by increasing B^*. These effects lead to the third hypothesis.

> *H3: Domestic financial safety nets increase with a state's history of banking crises.*

4) Domestic financial safety nets and banking crisis onset

Banking crises were modelled in two ways above, through a liquidity crisis if the liquidity shock exceeded the size of the commercial bank's domestic and global financial safety net and through an insolvency crisis if the bank's investment failed. Both types of crises become less likely as B^* increases.

Figure 2: Liquidity crises



Consider the depiction of the onset of a liquidity crisis in Figure 2, which occurs when the liquidity withdrawal exceeds the combined domestic and global financial safety net $B^* + \bar{x}^*$. Since the liquidity withdrawal is assumed to be drawn from the uniform distribution, where $v \in [0, 1-\alpha]$, it follows that the probability of a liquidity crisis equals $\frac{(1-\alpha)-B^*-\bar{x}^*}{1-\alpha}$, which is decreasing in B^*.

It is also straightforward to see from Equation (7) that the probability of an insolvency crisis decreases with the size of the domestic financial safety net. Thus, the final hypothesis can be stated as follows.

H4: The expansion of a domestic financial safety net reduces the probability of a banking crisis.

Empirical Analysis

The empirical analysis is conducted in three phases, all of which feature a newly constructed Domestic Financial Safety Net Index (DFSNI). Constructing an index of financial safety nets is challenging and the most prominent existing financial safety net index is that of Demirgüç-Kunt et al. (2014). Comprised of various measures such as the generosity of deposit insurance and the existence of explicit government guarantees on deposit and non-deposit bank liabilities, their Safety Net Index explicitly attempts to capture the degree of moral hazard embedded in state-supplied financial safety nets. Indeed, previous versions of this index were dubbed the Moral Hazard Index.[36]

There are two important shortcomings in the index of Demirgüç-Kunt et al. (2014). First, their index does not adequately capture the range of financial safety net options available to states. While deposit insurance and related forms of liability insurance are an important component of a state's financial safety net, and indeed are included in the DFSNI developed below, they are only one component in a state's financial stability toolkit. Second, empirical analyses have produced some debatable results using this index. For example, Anginer et al. (2014) find that the Safety Net Index imparts a net negative effect on financial stability, especially during non-crisis times. On the one hand this negative association is not surprising given that many of the components of the Safety Net Index are those most likely to be implemented during a crisis, such as explicit deposit guarantees. But on the other hand, this negative association sits uncomfortably with the falling incidence of emerging market banking crises given that they also document a general expansion in financial safety nets over time.

[36]Demirgüç-Kunt and Detragiache (2002).

Data for the DFSNI has been collected from four sources, each of which captures the resources and institutional developments indicative of a state's capacity to stabilize financial institutions in distress. The four components of the DFSNI include:

1) Foreign currency reserves (% GDP): A state's stock of foreign currency reserves is a well-known bulwark against international financial shocks. An ample stock of foreign currency reserves is valuable to banks because it provides them with a vehicle to purchase or borrow foreign currency, typically from their central bank, when foreign sources have either dried up or have become prohibitively expensive, such as during a financial crisis. Data comes from the World Development Indicators and the ratio of foreign currency reserves to Gross Domestic Product (GDP) is capped at one.

2) Deposit insurance: In addition to foreign currency reserves, deposit insurance is a well-known component of a state's domestic financial safety net. The ability of deposit insurance to temper and even prevent bank runs is well-known as it breaks the vicious cycle of depositors rushing to be first in line to recover their deposits.[37] A dummy variable indicating the existence of an explicit deposit insurance scheme is taken from Demirgüç-Kunt et al. (2014).

3) RTGS payment system: A state's payment system facilitates and settles payments between buyers and sellers safely and efficiently. In a typical RTGS (Real-Time-Gross-Settlement) system, large payments are settled on a transaction-by-transaction basis in real time at the central bank, where the central bank can monitor and provide additional liquidity to the system if necessary. A dummy variable indicating the presence of a RTGS system was compiled from various sources, including Bech and Hobijn (2006), Cirasina and Nicoli (2010), and the websites of Montran Corporation and CMA Small Systems AB, two corporations that provide RTGS settlement systems for emerging market economies.[38]

[37] Diamond and Dybvig (1983).

[38] At the international level, the RTGS system operated by the Continuously Linked Settlement Bank has been held up as an example of a payment system that has significantly reduced the liquidity and credit risks associated with settling large cross-border payments (Galati, 2002). However, the results of this paper continue to hold if the RTGS dummy is excluded from the DFSNI.

4) Last resort lending independence: During financial crises central banks can create their own liquidity by lending directly to financial firms, typically commercial banks, with terms measured in days or weeks. These operations help stabilize markets by supporting bank balance sheets, maintaining payments systems, and boosting overall confidence.[39] Research also shows that central banks which operate free from a government borrowing requirement are more effective last resort lenders during a banking crisis.[40] Data on a central bank's "financial independence" are incorporated into the index and are collected from Garriga (2016).

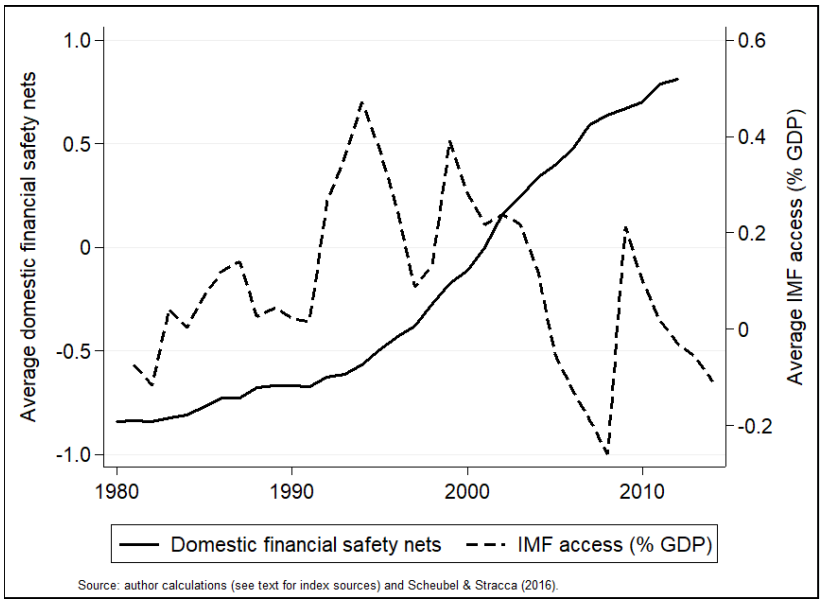
The widespread availability of these components gives the index broad coverage across time and space. The DFSNI consists of annual observations for 166 countries, of which 143 are emerging market economies (i.e., non-OECD countries), and the maximum coverage of the index spans 1974 – 2012. The full list of countries and years covered by the index are shown in the Supplementary Appendix. Following Lipscy and Lee (forthcoming), the DFSNI has been constructed using principal component analysis, with the index comprising the first principal component.

Figure 3 shows how the average strength of domestic financial safety nets in emerging market economies compares with their average access to the global financial safety net since 1974. Broadly speaking, the two series rise together for the first two decades following the breakdown of the Bretton Woods system. However, beginning in the mid 1990s, a protracted divergence sets in, with domestic financial safety nets beginning a rapid ascent and global financial safety nets beginning a steady retreat.[41]

The DFSNI constitutes the dependent variable to test the first three hypotheses. To test H1, a *financial globalization* measure is constructed as the ratio of a state's stock of foreign liabilities to GDP. This is a standard measure of financial globalization and data on this measure come from Lane and Milesi-Ferretti (2007). To test H2, a state's access to the *global*

[39] Cecchetti and Disyatat (2010).
[40] Gavin (forthcoming).
[41] The long-term decline in the IMF's lending capacity is well documented. See Denbee et al. (2016).

Figure 3: Global and domestic financial safety nets



financial safety net is measured according to a state's cumulative borrowing capacity from the International Monetary Fund (IMF) relative to its GDP. This variable was obtained from Scheubel and Stracca (2016). In line with historical cumulative access limits, a state's IMF quota has been scaled by 300% for observations prior to 2009 and by 600% from 2009 onward. Tests of H3 are conducted using the *crisis history* of a state. This variable is a simple count of the prior number of banking crises in each state. Data on this measure come from Laeven and Valencia (2018). In total, 129 emerging market banking crises are included in the sample spanning 1976-2012.

Numerous control variables are included in the analysis and cover a state's banking sector, domestic institutional context, domestic economic context, and the state of global capital markets. Banking sector variables include *bank assets*, which measures the size of a state's banking system as the ratio of a banking system's assets to GDP. The variable *bank leverage* captures the fragility of a banking system's liability structure as indicated by the credit to deposit ratio. These variables come from Beck et al. (2010). Domestic institutional variables include a measure of *democracy* from Pemstein et al. (2010), a measure of *capital account*

openness from Chinn and Ito (2008), and a dummy variable indicating membership in a *regional financing arrangement* as provided by Scheubel and Stracca (2016).[42] A state's *net capital inflows* as a share of GDP are taken from Bluedorn et al. (2013) and the existence of a capital inflow bonanza is taken from the dataset of Bauerle Danzman et al. (2017). A capital inflow bonanza is defined to have occurred if a country's net capital inflows, measured as the current account balance as a share of GDP, is in the top twentieth percentile of the entire sample. To isolate the effect of a bonanza on the onset of banking crises, the analysis follows Bauerle Danzman et al. (2017) by using their *bonanza residuals* variable.[43]

Credit booms are controlled for as these events have recently been linked with the onset of banking crises.[44] Credit booms are defined as episodes where credit to the private sector expands at an abnormally high rate. Identifying such episodes is done in two steps and follows the method of Mendoza and Terrones (2012). First, for each country the log of credit to the private sector as a share of GDP is separated into a long-run trend component and a cyclical component.[45] The method of Hamilton (forthcoming) is used at this stage rather than the well-known Hodrick-Prescott (HP) filter, although the results below do not hinge on this choice.[46] Second, a credit boom is defined as any year where the cyclical component of the credit series exceeds its standard deviation by a factor of 1.65.[47] Additional domestic economic control variables include *GDP per capita* in constant 2010 dollars, the annual rate of *inflation* as measured by the growth rate of consumer prices, and the annual rate of *GDP*

[42]Examples of regional financing arrangements include reserve pooling funds such as the Chiang Mai Initiative and the Latin American Reserve Fund.

[43]This variable indicates bonanzas that remain unexplained by the variables in a model of capital inflow bonanzas. See Bauerle Danzman et al. (2017) for further details. Note that no results in this paper hinge on this method of measuring capital inflow bonanzas. All results hold if a dummy variable is used to indicate the presence of a capital inflow bonanza.

[44]Schularick and Taylor (2012); Mendoza and Terrones (2012).

[45]Mendoza and Terrones (2012) prefer the log of real credit per capita, rather than the log of credit as a share of GDP. However, results reported below and in the Supplementary Appendix, including the null results regarding the effects of credit booms, are unchanged if credit booms are identified using the log of credit per capita.

[46]Hamilton (forthcoming) strongly recommends his method over the HP filter.

[47]This is the threshold set by Mendoza and Terrones (2012). Results are unchanged if the threshold identifying a credit boom is increased to 2 or lowered to 1.

growth. These latter three variables and the credit series used to construct the credit boom measure are taken from the World Development Indicators.

Conditions in global capital markets are measured in multiple ways. The first is through a measure of *global risk*, which is measured as the average value of end of month observations in the Cboe S&P 100 Volatility Index. More commonly known as the VXO, this variable is the precursor to the more well known VIX. The advantage of the VXO is that it is highly correlated with the VIX and provides an additional four years of observations. The second global variable is the *capital account inequality* measure from Bauerle Danzman et al. (2017). Increases in this variable indicate greater capital flows towards the United States, which the authors argue reduces the buildup of fragile financial conditions in emerging market economies.

The stance of American monetary policy, which has been shown to be critical to setting the context for monetary policy in peripheral economies,[48] has been measured in two ways. The first is the 3-month nominal *US Treasury bill interest rate*, which was collected from the International Financial Statistics. The second measure is a *global liquidity contraction* variable derived from a global liquidity indicator compiled by the Bank for International Settlements (BIS).[49] The BIS measures global liquidity as the sum of cross-border positions of all BIS reporting banks to all sectors, across all instruments, and in all currencies. This variable has been inverted so that increases indicate a contraction in global liquidity. All dependent, independent, and control variables have been standardized to have a mean of zero and a standard deviation of one, apart from the credit boom and regional financing arrangement dummy variables.

[48] Rey (2015); Nier et al. (2014).
[49] Bank for International Settlements (2018).

Estimations

For robustness, the empirical analysis uses multiple estimation strategies. Two estimators are used to test the first three hypotheses. The first is the dynamic fixed effects estimator of Pesaran et al. (1999), which estimates separate long-run and short-run relationships between the regressors and the dependent variable. Properties of this estimator are attractive for the analysis as this estimator accounts for potential dynamic relationships in the data and possibly endogenous regressors. Key results using this estimator are reported in Table 1. The second estimator is the well-known time-series cross-section estimator of Beck and Katz (1995). With this estimator, a lagged dependent variable has been included to model dynamics[50] as well as country fixed effects to control for unobserved, and fixed, country heterogeneity. Results using this estimator are shown in Figure 4.

Three estimation strategies are used to evaluate the banking crisis models used to test H4. The first technique is a standard panel logit model with conditional fixed effects. Results from this model are reported in Figure 5. These results are confirmed using two other estimators. These include a linear probability model with country fixed effects and the estimator of King and Zeng (2009) that accounts for the relative rarity of banking crises in the sample. Tables with the full results across all hypotheses and estimation strategies are available in the Supplementary Appendix.

Results

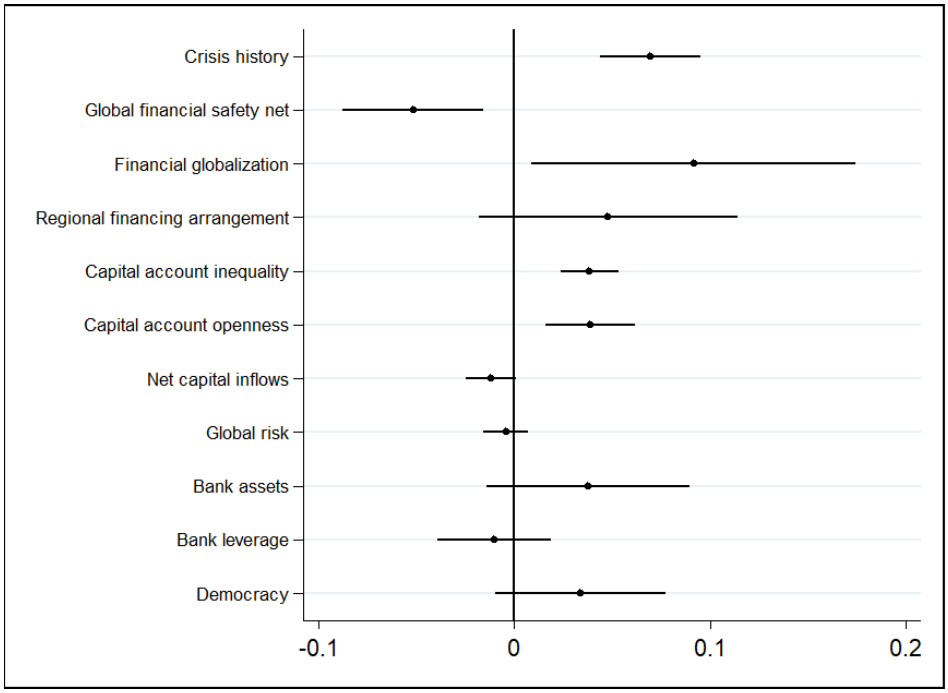
The standardization of the variables allows the results to be reported using plots of regression coefficients and associated 95% confidence intervals. Results supporting the first three hypotheses are reported in Figure 4.[51] With respect to H1, the third row of Figure 4 shows that

[50]The *actest* command in Stata 14 indicates that autocorrelation is purged from the model with the inclusion of one lagged dependent variable.

[51]The lagged dependent variable and some control variables are not reported. See the Supplementary Appendix for full details.

a state's degree of financial globalization has a positive and statistically significant effect on the size of a state's domestic financial safety net. However, statistical significance notwithstanding, the confidence interval around the financial globalization coefficient appears to be wide relative to the other two independent variables. Evidence in favor of H2 is reported in the second row, which shows that the size of a state's domestic financial safety net grows when its access to the global financial safety net declines. This result accords with the overall picture described in Figure 3, where emerging market governments appear to replace a declining global financial safety net with a stronger domestic financial safety net. Lastly, results for H3 are reported in the first row and show that a state's history of banking crises imparts a positive and statistically significant effect on the size of a state's domestic financial safety net.[52]

Figure 4: Explaining domestic financial safety nets



[52]These results are robust to numerous combinations of the control variables and alternative econometric specifications. For example, the Supplementary Appendix shows that these results continue to hold when control variables are added sequentially to a baseline specification. Moreover, results utilizing the dynamic fixed effects estimator of Pesaran et al. (1999) and the estimator of King and Zeng (2009) also show strong support for the first three hypotheses.

These results are also substantive. Consider Table 1, which reports the results of the first three hypotheses using the long-run coefficients of the Pesaran et al. (1999) estimator.[53] Given the standardization of the variables, a one standard deviation increase in the crisis history variable corresponds with an increase of 0.369 standard deviations in a state's domestic financial safety net index. Substantively, this implies that for every extra banking crisis a state has in its history, its domestic financial safety net index is expected to increase by 0.47 units.[54] In practical terms, an increase of 0.47 units in the DFSNI is approximately equal to half of the change observed in Thailand and Malaysia around the time of the Asian financial crisis and Mexico following its peso crisis of 1994. With respect to the other two independent variables, results are equally substantive. For each standard deviation increase in a state's access to the global financial safety net and a state's degree of financial globalization, the domestic financial safety net index is expected to decrease and increase by 0.463 and 0.866 units, respectively.

Table 1: Dependent variable: Domestic financial safety nets index

	Long-run coefficients
Crisis history	0.368***
	(0.083)
Global financial safety net	-0.360**
	(0.15)
Financial globalization	0.673**
	(0.653)

Dynamic fixed-effects estimations, clustered standard errors in parentheses.
Control variables and short-run coefficients not reported.
*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

[53]Given that results reported in Figure 4 include a lagged dependent variable that absorbed a significant amount of variation in the size of a state's domestic financial safety net, results in Table 1 give a clearer indication of how substantive the results of the analysis are. Also note that short-run coefficients and control variables have been excluded from Table 1.

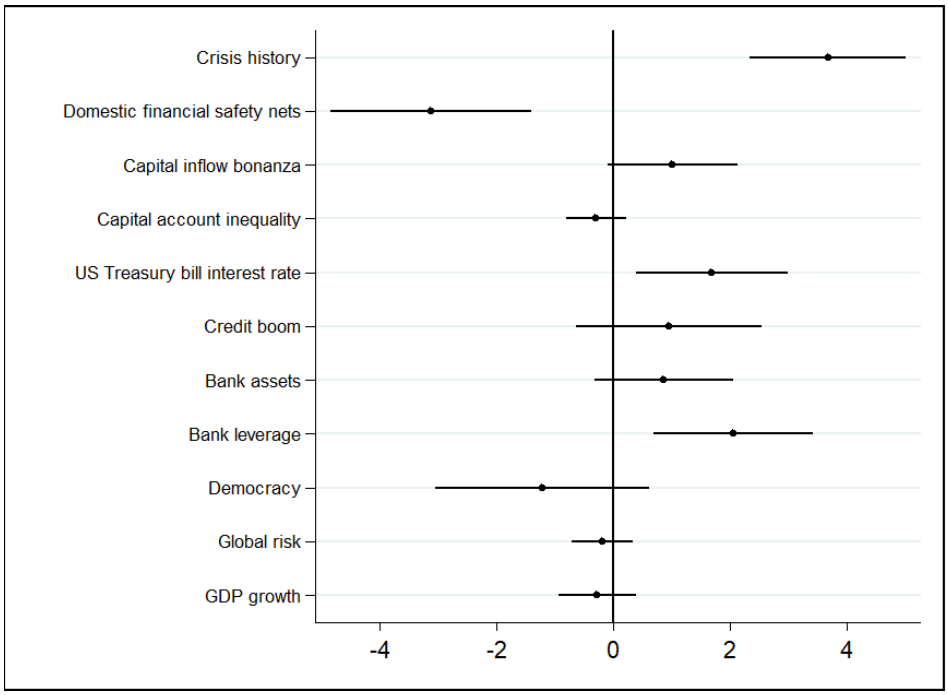
[54]While the standard deviation of the domestic financial safety nets variable is approximately 1, the standard deviation of the domestic financial safety nets index in the sample used in Table 1 is 1.287 units.

The estimated effects of the control variables are as expected. The capital account inequality measure of Bauerle Danzman et al. (2017) and the capital account openness measure of Chinn and Ito (2008) each impart a positive and statistically significant effect on domestic financial safety nets. The size of a state's banking system and its degree of democracy also impart effects similar in size and direction to the capital account measures just described, albeit with less precision given their wider confidence intervals. Membership in a regional financing arrangement, a state's net capital inflows, global financial risk, and the degree of leverage in the banking system were found to have no statistical or substantive effect on domestic financial safety nets.

The picture to emerge from these results is of emerging market governments bolstering their capacity for self-insurance in response to multiple risks to their domestic financial stability. Some of these risks are domestic such as having a history of past crises and, to a lesser extent, having a larger banking system. Other risks are inherent to financial openness, such as actively participating in financial globalization or having a more open capital account. Structural conditions also appear to have enhanced the self-insurance motive, such as when capital increasingly flows away from emerging market economies (i.e., capital account inequality rises) and state's have limited recourse to a global financial safety net.

These results have important consequences for emerging market banking crisis onset. Summarized in Figure 5 are results for the banking crisis analysis. The second line reports supporting evidence for H4, that expanded domestic financial safety nets reduce the likelihood of banking crises. As shown in the Supplementary Appendix, this result holds across multiple econometric specifications and under numerous combinations of the control variables. This result supports the notion that domestic financial safety nets are effective in staving off crises, net of any moral hazard effects they may promote.

Figure 5: Financial safety nets and banking crises



Figures 6 and 7 report additional support for the hypothesis that domestic financial safety nets reduce the probability of a banking crisis. Previous studies have identified adverse movements in global monetary conditions as key triggers of emerging market financial instability.[55] Utilizing the method of Hainmueller et al. (forthcoming), Figures 6 and 7 report that the marginal effect of a tightening of global monetary conditions, respectively an increase in the 3-month US Treasury bill interest rate and a contraction in global liquidity, on the probability of an emerging market banking crisis. In both figures, the marginal effect of a tightening in global liquidity imparts a positive and statistically significant effect on the probability of emerging market banking crises, but only in states with the weakest domestic financial safety nets. Stronger domestic financial safety nets therefore appear to protect domestic banking

[55]Pettis (2001); Durdu et al. (2018).

systems from shocks originating from global financial markets.[56]

Figure 6: Marginal effect of US Treasury bill rate increase on the probability of banking crises

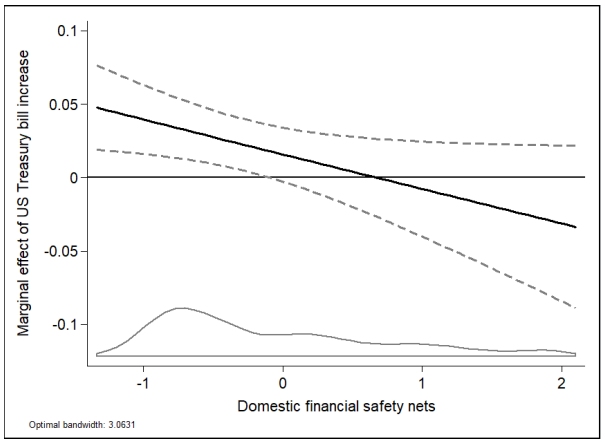
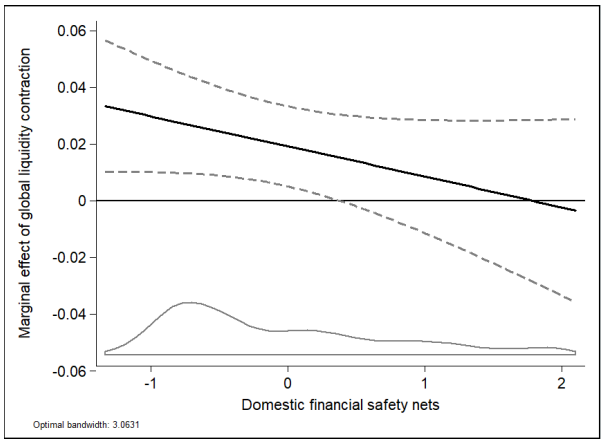


Figure 7: Marginal effect of global liquidity contraction on the probability of banking crises



In Figure 5 some control variables impart positive and statistically significant effects on the likelihood of banking crises. A states history of banking crises is strongly associated with the probability of incurring another crisis. This factor hints that structural factors in a state's politics, beyond those controlled for by the fixed effects, are strongly associated with the likelihood of experiencing further crises. Two other variables positively associated with the onset of banking crises include a banking system's size and degree of leverage. Given that the latter of these variables is a common measure of banking sector fragility, it is not surprising that it is also strongly associated with the onset of banking crises.

Other control variables were less strongly associated with banking crises than the existing literature would predict. The most prominent of these is the occurrence of a credit boom, which some have argued is one of the most reliable predictors of banking crises.[57] Two reasons explain the null findings of this study. The first is the use of Hamilton (forthcoming),

[56]Pepinsky (2018) cautions against this interpretation and argues that scholars should focus on interaction term regression coefficients. As shown in the Supplementary Appendix, interaction terms for both measures of adverse global monetary conditions and domestic financial safety nets are statistically significant at the 5% level.

[57]Jordà et al. (2011).

rather than the HP filter, to detrend the private sector credit data series. While both methods identified a similar number of credit booms, 192 using Hamilton (forthcoming) versus 213 using the HP filter, the distribution of these credit booms were different. Indeed, the correlation between the two credit boom indicators is only 0.31. In only 68 country-year observations do both methods identify a credit boom. This leaves 124 country-year observations where the method of Hamilton (forthcoming) identifies a credit boom where the HP filter does not, and 145 cases where the HP filter identifies a credit boom where the method of Hamilton (forthcoming) does not. Moreover, the choice in methodology made a material difference in the estimated effect of credit booms on the onset of banking crises. As shown in the Supplementary Appendix, when credit booms are identified using the HP filter, they *are* statistically significant across a large range of specifications. The second reason for the null findings on credit booms is because the analysis controls for *crisis history* and *bank leverage*. In specifications that do not control for these variables, credit booms, even those identified using the method of Hamilton (forthcoming), attain statistical significance at conventional levels. While the study of credit booms on the likelihood of banking crises was not the main object of study in this article, at a minimum these results imply that the effects of a credit boom on the likelihood of a banking crisis are more tenuous than the existing literature has found, owing both to the difficulty in identifying abnormal fluctuations in credit and whether past studies have taken enough care to identify potential confounding variables.

Conclusion

While there is a widespread consensus that emerging market banking systems benefit from maintaining access to international capital markets, there is less agreement on what concrete actions emerging market governments can take to negotiate the inevitable costs of financial openness. In an ideal world, a global solution to this dilemma would emerge, with a robust

global financial safety net playing a leading role. The main finding from this article is that emerging market governments are not holding their breath for global politics to produce such an outcome. Rather, confronted with a global financial safety net that has not kept pace with the demands of their increasingly globalized financial markets, emerging market governments have constructed their own financial safety nets as a substitute. While time may reveal that these domestic efforts are a second-best outcome and less effective than an ideally designed and generously funded global financial safety net, to date these efforts appear to have done their part to reduce the probability of banking crises in emerging market states.

Two implications follow from this analysis. First, financial safety nets are not simply levers increasing moral hazard. While it is reasonable to assert that, at some level, decreasing the cost of irresponsible behavior promotes those very same behaviors, the net effect of financial safety nets is more complex than this. Indeed, the moral hazard effects of financial safety nets are a second order effect which may or may not be outweighed by their first order effect, such as providing emerging market governments a means of self-insurance against financial instability. Given the clear expansion in domestic financial safety nets over the past few decades, if the second order effects of moral hazard are indeed significant, this fact is difficult to reconcile with the clear reduction in emerging market banking crises over this same period.

Second, alongside important, but also limited, reform to global financial institutions,[58] the strengthening mosaic of domestic financial safety nets has been an unsung innovation in 21st century global financial governance. Marked by many emerging market banking systems successfully transitioning from being vulnerable to international financial interdependence to being merely sensitive to it,[59] this shift in global financial governance is of a different kind than that studied by other scholars, such as whether the growing weight of emerging market governments is being felt within existing global financial institutions.[60] In conjunction with the expansion in local currency private credit and sovereign bond markets and the growing,

[58]Helleiner (2014).
[59]Keohane and Nye (1977).
[60]Germain (2001); Woods (2010).

but still limited, capacity of emerging market actors to place their local currency bonds on international capital markets,[61] the collective impact of dozens of emerging market institutions geared towards domestic financial stability represents another face of global financial governance worthy of future research.

The capabilities of emerging market states were evident in the summer of 2013. At that time, Federal Reserve Chairman Ben Bernanke speculated that the Federal Reserve may soon begin to taper its quantitative easing program in a few months hence. This event quickly set off the now well known "taper-tantrum" in global capital markets, as the mere hint of the possibility of a modest tightening in American monetary policy led to a weeks-long flight of capital from emerging market financial systems. Many have argued that this episode laid bare the latent vulnerabilities present in emerging market economies that are integrated into global capital markets.[62] Yet considering the arguments and evidence above, the wider lesson from this episode is that, despite their vulnerabilities, no states actually fell into crisis. Furthermore, what is most telling about the non-crises of 2013 and since is that the shock from the taper tantrum was arguably larger than the shocks that triggered the emerging market crises of the 1980s and 1990s.

These positive developments notwithstanding, global financial markets continue to possess enough energy to overwhelm even the strongest domestic financial safety nets. While domestic financial safety nets are no panacea against future banking crises, the political obstacles to the formation of a durable and robust global financial safety net ensures that their contribution to global financial governance will continue to grow.

[61] Hale et al. (2016).
[62] Wolf (2013); Steil (2014).

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