

# International finance and central bank independence: Institutional diffusion and the flow and cost of capital

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## Abstract

Research on central bank independence (CBI) focuses overwhelmingly on domestic causes and consequences. We consider CBI in relation to global finance. A first step links government decisions to reform central bank legislation to a perceived need to attract capital in the form of foreign direct investment or sovereign borrowing. A second step models investors' actual decisions as a function of CBI. We test our argument on a sample of 78 countries (1974-2007). Logit models investigate the determinants of central bank reform. Results show the effect of international capital through a direct competition channel and through learning in the context of competition. Socialization of countries in networks of intergovernmental organizations is also a determinant of CBI reform. In addition, we show that CBI affects the flow and cost of capital in non-OECD countries, before CBI became globally widespread, and where political institutions allow the central bank to de facto be credible.

## 1. Introduction

The last decades have seen a global move towards neoliberal economic policies (Simmons et al. 2008), including central bank reforms aimed at increasing the independence of monetary policy from politicians. Monetary policy is independent when the government delegates this task to central bankers who can then pursue their legal mandate - usually low inflation - without regard to incumbent politicians' public approval or reelection prospects. Much of the extant work focuses on the effect of central bank independence (CBI) on inflation and the trade-off with economic growth (Grilli et al. 1991, Cukierman et al 1992, Franzese 1999, Keefer and Stasavage 2003, Crowe and Meade 2008). This is mostly because bank independence has been seen as a solution to the time inconsistency problem in monetary policy (Rogoff 1985) or as driven by domestic politics (Bernhard 1998, Crowe and Meade 2008, Hallerberg 2002, Broz 2002). The extant literature also shows that legal CBI is likely to be credible and thus affect domestic outcomes (like inflation, money supply, fiscal deficits) predominantly in democracies, in countries with constraints on executive power, and in those with a free press (Broz 2002, Keefer and Stasavage 2003, Bodea and Hicks 2012, Bodea 2013).

Yet countries as politically diverse as Venezuela, Russia and Belarus, on the one hand, and Japan, Chile and the Czech Republic, on the other, have very autonomous central banks. If central bank reform has little domestic credibility in non-democracies, is imitation of peers responsible for such nominal delegation? What are the theoretical mechanisms of diffusion and, in turn, does CBI affect investor behavior? We relate central bank reform and independence to global finance and argue that the credibility benefits of CBI extend beyond its potential effects on domestic outcomes. We treat such interdependence in two steps: A first links a government's decision to reform central bank legislation to a perceived need to attract capital, in the form of foreign direct investment or sovereign borrowing. A second step models investor decisions to move capital and the price of such capital as a function of CBI.

The extensive literature on the international diffusion of liberal policies posits multiple causal mechanisms (Simmons et al. 2008). Because of our interest in international finance, we focus on

mechanisms related to competition. Investors value central banks because they may deliver better macroeconomic outcomes and also because they signal policy and institutional stability. In turn, countries prize international capital for its potential to generate economic growth and for contributing resources to be spent on governments' agendas. We expect therefore institutional conformity to emerge across countries that are close investment substitutes and that countries will reform central bank laws in response to the behavior of direct rivals for portfolio capital or direct investment flows. We also investigate whether CBI adoption emerges in rivals for capital from a process of learning about central bank credibility or whether countries conform to CBI as it becomes a norm for macro-economic governance, without grasping what McNamara (2011:84) calls "means-ends relationships".

In a second step, we explain the conditions when CBI is attractive to investors. Capital is shown to react to favorable macroeconomic outcomes (Mosley 2003, Ahlquist 2006). Yet with institutions, investors question how likely they are to deliver such preferred outcomes. CBI is generally granted via regular legislation and the risks to bank independence come from implicit or explicit threats to amend the law. Our argument is that investors condition the signal sent by legal CBI on the political institutions that increase the credibility of the bank's legal status. Additionally, we suggest that CBI is more relevant for less developed countries and in relation to institutional reforms globally.

We use new author-collected data on central bank independence to test our argument for a sample of 78 democracies, mixed regimes and dictatorships (1974-2007). In addition to coding central bank laws to update the Cukierman et al. (1992) index of bank independence, we specifically identify central bank reform years. This allows us to test not only the effect of CBI on investor decisions, but also the effect of international competition for capital on central bank reform. A first set of models uses logit regressions to explain the decision to reform a country's central bank. Our key explanatory variables are spatial lags of average CBI levels within country groupings that reflect our theoretical mechanisms. We find strong evidence that central bank reform responds to the decisions of direct competitors for capital, i.e. countries with similar risk profiles in the eyes of investors. Also, when competing for capital,

countries appear to learn from the experience of peers with similar political institutions. On the other hand, functional learning outside the context of competition does not occur. Further, we find that socialization of countries in networks of intergovernmental organizations is a robust determinant of central bank reform. While it acts a control variable for us, its substantive effect is similar to the effects of our key competition mechanism variables. The effect of CBI on FDI flows or bond rates reflects to a great extent investors' attention to the conditions that give legal CBI de facto credibility. Thus, we find evidence that in non-OECD democracies, CBI increases FDI flows and lowers 10-year bond rates. Additionally, investors appear to consider the CBI of other countries when making decisions: Bank independence has a larger effect before the late 1990s, i.e., in democracies that reformed their central bank before CBI become widespread. Also, democracies with a greater level of CBI compared to the global average attract both FDI and sovereign investment.

Our paper contributes directly to several research agendas. First, it increases understanding of the causes and implications of global capital flows. Other neo-liberal policies have been shown to respond to competition for capital (Simmons 2000, Simmons and Elkins 2004, Elkins et al. 2006). Yet, while prior work has made strides in understanding central bank reform as a reaction to international conditions (Maxfield 1997, Polillo and Guillen 2005, McNamara 2011), this research offers an incomplete theoretical and empirical treatment of competition for global finance and the credibility of institutions. In addition, while we understand the effect of democracy (Jensen 2003, Li and Resnick 2003, Archer et al. 2007, Beaulieu et al. 2012) and international institutions (Buthe and Milner 2008, Gray 2013) on the flow and cost of capital, CBI's influence on investor decisions is poorly understood. This is important because even if central bank reform is driven by functional learning only in limited contexts, investor reaction is determined by what CBI can de facto deliver. Our findings complement research showing that developing countries face strong additional scrutiny from investors (Mosley 2003, Sobel 1999, Gray 2013, Wibbels 2006) by bringing evidence that in democracies CBI is an important signal to investors. Second, Broz (2002), in an influential paper, argues that democracies should prefer

CBI over fixed exchange rates because the transparency of democratic political institutions substitutes for the relative lack of transparency of central banks. Because, however, previous data do not precisely identify reform years, the literature has been unable to properly test whether democracies give their central banks more independence. Using our annual data we find little direct evidence that democracies are more likely to reform. Rather, it appears that democracies increase CBI following bank reform in other democratic countries that are direct competitors for capital.

The paper proceeds as follows. Section 2 provides background on the drivers of CBI. Section 3 reviews research on the effects of institutions on investor decisions. Section 4 links competition for capital to central bank reform. Section 5 explains how we expect CBI to affect international capital. Section 6 & 7 present the empirical evidence. Section 8 concludes.

## **2. Domestic and international drivers of central bank independence**

In the last twenty years, governments of every political stripe and across political regimes have reformed their central bank laws and increased CBI. Most of the identified reasons behind the reforms rest with domestic conditions. Economists stress that CBI solves the time inconsistency problem faced by governments in monetary policy (Kydland and Prescott 1977, Barro and Gordon 1983, Rogoff 1985). That is, if governments control economic policy, they have an incentive to make promises they do not intend to keep in order to spur economic growth. Because people will realize that such promises are not credible, the government cannot surprise them and the economy will perform worse. To overcome this, governments will delegate monetary policy to an independent central bank in order to tie their own hands and improve economic performance. Other domestic factors include information asymmetries between governments and legislators or coalition partners (Bernhard 1998); diverse political coalitions (Crowe 2008); more checks and balances (Moser 1999); federal systems and party veto players (Hallerberg 2002); the presence of coalitions favoring price stability (Goodman 1991, Treisman 2000); and transparent political systems (Broz 2002).

By comparison, international factors, especially international finance, have enjoyed far less systematic treatment as explanations for central bank reform. Yet CBI is a part of the global wave of neo-liberal reforms and significant evidence exists that international competition for capital drives other liberal policies such as current account liberalization (Simmons 2000, Simmons and Elkins 2004), capital account liberalization (Simmons and Elkins 2004), and the legalization of investment obligations via bilateral investment treaties (BITs) (Elkins et al. 2006, Jandhyala et al. 2011).

Even when CBI is linked to international conditions are, extant work offers an incomplete theoretical and empirical treatment of global finance. Maxfield (1997) broadly suggests that central bank autonomy signals creditworthiness to potential investors. Independence, in turn, is argued to be a function of countries' exposure to global capital as reflected in the balance of payments, foreign reserves, cost of capital or the amount of foreign investment. Polillo and Guillen (2005) argue that cultural, political and economic competition among states leads to the adoption of institutions prevalent in each country's environment. Although resulting from a different causal logic, their hypothesis is similar to Maxfield's prediction: Trade or investment dependency results in greater CBI. Another implication is that trade ties put normative and competitive pressures on countries to mimic central bank reform in trade partners and competitors. McNamara (2011) also suggests that isomorphism is a leading cause of CBI adoption, with an emphasis on coercion from international organizations and pressure to conform to Western economic models. While such work pushes the CBI literature in a distinctly new direction, the theoretical accounts lack precise derivation of hypotheses based on competition for global capital. For example, exposure to world markets (Maxfield 1997, Polillo and Guillen 2005) is a necessary but insufficient condition for policy liberalization if such liberalization is claimed to be a direct result of competition for capital (Simmons et al. 2008). Moreover, there is little in the way of evidence in McNamara's article and evidence in the other research is limited to case studies (Maxfield 1997) or the examination of trade competition for the decade of the 1990s (Polillo and Guillen 2005).

Finally, if competition is a posited mechanism for the spread of CBI, insufficient attention is paid to the conditions that make such reform credible. Countries and investors may view CBI a signal, but do they consider its credibility? CBI has its intended effect on domestic variables in countries with strong rule of law: Broz (2002) finds that in political systems where decision making is transparent (democracies), CBI can contribute to low inflation. Keefer and Stasavage (2003) show CBI is credible only in political systems with multiple veto players with distinct preferences, which, again, is predominantly a feature of democracies. The combination of CBI and political regimes also has a discipline effect on money growth rates and a credibility effect on inflation in democracies but not in autocracies (Bodea and Hicks 2012). And, fiscal discipline is improved by the presence of an independent central bank, but only in democracies (Bodea 2013). McNamara (2011), however, argues that rational learning about when CBI is effective can be a daunting task for many countries because of uncertainty regarding “means-ends relationships” (p.64). The implication is that CB reform is driven by social mechanisms of diffusion rather than concern for credibility or competition. On the other hand, Maxfield suggests that investors pay attention and may distinguish even informal changes to CBI in dictatorships that lack transparency. Yet, such claims are still waiting rigorous testing.

### **3. Institutions and international capital**

The relationship between CBI and capital flows is similarly poorly understood, even if, as noted above, globalization via trade or lending channels has been argued to influence CBI reform. Most extant work predates the spate of recent reforms and finds mixed results for CBI's effect on the cost of capital. For example, Alesina and Summers (1993) show that CBI does not reduce risk premia on real interest rates (also Cukierman et al. 1993). On the other hand, Spiegel (1998) finds that the 1997 Bank of England reform reduced inflation expectations as reflected in lower long-term bond yields. Related, Maxfield (1997) shows a statistically significant relationship between legal CBI and the share of private investment to GDP. Moser and Dreher (2010) find that sovereign bond spreads in developing countries

react to the turnover of central bank governors. Yet virtually no work examines the effect of legal CBI on flows of foreign direct investment or whether recent reforms have affected sovereign borrowing.

The question is relevant given that other institutions or legal constraints are important to investor decisions. Following an early focus on economic factors, recent work investigates the role of domestic political institutions and international agreements on international capital flows. Democratic institutions are argued to increase inflows of foreign direct investment because of greater policy stability, transparency, audience costs or property rights protection (Henisz 2002, Jensen 2003, Li and Resnick 2003). Yet electoral competition and responsiveness to the preferences of voters and local firms are argued to reduce the appeal of democracies to investors (Li and Resnick 2003). Other work shows that international agreements such as BITs or PTAs can signal a credible commitment to limit government intervention in the economy, thus increasing FDI flows (Kerner 2009, Buthe and Milner 2008).

Institutions are important for sovereign lending as well. Schultz and Weingast (2003) argue that political constraints increase the likelihood that governments honor debt, which should translate into access to credit and lower cost of capital. While historical analyses support this idea (North and Weingast 1989, Schultz and Weingast 2003), some recent work fails to find a significant “democratic” advantage for the cost of capital (Saiegh 2005, Archer et al. 2007).<sup>1</sup> Accounting for the selection involved in entering the bond market does, however, reveal that democracies receive better credit ratings (Beaulieu et al. 2012). And, the same credit ratings are improved by adherence to the rule of law (Biglaiser and Staats 2012). As with FDI, international commitments also lower the cost of capital: The European Union’s seal of approval reduces bond spreads (Gray 2009), or, more generally, membership in international organizations improves countries’ risk ratings (Dreher and Voigt 2011, Gray 2013).

#### **4. International capital and central bank reform**

Numerous examples suggest tight links between CBI and global finance. During the 2002 Brazilian presidential campaign investors reacted in a dramatically negative fashion (high bond spreads, currency

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<sup>1</sup> The democratic advantage is unclear for portfolio capital (Ahlquist 2006).



depreciation) to polls revealing that the leading candidate was the leftist Luiz Inacio “Lula” da Silva. Lula advocated replacing the sitting central bank president, a former investment banker popular with international capital markets (Martinez and Santiso 2003). In reaction, Mohamed El Erian, head of PIMCO – the largest global bond investor – stated directly in 2002 that, in Brazil, “in granting the central bank greater operational autonomy, the next president would need to refrain from overly relaxing the inflation target or distorting the allocation of credit in the economy”<sup>2</sup>. Market worries eased when Lula promised to grant the central bank greater independence. In another example, after a landslide victory in the 2010 election, Hungary’s Fidesz party passed a controversial law in 2011 undermining CBI. Markets reacted negatively to the proposed legislation (high borrowing cost, a junk country credit rating, currency depreciation)<sup>3</sup>. The Fidesz government restored the bank’s legal independence in 2012, yet in early 2013 it was perceived as abrogating de facto independence by proposing that the sitting, market unfriendly, finance minister become the head of the central bank. Negative investor commentary followed: “The appointment of Hungary’s new central bank governor has the potential to shatter the recent calm in local financial markets” (Capital Economics) and “The market fears that Mr Orbán (the prime-minister) will seek to spend the bank’s reserves to boost both commercial lending and support government bond issues, should the market prove unwilling to buy” (Zoltan Torok, Raiffeisen Bank).<sup>4</sup> Furthermore, democratizing Myanmar passed legislation in 2013 that separates its central bank from the Ministry of Finance, designating it as an independent entity. Economists and analysts expect that central bank reform will increase transparency and operate in the eyes of investors as a “seal of good housekeeping” that will associate Myanmar with countries like the Philippines or Thailand and separate it from laggards like Vietnam.<sup>5</sup> One investor remarks on the bank reform: “This is a step in the right

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<sup>2</sup> “What Lula Must do to save Brazil” Financial Times 10/22/2002.

<sup>3</sup> “EU bailout breakthrough as Hungary agrees to restore Central Bank Independence” Egov-Monitor, 4/30/2012. Wall Street Journal “Hungary Leader Takes Steps to Calm Markets”1/7/2012.

<sup>4</sup> “Investor Concern over Hungary Bank Chief” Financial Times 1/29/2013.

<sup>5</sup> “Myanmar Central Bank sees Independence Near”, Wall Street Journal Europe 06/10/2013.

direction that will create a lot more transparency, comfort and stability for investors” (Thura Soe Paing, All Myanmar Investment & Development Partners).<sup>6</sup>

These anecdotes suggest that markets react to government decisions about central bank laws. We examine analytically the interdependence between CBI and global capital in two distinct steps. In this section we tie government decisions to reform the central bank law to a perceived need to attract international capital, using the literature on the diffusion of liberal outcomes to parse out causal mechanisms. The next section specifies the conditions under which CBI can be attractive to investors.<sup>7</sup>

Several consequences of central bank reform appeal to international financial markets. First, CBI can act as a domestic institutional commitment that serves as a broad signal of policy stability. Just as PTAs can increase FDI by signaling that a government will not intervene in the economy (Milner and Buthe 2008), an independent central bank should signal a hands-off government approach.<sup>8</sup> Second, in specific contexts, CBI affects key outcomes that investors care about like domestic inflation and fiscal deficits and therefore can increase the predictability of returns to capital. Credible and autonomous central banks may also be able to anchor inflation expectations. In this case, more than just contributing to lower inflation, CBI allows policymakers to focus on the long-term and engage in fewer interest rate increases in reaction to short term bumps in inflation.<sup>9</sup> Credible independent central banks can also flexibly respond to output drops, without tick-ups in inflation (Adolph 2013). In Maxfield’s view, CBI’s

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<sup>6</sup> “Myanmar's central bank law explained”, *International Law Review* 09/2013.

<sup>7</sup> Mosley (2003) makes the related argument that international financial markets both affect governments’ policy choices and reward particular policies. Mosley briefly discusses CBI, with the expectation that central bank independence would lower bond rates (Ch. 6).

<sup>8</sup> A key premise in Rogoff (1985) is that the central bank has more conservative preferences than politicians and the public at large. An independent central bank concerned with inflation is likely then to stand for de-indexation of labor contracts and a social pact that contains wage increases, congruent with the preference of direct investors for containing labor costs.

<sup>9</sup> Siklos (2002) shows that for several OECD autonomous central banks credibility affords lower interest rates (New Zealand, United Kingdom, Switzerland). More evidence is in Adolph (2013).

largest effect is on bond investors because they tend to be dispersed and lack reliable access to local information. FDI investors, however, should still favor CBI and its conservatism given that host countries are increasingly used as export platforms, in which case, currency stability matters for export competitiveness (Frieden 1991, Polillo and Guillen 2005). Finally, the central bank can emerge as a veto player with respect to property rights protection<sup>10</sup> and contribute to broad institutional stability. Banaian and Luksetich (2001), for example, show that countries with greater economic freedom, of which secure property rights is a key component, tend to have more independent central banks.<sup>11</sup> This is not direct evidence that CBI leads to fewer expropriation, yet central banks, if independent, can be part of what Elkins et al. (2006: 827) call “institutions and practices that are favorable to investors, transparent and predictable.”

The international environment has overlapping effects on countries’ policy choices. In the broadest sense, the literature groups such influences into mechanisms of competition, coercion, emulation and learning (Simmons et al. 2008). We are interested in the role of international finance, and therefore focus on mechanisms related to competition, but we also lay out plausible alternative mechanisms that may affect CBI reform. Convergence theories predict that competition for capital leads countries to adopt market-preferred policies following the behavior of direct competitors (Simmons and Elkins 2004, Elkins et al. 2006). This happens because reform in one country has externalities for subsequent CBI reform decisions in other countries so governments have incentives to match peer decisions.

Specifically, when a country reforms its central bank, this has the potential to make investors reconsider the location of their next direct investment or their portfolio allocation in search of the best risk-return

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<sup>10</sup> The following example illustrates our point: In the latest Eurozone bailout, Cyprus imposed significant losses on large bank depositors. Following, Benoit Coeure, a member of the executive board of the European Central Bank explicitly favored secured property rights, rejecting the idea that depositors should fear their savings on grounds of Cyprus’ unique circumstances (“ECB, Eurogroup at odds over Cyprus rescue as a model”, Associated Press 3-2-2013)..

<sup>11</sup> Banaian and Luksetich (2008) argue that property right protection is a key determinant economic freedom, while other components of economic freedom indexes are rather expressions of such freedom.

ratios. Governments value direct investment because it implies a long-term commitment to the country with the potential to generate economic growth, local employment or transfers of technology (Jensen 2003). Sovereign lending is also valued because the freedom to spend financial resources directly on government priorities can lead both to better aggregate economic growth outcomes and political support from direct beneficiaries of government spending (Schultz and Weingast 2003). Consequently, institutional conformity should emerge across countries that are close investment substitutes.<sup>12</sup> *That is, countries will reform their central bank laws in response to the behavior of direct rivals for portfolio capital or direct investment flows (H1.1).*

Yet, CBI legal reform brings de facto credibility gains only to a limited set of countries with transparent political institutions and real political competition. This conditional effect arises because authoritarian governments can covertly pressure an "independent" bank or even easily reverse the legal independence of the central bank. Without meaningful opposition to highlight such interference or block changes, investors and the public need not believe a government's promises. Countries competing for capital may thus consider the credibility of particular institutional innovations and mirror the behavior of relevant peers based on functional considerations. That is, we can see CBI reform being driven by a process of learning from peers about what McNamara calls "means-ends relationships". Such learning can occur broadly. However, directly linked to our interest in the role of global competition for capital we hypothesize that: *CBI adoption emerges in rivals for capital from a process of learning about what works from the experience of countries with similar political institutions (H1.2).*

Globalization of capital may, in addition, drive CBI reform even when countries lack a full grasp of the conditions that make legal delegation of monetary policy credible. Jandhyala et al. (2011), for example, argue that early and late adopters of BITs have different motivations. Late adopters could be motivated by a "rational cascade, in which countries uncertain of the net benefits of BITs or the full

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<sup>12</sup> Divergent or contingent responses to international competition are possible (Garrett 1998, Garrett and Lange 1991, Basinger and Hallerberg 2004, Hays 2003, Pluemper et al. 2009).

nature of the liabilities to which they are obligating themselves nevertheless sign such treaties because peer states are doing so” (p. 4). Similarly, Simmons and Elkins (2004) argue that capital and current account liberalization are driven by an emerging consensus on neoliberal ideas. The costs from not matching global norms come from capital markets’ doubts about countries approach to economic policy and the legitimacy of domestic governance. The trend in CBI reform coincides with studies showing a correlation between CBI and low inflation in developed countries and the International Monetary Fund’s (IMF) decision to make lending conditional on CBI reform (McNamara 2011). To a large degree, then, as trade and investment became global by the late 1990s, CBI was a broad signal of good economic governance. *Therefore, as with other liberal outcomes, countries can rush to reform the legal status of their central banks because a critical mass of other countries has already done it (H1.3).*

Alternative explanations emerge directly from extant work and we account for them in the empirical estimation. Most notably, dependence on international capital can increase countries’ vulnerability to interest rate increases or sudden outflows of capital, and thus the opportunity cost of delayed central bank reform. Accordingly, countries reform their central bank when international financial flows are liberalized (Maxfield 1997) or when they have large exposure to FDI (Polillo and Guillen 2005). Furthermore, other peer groups may matter for a particular country’s CBI reform. The adoption of CBI can thus be the result of a process of socialization in networks of culturally similar states or among members of the same international organizations (McNamara 2011, Simmons and Elkins 2004).

## **5. Central bank independence and investor decisions**

The previous section lays out plausible country reactions to global competition for capital. Here we ask whether the spread of CBI has its desired effect on investor behavior. We argue that investors condition the signal sent by legal CBI on the political institutions that increase the bank’s credibility. Additionally, we suggest that CBI reform is more relevant for less developed countries and in relation to institutional reforms in other countries.

If CBI matters for outcomes like inflation or fiscal deficits in ways described by the literature, investors ought to appreciate the crucial role played by political institutions in the bank's de facto status and ability to determine monetary policy. Santiso (2013) shows that analysts and economists at major investment banks downgrade their recommendations for Latin American debt purchases in those countries whose policies are deemed not credible. Lack of credibility comes from fears of expansionary fiscal or monetary policies and abandoning central bank independence. Fund managers also flee countries lacking credible policies and institutions. An example is Venezuela: After the central bank was given significant legal independence in December 1992, the country was sufficiently credible that the election of populist Hugo Chavez as president in 1998 did not stir financial markets, unlike Lula's election in Brazil (Santiso 2013). By the mid-2000s, however, as Venezuela became increasingly dictatorial, the central bank funded the government's budget despite its legal independence (EIU Country Report, December 2004, 2005) and foreign investors fled the country in hordes between Chavez' reelections in 2000 and 2006 (Santiso 2013). As emphasized earlier, in countries with rule of law, strong constraints and freedom of the press a legally independent central bank can be a credible indicator of price stability or fiscal discipline (Broz 2002, Keefer and Stasavage 2003, Bodea 2013). Also, such conditions will likely mediate the central bank's preference for stability and investor protection into real influence on government policy. *We expect then that greater capital flows and lower cost of capital in reaction to central bank independence are contingent on political institutions (H2.1).*

The value of CBI as a signal may also vary depending on the amount of information it conveys to investors. Mosley (2003) and Sobel (1999) find that interest rates on sovereign debt in developing countries react to comparatively more indicators than in developed economies, reflecting more thorough investor scrutiny. Similarly, Gray (2013) argues that developing nations need to strive continuously to show their creditworthiness, while Wibbels (2006) finds that such countries have precarious access to international finance and remain largely unable to borrow during tough times. Given the non-negligible risk of default or nationalization in developing countries, CBI has the potential to be a more important

cue for investor destinations outside the OECD. In such countries, the central bank, if credibly independent, can be both an indicator of conservative macroeconomic outcomes and an actor with a preference for stability and investor protection.<sup>13</sup> *Following, our hypothesis is that the effect of CBI on the flow and cost of capital is likely stronger in non-OECD countries (H2.2).*

In addition, when making decisions about capital allocations, investors may compare the information provided by CBI in a particular country against the practice of other, earlier reformers. In this case, the effect of CBI is likely contingent on whether countries are early adopters of central bank reform. This is because, on the one hand, late reformers may simply be playing a catch-up game with investors remaining skeptical that CBI can de facto work if adopted mainly to fit an international norm, as we suggested earlier. Investors may also discount the level of CBI because it no longer sends a clear separating signal—if all countries have an independent bank, it no longer distinguishes countries. *The effect of CBI is then more likely to hold for the early adopters of central bank reforms (H2.3).*

In the previous section we underlined that countries could reform their central bank for reasons that have little to do with the expected consequences of such reform. As CBI becomes a standard of macroeconomic governance, countries may change central bank legislation following practices of social peers and without having in place institutional constraints that make CBI credible. We have so far suggested that, under certain conditions, investors find central bank reform informative. An alternative view we test below is that CBI, by itself, is a signal to investors about the future course of policy and increases FDI flows or lowers sovereign borrowing costs (e.g., Polillo and Guillen 2005).

## **6. Central bank reform**

**Data, measurement and research design.** Despite the popularity of central bank independence measures, there have been few attempts to code independence annually, identify the year of reform, or even, beyond a handful of countries, code new legislation over the last twenty years. Our new data does

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<sup>13</sup> Mosley (2003) finds that inflation risk is more salient than default risk in developed countries. Emerging market investors appear, however, relatively more concerned about default.

exactly this.<sup>14</sup> We code the level of central bank independence based on the Cukierman et al. (1992) index and identify reform years when the central bank law is amended and the CBI index increases for 78 countries between 1973 and 2007.<sup>15</sup> The CBI scores are based on a weighted calculation of 16 indicators in four categories regarding the central bank's Chief Executive Officer, Policy Formation, Objectives, and Limitations on Lending to the Government.<sup>16</sup> A bank has more legal independence for longer governor terms in office; when the appointment and dismissal procedures are insulated from the government; when the bank's mandate is focused on price stability; when the formulation of monetary policy is in the hands of the central bank; and when the terms on central bank lending to the government are more restrictive. The overall CBI index ranges from 0 to 1, with 1 being the greatest independence.

Given our theory, we use the CBI index in two distinct ways. In this section we investigate the effect of global capital on central bank reform. We consider a reform to be any increase in the CBI index.<sup>17</sup> There are 90 cases of such reform in our data. Sixty of the 79 countries in our sample reformed their central bank. Most countries only reform once, although Portugal and Venezuela enacted 4 reforms. The next section uses the level of CBI as the key independent variable in models of investor decision.

We use several indicators to measure the hypothesized role played by international capital in the diffusion of CBI reform. Key independent variables are spatial weight matrices ( $N*N*t$ ) that capture the impact of CBI in similar peers on a reference country at a particular time  $t$ . The elements we use to create the spatial weights vary with the relevant peer groups identified in hypotheses H1.1-H1.3. For the different measures, we first compute similarity scores across all the countries in our sample (Elkins et al. 2006). That is, we use as spatial lags the average CBI index in the top 25<sup>th</sup> percentile of countries for each similarity measure (the peer group), weighted by the similarity to the reference country. The

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<sup>14</sup> Other work covers specific decades (Polillo and Guillen 2005, Dincer and Eichengreen 2013).

<sup>15</sup> The Appendix shows data availability and the categories / weights comprising the CBI index.

<sup>16</sup> We use the original Cukierman et al. (1992) weights to aggregate the CBI index.

<sup>17</sup> We also code as reform increases in the CBI index of more than 0.10 (64 reforms). 0.15 (50 reforms), or more than 0.20 (42 reforms) and our results continue to hold.



computations of spatial weights do not include the observation for the reference country and are lagged one year to minimize simultaneity bias (Beck et al. 2006). Our spatial weights attempt to overcome a distinct challenge. In particular, they ought to capture specific mechanisms that drive countries' reactions and to empirically differentiate these mechanisms. This is problematic because, for example, countries with a similar Standard and Poor country risk rating tend to have similar political institutions (Cox et al. 2012), and therefore, simple averages of CBI levels across categories of country ratings or democracy scores are highly correlated. Consequently we use multiple variables in each spatial weight to generate similarity to the reference country.

Based on country responses to competitive pressure (H1.1), we expect that central bank reform is driven by the behavior of countries with similar costs of capital and FDI exposure. To the extent that the cost and flow of capital reflect investment risk, it is reasonable to assume that countries with similar risks for portfolio or direct capital are close substitutes in the eyes of investors. Thus, for direct international market pressure we create a similarity measure based on variables that plausibly identify investment competitors: The Standard and Poor's (S&P) and Moody's country risk ratings, the real 3 month interest rate, and FDI inflows as a percentage of GDP. For the mechanism involving learning from countries with similar political institutions (H1.2) we compute two distinct variables. A first captures broad functional learning and measures similarity of political institutions based on the 6 components of the Polity2 score and Henisz's political constraints (Henisz 2002). A second measure aims to discern whether functional learning is more likely in the context of countries already competing for capital. For this variable we identify the top 25<sup>th</sup> percentile similar countries based on the market pressure variables. We then create a rough political similarity weight by dividing countries into 4 groups based on their Polity score (scores between -10 and -6, -5 and 0, 1 and 5, and 6 and 10). Country pairs in the same group have a weight of 1; pairs in contiguous categories receive a weight of 0.5, and for those in non-adjacent categories the weight is 0.25.<sup>18</sup> The peers' average CBI is weighted by both the market

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<sup>18</sup> We obtain similar results if the weighing is done using Henisz' measure of political constraints.

similarity and political weight and then averaged. Finally, to examine the link between competition and norms (H1.3), we average CBI scores of countries globally and in each region, weighting each partner's CBI by its geographical distance to the reference country.<sup>19</sup> The further away a partner is, the less importance the weighting will attach to its CBI. The correlations between our spatial lags vary from about 0.1 to 0.55, so our measures are picking up different types of international pressures to reform.<sup>20</sup>

In addition to the key spatial lags described above, we include several control variables that may impact the likelihood of reform: The country's democracy score (Polity2); the one year lagged value of the CBI index; the log of inflation (WDI); the log of GDP per capita (WDI); lagged GDP growth (WDI); trade openness (WDI); the value of a country's fiscal budget deficit/surplus relative to GDP<sup>21</sup>; the change in the US federal funds rate (US Fed); the change in international reserves (Lane and Milesi-Ferretti 2007); a dummy variable for a fixed exchange rate regime based on the IMF's official classification<sup>22</sup>; FDI inflows as a percentage of GDP (WDI); and capital account openness (Chinn and Ito 2008). To explore the determinants of CBI reform we estimate logit models with country clustered standard errors that include the length of time to reform and cubic splines to control for time dependence (Beck et al. 1998). The unit of analysis is the country-year.

**Results and discussion.** Table 1 shows the results of our analysis of central bank reform. In Models 1-4, we include each of our spatial lag measures separately. Model 1 shows that the spatial lag measure

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<sup>19</sup> We weight by the ratio of the minimum distance between the reference country and a partner country (closest capital to the reference country) and the distance between the reference country and each partner:  $\exp(\ln(\text{DIST}_{\min}) - \ln(\text{DIST}_{\text{dyad}}))$ . For the closest neighbor, the value inside the parentheses will equal 0 and after exponentiation, we get a value of 1 for its weight. This measure is different than a simple average, which we do not prefer because of high correlation to our other measures (0.65-0.75).

<sup>20</sup> Another way to construct spatial lags is based on CBI reform (rather than CBI levels) and similarity to competitors for capital, political and regional peers, and social isomorphism. These lags, however, remain highly correlated (correlations 0.7-0.8), severely limiting out ability to draw inferences.

<sup>21</sup> IMF IFS, EBRD transition reports, OECD statistics, Brender & Drazen 2005.

<sup>22</sup> Ilzetzki et al. 2009. We code a fixed regime if the observation is a 1 under the IMF's coarse coding.

based on similarity of country credit ratings, short term interest rates and FDI exposure is positive and highly statistically significant. This supports H1.1 and means that CBI reform is more likely if direct competitors for capital have a higher average level of bank independence. In the next two models we return to the question of whether and how countries consider credibility while reforming central bank legislation. Model 2 shows that, by itself, functional learning from peers with similar political institutions does not drive reform. Yet, Model 3 supports hypothesis H1.2 and shows a statistically significant coefficient for our spatial lag that weights competitors for capital by the similarity of political institutions. This indicates that, when competing for capital through CBI, countries consider whether such a reform is credible. Finally, Model 4 shows little support for the idea that competition through norms that give more weight to close neighbors increases the probability of CBI reform. In Models 5&6 we discriminate among causal mechanisms for international diffusion. That is, we include our key measures in the same model together with an additional spatial lag that weighs the CBI level by the percentage of shared membership in intergovernmental organizations or IGOs (Pevehouse et al. 2004).<sup>23</sup> When a pair of countries shares IGO networks, they may look to each other's institutions for inspiration, and so the variable controls for sources of social isomorphism. This variable is positive and significant suggesting that socialization does matter. More importantly, however, both measures of capital market pressure (weighted and un-weighted by political institutions) remain statistically significant.

[Table 1 about here]

To evaluate substantive effects, we compute the relative probability of reform when varying our spatial lags. We predict the probability of CBI reform while varying one by one all the statistically significant variables (Models 5&6) from the 10<sup>th</sup> percentile to the 90<sup>th</sup> percentile and keeping all other variables at the average of observational values. Changing to the 90<sup>th</sup> percentile for the spatial lag based on levels of CBI in countries that compete for capital increases the likelihood of reform 2.1 times

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<sup>23</sup> For networks of culturally similar states we use genetic distance as weights (Spolaore and Wacziarg 2009). This spatial lag is little correlated with our other measures and is never statistically significant.

(Model 5). The substantive effect of the spatial lag based on competitive pressure weighed by political institutions (Model 6) is even larger, showing a 3 times increase in the probability of reform. These substantive effects are similar in size to the effect of other drivers of reform. Based on Model 5, increasing inflation in a similar fashion (10<sup>th</sup> to the 90<sup>th</sup> percentile) raises the probability of reform 2.7 times, increasing exposure to FDI by about 1.5 times, and increasing the CBI level in countries with similar IGO membership raises the probability of CBI reform 3.8 times. This evidence suggests that, while there is social isomorphism, competition for capital in the form of imitation of the institutions in direct competitors is important in its own right.

We explore further the meaning and robustness of our results. First we use a number of additional relevant variables that mitigate the concern that common international shocks or domestic economic crisis drives CBI reform. Our results are robust to the inclusion of participation in an IMF program; the executive's partisanship, domestic debt levels, inflation averages in the past five or ten years, major exchange rate devaluations, and domestic banking crises. The key results for the spatial lags based on competition for capital remain statistically significant.

In addition, we compute our spatial lags in ways that either increase our sample size or extend support to the posited causal mechanisms (Appendix). First, we employ a simpler measure based only on S&P country risk ratings that increases our sample size by upwards of 200 observations. We split the S&P ratings into four groups and then calculate the average CBI level in each category for each year, excluding the reference country.<sup>24</sup> This measure is positive and highly significant, even with the inclusion of spatial lags for functional learning, norms and IGO network similarity. Second, we examine whether democracies are more sensitive to market pressure than non-democracies. Rather than including an interaction between the market pressure spatial lag and a democracy dummy variable, we enter the market pressure spatial lag computed separately for democracies ( $\text{Polity2} \geq 6$ ) and non-democracies. We find a statistically significant effect in democracies but no effect in non-democracies, supporting our

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<sup>24</sup> All countries without a credit rating go into a fifth category which increases the sample size.

hypothesis H1.2. Next, we replace the norms measured as a global weighted distance measure with regional distance. As with the global measure we weight by the ratio of the minimum distance between the reference country and a partner country and the distance between the reference country and each partner country, for countries in the same region. Still, such norms are not statistically significant.

We also focus exclusively on non-OECD countries. For this smaller sample, our spatial lag for market pressure loses significance, while similarity of IGO membership remains positive and highly statistically significant. Given the expectation that non OECD countries are under greater pressure to show creditworthiness to financial markets, we investigate this result further. Perhaps, the inclusion of countries with already independent central banks is affecting the results. Once a country has an independent bank, further reform is less likely and may not be due to market pressure. For example, to conform to EU rules, shortly before accession into the European Union countries like Slovakia, Hungary or Romania raised CBI to very high levels (above 0.8) from already respectable levels of independence. The most hailed independent central bank, the German Bundesbank, has an independence score of 0.68. We enter distinct spatial lags for countries with an independence score less than 0.65 and greater than 0.65. The coefficient is positive and significant in the former case but insignificant in the latter. Second, we drop observations with CBI scores greater than 0.65. We again find a positive and significant coefficient for market pressure.

Few of the control variables appear to have a consistent effect on CBI reform. The lagged level of CBI has a negative and significant effect, showing that countries with lower levels of CBI will reform their banks. Surprisingly, while positive, a country's Polity score does not affect the decision to reform the bank. When used as an alternative, the number of veto players is similarly statistically insignificant. Key macroeconomic policies and outcomes like capital account openness, economic growth or deficit levels are not consistently statistically significant, although inflation and exchange rate regime are significant in several models. On the other hand, countries with more exposure to FDI are significantly more likely to reform their central banks.

## 7. CBI level and investor decision

**Data, measurement and research design.** To test our hypotheses H2.1-H2.3, we focus on the effect of the CBI index on foreign direct capital flows and the real yield on 10 year domestic bonds.

Institutions that have a demonstrated effect on policy outcomes are likely to matter for investment with a longer term horizon. Short term investments (portfolio investment, the 3-month T-bill yield) are more likely to be interested in quick profits, immediate macro outcomes and the ability to exit (Gray 2013).

Our main measure of direct investment is FDI as a percentage of GDP.<sup>25</sup> Most observations are between -15 and 20 percent, but about 4 percent of observations are above 20 percent. We correct for outliers in two ways. First, we restrict the sample to cases where the absolute value of FDI/GDP is less than 30 (86 observations fail this criterion). Second, to ensure that dropping large positive values does not create its own bias, we take the log of 1 plus the absolute value of FDI/GDP; for negative inflows we then add a minus sign to the logged value. To measure the effect of CBI on government borrowing costs, we focus on the 10-year inflation-adjusted government bond rate (Global Financial Database). As with FDI, the data includes outliers. Here, we exclude the 7 of the 1190 observations with an absolute value greater than 50.<sup>26</sup> We have 58 non-OECD countries in the FDI models, but only 28 in the 10-year bond models, reflecting the fact that many such countries lack the credibility to issue long-term bonds.

The key independent variable is the level of the CBI index described above. To test our interactive hypothesis (H2.1) we rely on Polity 2 democracy scores. Testing H2.2 implies restricting the sample to countries outside the OECD. Finally, we test whether investors compare CBI across countries (H2.3) by identifying temporal structural breaks in the data and looking at the effect of the difference between country CBI and the global average of bank independence. Our estimations use all control variables included in the reform models, to mitigate the concerns that the conditions leading to CBI reform also

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<sup>25</sup> Because it is scaled to GDP, the measure may capture openness to FDI rather than the amount of investment (Li and Reuveny 2003). Appendix 5 reports results using the log of total FDI inflows.

<sup>26</sup> More than 25% of observations have real negative rates so using the log makes little sense.

drive the effect on the flow and cost of capital. In addition, the FDI models include GDP per capita and a count of the number of BITs signed by a country (Buthe and Milner 2008).

We use OLS models on country-year data and include country fixed effects, a time trend and country clustered standard errors.<sup>27</sup> Fixed effects control for time invariant country characteristics, while the time trend helps control for the over-time increase in FDI and sovereign borrowing. To deal with issues of reverse causality Appendix 5 shows results using lagged five year averages of the CBI index<sup>28</sup> and system GMM models (Arellano and Bover 1995, Blundell and Bond 1998).

**Results and discussion.** Table 2 shows the effect of CBI on foreign direct investment and the 10-year bond rates. Models 7 and 13 show the results for all countries and with Polity2 and CBI included separately. In the full sample there is little support for a direct effect of CBI on FDI or the 10-year bond rates; we find no conditional effect either, so in the rest of our models we restrict the sample to non-OECD countries.<sup>29</sup>

For developing countries, we start with a similar naïve model where Polity2 and CBI are included on their own. We continue with models where CBI is interacted with Polity; models run distinctly for the years before 1997 and after; models with CBI interacted with both Polity and a dummy variable for years after 1997; and an interaction of Polity2 with the difference between a country's CBI index and the global CBI average (Appendix). The interaction terms attempt to distinguish instances when CBI can be credible and, respectively, identify the effect of an individual country's CBI in relation to global reforms. We discuss first results for FDI (Models 8-12) and subsequently for the 10-year bond yields (Models 14-18).

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<sup>27</sup> Hausman tests reject a random effects specification. We do not include the lagged dependent variable in OLS models with country fixed effects because that introduces the Nickell bias, which is aggravated by the small time duration of our data (Wooldridge 2002).

<sup>28</sup> The five year average lag also increases the chance of turnover among the politicians involved in passing central bank reforms, mitigating concerns that national preferences for liberal outcomes drive both CBI reform and the effect of CBI on the flow and cost of capital.

<sup>29</sup> The lagged 5 year CBI average and system GMM do not have better results in the whole sample.

Model 8 shows a statistically insignificant coefficient on the CBI index in non-OECD countries, indicating that CBI does not affect foreign direct investment similarly across all countries.<sup>30</sup> Non-democracies ( $\text{Polity2} \leq 5$ ) comprise about 36 percent of our sample of non-OECD countries, of which 30 percent have legally very independent central banks ( $\text{CBI} \geq 0.5$ ). To test the hypothesis that the effect of CBI depends on a country's political institutions, Model 9 includes an interaction between Polity2 and the CBI index. In all of the interaction models, we rescale Polity to range from -20 to 0. This does not affect the coefficient on Polity or the interaction, but it does change the coefficient on CBI. With the rescaling it shows the effect of CBI when Polity is equal to 0, or the effect in the most democratic countries, directly reflecting our H2.1. In model 9 we find a statistically significant and correctly signed (positive) CBI index, with a further positive coefficient of the interaction of CBI and Polity. Interaction terms and their components are, however, difficult to interpret and Brambor et al. (2006) prescribe that for multiplicative interaction models like ours, inference should be done with meaningful marginal effects and standard errors to determine the conditions under which key variables have a statistically significant effect. We plot the marginal effect of CBI as democracy increases in non-OECD countries in Figure 2(a). The marginal effect is significant only at high levels of Polity, supporting hypothesis H2.1. This effect also obtains when using the past 5-year CBI average (instead of the one year lag of CBI), Driscoll-Kraay standard errors and panel corrected standard errors with country dummies and an AR1 process (Appendix).<sup>31</sup>

[Table 2 and Figure 2 about here]

We also test whether investors make comparisons to the institutions of other countries (H2.3). First, there is evidence of a temporal aspect to CBI. In non-OECD countries, CBI has a positive and significant effect that is unconditioned by regime type in the years before 1997 (Model 10), but has no

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<sup>30</sup> Using the 5-year lag average of CBI offers some support for the naïve hypothesis, but that is not consistent with the system GMM estimation (Appendix).

<sup>31</sup> The marginal effect is statistically significant with the log of FDI inflows to GDP. However, with the log of FDI flows the marginal effect is in the correct direction, but short of statistical significance.



effect for later years (Model 11).<sup>32</sup> We further test whether there is there an interactive effect to the temporal results. That is, does CBI have a larger effect before 1997 in democracies and little effect in non-democracies? To examine this, we include a three-way interaction between CBI, democracy, and a dummy variable for the years after 1997. Results are in Model 12 and the marginal effect of CBI is plotted in Figure 2(b). The graph supports the idea that CBI loses effectiveness as more countries make their central banks independent. The marginal effect of CBI at higher levels of democracy is significant and positive in the years until 1997. The marginal effect is significant after 1997 for the three highest levels of Polity, but the effect is smaller than before 1997.<sup>33</sup> Also, in the appendix, we show that the interaction between Polity2 and the difference between a country's CBI and the global CBI average is significant with a similar marginal effect as in Figure 2(a). These findings support our intuition in H2.3 that competition for investment based on CBI has diminishing marginal returns: Once enough countries have independent banks, CBI is less likely to have an effect on FDI.<sup>34</sup>

We next turn our attention to CBI's effect on government borrowing costs, again, with a focus on non-OECD countries. Model 14 shows a statistically insignificant CBI coefficient, and thus no evidence that CBI by itself has an effect on real 10-year bond yields.<sup>35</sup> While data availability for bond rates is significantly lower than for FDI, just over 30 percent of observations are non-democracies and 20 percent of such observations have a legally independent central bank, similar to the FDI inflow sample. We next test hypothesis H2.1, by including an interaction between CBI and Polity (Model 15). As expected (given our rescaling of Polity), the coefficient of CBI is negative and statistically significant. In addition, the interaction term CBI\*Polity2 is negative and statistically significant. Figure 2(c) shows

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<sup>32</sup> This holds with both the log of FDI to GDP or the log of FDI inflows as dependent variables. Similar results obtain when we vary the cut-off year anywhere between 1994 to 1999.

<sup>33</sup> With the log of FDI flows the marginal effect of CBI is significant only at higher levels of Polity before 1997. From 1998 on, there is no effect of CBI.

<sup>34</sup> The conditional findings can be replicated when using the 5 year lag of the CBI index.

<sup>35</sup> There is also no evidence in models with the five-year average of CBI or system GMM models.

that the marginal effect of CBI is downward sloping and negative at higher levels of democracy. For the 10-year bonds, more independent central banks reduce borrowing costs for democratic governments but have no effect in non-democracies. This finding remains intact if we interact Polity with the 5-year average CBI, use Driscoll-Kraay standard errors or panel corrected standard errors with country dummies and an AR1 autocorrelation structure (Appendix).

Does the effect of CBI change in reaction to the institutions in other countries as in the case of FDI? Again, we find a significant and negative effect of CBI if the sample is limited to the year before 1997 (Model 16) and no effect for the years 1998 to 2007 (Model 17). This finding is, however, not robust: CBI becomes insignificant when Venezuela is excluded from the pre-1997 sample. Is there a more robust variation in the time effect of CBI in democracies versus non-democracies? We include the triple interaction of CBI, Polity2 and the years 1998-2007 (Model 18). Figure 2(d) plots the marginal effect of CBI for the two time periods at different levels of Polity2. We find a positive and significant marginal effect for low levels of Polity and a negative and significant marginal effect only for the highest values of Polity (scores greater than 7) before 1997. Surprisingly, after 1997, the marginal effect of CBI is significant and negative (though very flat) for a larger range of Polity scores that includes anocracies. Again, we find support for a time-varying effect of CBI. The yield on the 10-year bond reacts more strongly to CBI in democracies before bank independence becomes a global norm. However, the evidence shows that after 1998 CBI reduces bond yields even in countries mixing democratic and authoritarian features (Polity between -5 and 5). Finally, we find that the difference between a country's CBI and the global average CBI reduces bond rates in democracies: Figure 2(f) in the Appendix shows a negative statistically significant marginal effect of the difference for Polity levels above 5. On the whole, these findings support H2.3, showing that investors reward a credible independent central bank, especially when other countries have less central bank independence. The evidence also suggests, however, that in the more recent years investors are eager to enter early countries that appear to be democratizing and that legal CBI can, on the margin, reduce borrowing costs even for such countries.

While a number of robustness checks have been discussed so far, our results also hold when we include additional independent variables: political instability; elections; political constraints; partisanship; the ratio of debt to GDP; banking crises, participation in IMF programs. Also, to ensure that our results are not driven by particular countries or observations we run the models excluding countries (one by one) and dropping influential observations identified using Stata 12s' `dfbeta` command. As we report above, the large negative effect of CBI on the 10-year bond yields unconditioned by democracy before 1997 is driven largely by the inclusion of Venezuela. All our other results are, however, robust to sample changes. Finally, Bernhard et al. (2002) explore whether CBI and fixed exchange rates act as substitutes or complements, with the implication that the effect of CBI on investor decision may only hold for flexible exchange rates. We investigate this important issue by including in our models an interaction between CBI and the exchange rate regime, as well as a dummy variable for the years after 1997 and Polity 2 scores. We do not find important conditional effects of CBI interacted with the exchange rate regime.<sup>36</sup>

Several control variables from our FDI and bond models are worth discussing: Past inflation is not consistently statistically significant, but tends to reduce FDI inflows and, if anything, shows that higher inflation countries may see negative real interest rates. Fiscal balance does not appear to matter directly for either FDI or bond investors. Fixed exchange rates tend to reduce FDI inflows, and increase 10-year bond yields. This may be due both to the expectation of devaluation of fixed rates and the high short term interest rates used to preserve such exchange rate commitments.

## **6. Conclusion**

CBI has been seen as an important institutional mechanism providing domestic credibility to monetary policy. Inextricably then, central bank reform and independence are linked to outcomes that investors care about, including inflation, fiscal conservatism and stable exchange rates. That is, governments may reform their central bank in the face of competition for capital and investors could consider the status of

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<sup>36</sup> For results see Appendix 6. We thank an anonymous reviewer for raising the issue.

the central bank when making investment decisions. In this paper we advance testable mechanisms for the influence of international capital on central bank reform, ranging from direct competition within peer groups of countries with similar investment risk, to learning about when CBI works in the context of competition and norms of good governance. We also posit ways in which investors may react to CBI, ranging from processing information about the central bank contingent on political institutions, a country's level of development and other countries' central bank independence.

Empirical results show that countries reform their central banks in order to attract international capital, but that reform is driven not just by competition and "means-ends relationships" (McNamara 2011), but also by imitation of social peers from networks of inter-governmental organizations. So, if countries hope to please international capital when reforming central bank legislation, does CBI, in turn, affect investor's choice? Reflecting other research that points to the difference between developed and developing countries (Mosley 2003, Wibbels 2006, Gray 2013, Santiso 2013), we show that non-OECD countries may expect more FDI or lower bond yields from greater CBI, as long as they are democratic and, when compared to other countries, CBI can act as a separating signal.

Our research shows good reasons to reopen the discussion on the origins and effects of central bank reforms. Besides domestic factors, reforms to increase CBI are driven by several mechanisms that can be linked to countries' perceived need to be more attractive to capital investors. Future work can search for specific conditions when competition for capital leads to central bank reform. In the literature on capital taxation, for example, there is substantial evidence that the effect of international competition for capital is conditional on domestic institutions, political calculations or norms of fairness (Basinger and Hallerberg 2004, Hays 2003, Pluemper et al. 2009). Research can further tackle the effect of CBI on the cost of capital. Sovereign ratings are a particularly important factor of countries' cost of capital (Archer et al. 2007) and we show evidence of competitive behavior among countries that share similar risk profiles, including similar credit ratings. Thus it may be the case that, by reducing expectations of inflation and fiscal deficits, independent and credible central banks increase the chances that countries

will be rated in the first place and contribute to better credit ratings. Another important reform accompanying legal bank independence has been an increase in the transparency of central banks. Future work can relate the pressure of global finance to make central banks more independent to a simultaneous move to make central bank decision-making more intelligible to investors.

Finally, future work will need to consider two competing dynamics: On the one hand, in the last two decades delegation to an independent central bank has been on the rise, most notably in developing countries (Cukierman et al. 2002; and Jácome and Vásquez 2005, Bodea and Hicks 2012). So, such non-OECD countries are using to a larger extent a central bank that is independent rather than a fixed exchange rate, although they continue to be affected by fear of floating (Ilzetzki et al. 2009). On the other hand, since the onset of the most recent financial crisis there is an emerging debate on the effects of CBI: Organizations like the International Monetary Fund continue to regard CBI as a key to good macro-economic governance. However, during the sluggish recovery from the crisis, developed countries like Japan and important economists have raised doubts about the desirability of CBI and its effect on economic growth. This debate raises questions about the relative costs and benefits of CBI in the emerging and developing countries that have embraced central bank reform and future research needs consider the reforms in the last twenty years and re-evaluate CBI's effects on real outcomes.

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## Tables and Figures

Table 1: Determinants of central bank reform

|   | Model 1              | Model 2             | Model 3              | Model 4             | Model 5              | Model 6              |
|---|----------------------|---------------------|----------------------|---------------------|----------------------|----------------------|
| Market pressure                                 | 2.895***<br>(1.074)  |                     |                      |                     | 2.077*<br>(1.193)    |                      |
| Functional learning from political regime peers |                      | 2.244<br>(1.776)    |                      |                     | 0.761<br>(2.091)     |                      |
| Market pressure and functional learning         |                      |                     | 3.128***<br>(1.208)  |                     |                      | 2.621**<br>(1.254)   |
| Weighted global average                         |                      |                     |                      | -3.354<br>(3.861)   | -5.812<br>(3.724)    | -6.199*<br>(3.711)   |
| IGO similarity                                  |                      |                     |                      |                     | 7.850**<br>(3.365)   | 8.447***<br>(3.130)  |
| Lag FDI (% of GDP)                              | 0.079***<br>(0.023)  | 0.088***<br>(0.023) | 0.085***<br>(0.022)  | 0.098***<br>(0.023) | 0.084***<br>(0.024)  | 0.090***<br>(0.023)  |
| Lag openness                                    | 0.001<br>(0.003)     | 0.002<br>(0.003)    | 0.002<br>(0.003)     | 0.002<br>(0.003)    | 0.002<br>(0.003)     | 0.003<br>(0.003)     |
| Lagged CBI                                      | -0.731<br>(0.758)    | -1.141<br>(0.726)   | -0.851<br>(0.823)    | -0.886<br>(0.667)   | -1.238<br>(0.845)    | -1.395<br>(0.919)    |
| Polity  | 0.039<br>(0.039)     | 0.047<br>(0.032)    | -0.027<br>(0.043)    | 0.062*<br>(0.033)   | 0.035<br>(0.042)     | -0.019<br>(0.049)    |
| Lag log inflation                               | 0.320**<br>(0.140)   | 0.181<br>(0.133)    | 0.328**<br>(0.139)   | 0.134<br>(0.129)    | 0.389**<br>(0.160)   | 0.394**<br>(0.160)   |
| Lag change in US Federal Funds Rate             | -0.272<br>(0.389)    | -0.196<br>(0.366)   | -0.275<br>(0.381)    | -0.173<br>(0.386)   | -0.238<br>(0.348)    | -0.251<br>(0.335)    |
| Lag change in foreign reserves                  | -0.365<br>(0.309)    | -0.184<br>(0.219)   | -0.355<br>(0.297)    | -0.184<br>(0.220)   | -0.337<br>(0.311)    | -0.325<br>(0.300)    |
| Lagged GDP growth                               | 0.809<br>(3.722)     | -1.041<br>(3.458)   | 0.767<br>(3.915)     | -1.602<br>(3.370)   | 2.236<br>(3.705)     | 2.016<br>(3.818)     |
| Lag GDP pc                                      | -0.088<br>(0.128)    | -0.173<br>(0.127)   | -0.069<br>(0.128)    | -0.221*<br>(0.125)  | -0.235<br>(0.155)    | -0.233<br>(0.148)    |
| De jure XR                                      | -0.728*<br>(0.429)   | -0.663*<br>(0.359)  | -0.732*<br>(0.424)   | -0.782**<br>(0.371) | -0.588<br>(0.409)    | -0.596<br>(0.407)    |
| Fiscal balance                                  | -0.012<br>(0.021)    | 0.011<br>(0.026)    | -0.012<br>(0.021)    | 0.014<br>(0.026)    | -0.002<br>(0.023)    | -0.003<br>(0.023)    |
| Lag capital controls                            | -0.002<br>(0.105)    | -0.043<br>(0.110)   | 0.010<br>(0.105)     | -0.044<br>(0.107)   | -0.009<br>(0.112)    | 0.004<br>(0.113)     |
| Constant  | -5.556***<br>(1.458) | -3.599**<br>(1.555) | -5.002***<br>(1.354) | -2.110<br>(1.474)   | -5.594***<br>(1.769) | -4.975***<br>(1.539) |
| N   | 1332                 | 1580                | 1332                 | 1580                | 1280                 | 1280                 |
| Countries                                       | 79                   | 79                  | 79                   | 79                  | 79                   | 79                   |

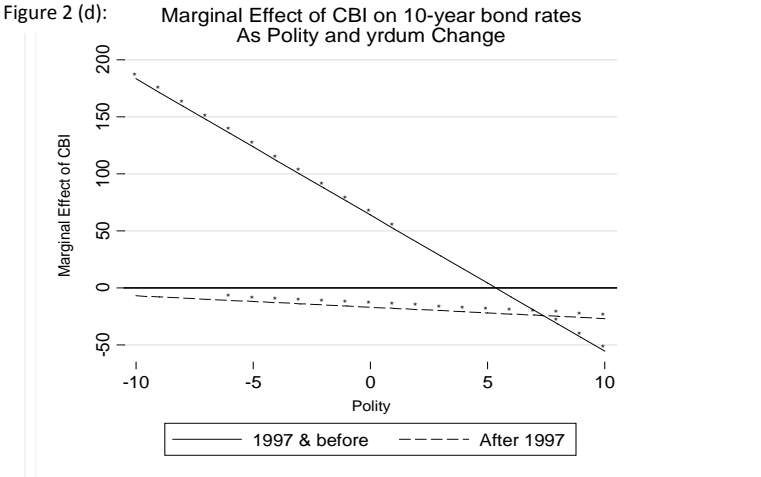
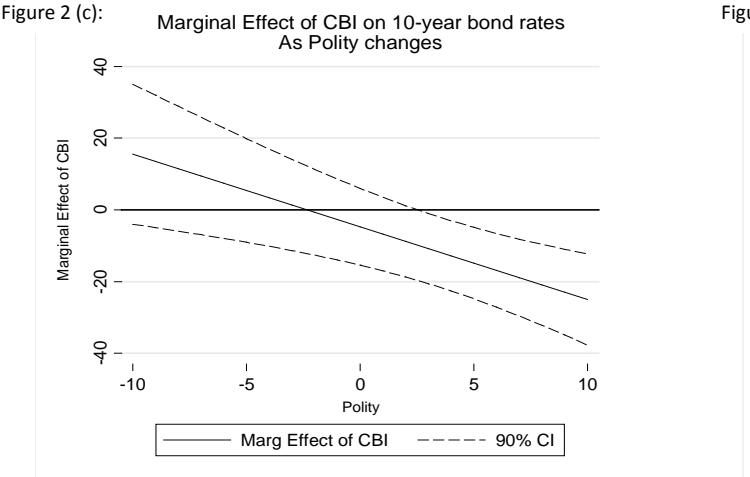
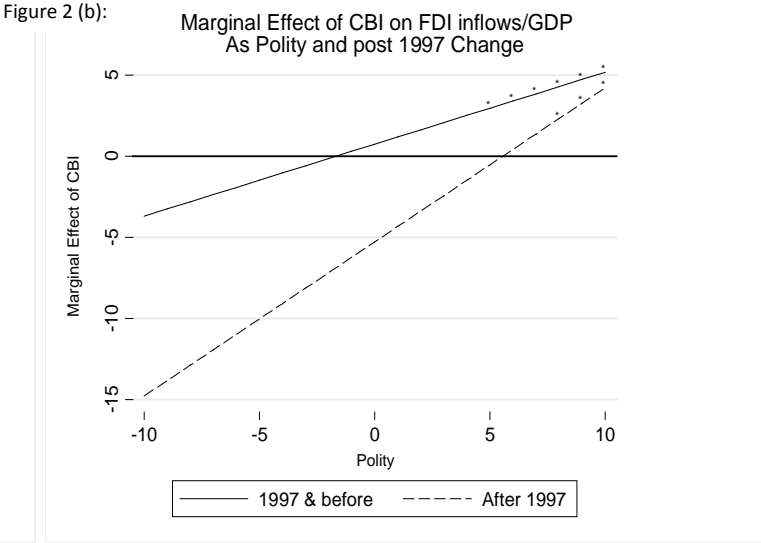
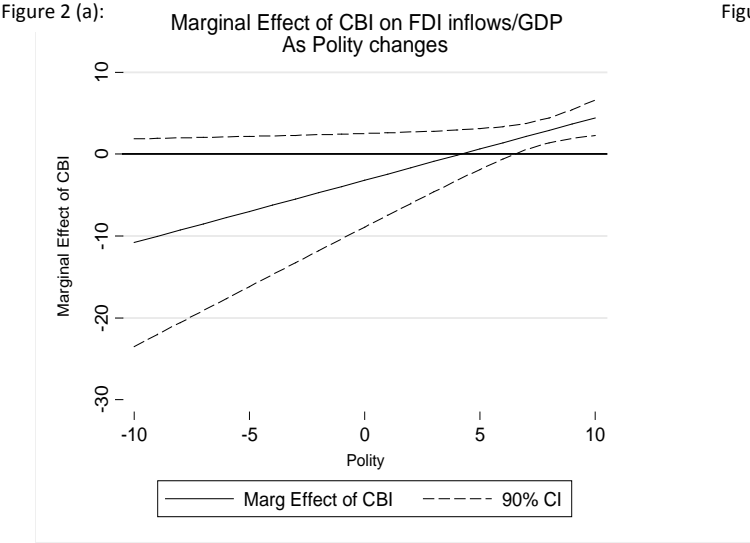
Note: \*\*\* p<0.01, \*\* p<0.05, \* p<0.1; Logit models of central bank reform. Country clustered standard errors in parenthesis; All models include the length of time to reform and cubic splines.

Table 2: Effect of central bank independence on FDI and 10-year real bond rates

|                                     | FDI                  |                        |                      |                     |                     |                     | 10-year real bond rates |                         |                      |                          |                          |                       |
|-------------------------------------|----------------------|------------------------|----------------------|---------------------|---------------------|---------------------|-------------------------|-------------------------|----------------------|--------------------------|--------------------------|-----------------------|
|                                     | All                  | Non-OECD (Models 8-12) |                      |                     |                     |                     | All                     | Non-OECD (Models 14-18) |                      |                          |                          |                       |
|                                     | Model 7              | Model 8                | Model 9              | Model 10            | Model 11            | Model 12            | Model 13                | Model 14                | Model 15             | Model 16                 | Model 17                 | Model 18              |
| Lag CBI                             | -0.065<br>(1.027)    | 1.008<br>(1.424)       | 4.268***<br>(1.348)  | 4.107***<br>(1.210) | -2.742<br>(2.412)   | 4.861***<br>(1.168) | 0.816<br>(6.664)        | -9.045<br>(6.223)       | -24.44***<br>(7.516) | -49.003***<br>(11.513)   | -5.600<br>(4.937)        | -52.43***<br>(14.636) |
| Polity                              | 0.011<br>(0.029)     | 0.004<br>(0.029)       | -0.305*<br>(0.167)   |                     |                     | -0.176<br>(0.120)   | -0.045<br>(0.284)       | 0.234<br>(0.330)        | 1.032***<br>(0.289)  | -0.182<br>(0.403)        | -0.186<br>(0.234)        | 3.322***<br>(0.879)   |
| Lag CBI * Polity                    |                      |                        | 0.766*<br>(0.436)    |                     |                     | 0.452<br>(0.302)    |                         |                         | -2.165***<br>(0.779) |                          |                          | -11.22***<br>(3.662)  |
| Year>1997                           |                      |                        |                      |                     |                     | 1.605*<br>(0.806)   |                         |                         |                      |                          |                          | -7.268***<br>(2.524)  |
| Lag CBI * Year>1997                 |                      |                        |                      |                     |                     | -0.853<br>(1.486)   |                         |                         |                      |                          |                          | 26.761***<br>(9.310)  |
| Polity * Year>1997                  |                      |                        |                      |                     |                     | -0.043<br>(0.151)   |                         |                         |                      |                          |                          | -3.982***<br>(1.307)  |
| Lag CBI *Polity*<br>Year>1997       |                      |                        |                      |                     |                     | 0.483<br>(0.384)    |                         |                         |                      |                          |                          | 10.202***<br>(3.491)  |
| Lagged BITS signed                  | 0.021<br>(0.014)     | 0.015<br>(0.017)       | 0.015<br>(0.017)     | 0.062***<br>(0.021) | 0.008<br>(0.040)    | 0.014<br>(0.015)    |                         |                         |                      |                          |                          |                       |
| De jure XR                          | -0.454<br>(0.325)    | -0.773*<br>(0.393)     | -0.860**<br>(0.397)  | -0.53***<br>(0.161) | -1.556<br>(1.193)   | -0.95***<br>(0.320) | -2.178<br>(1.707)       | 2.258**<br>(0.889)      | 2.693***<br>(0.886)  | 6.017**<br>(2.713)       | -0.240<br>(1.537)        | 2.020*<br>(1.041)     |
| Lag openness                        | 0.010<br>(0.009)     | 0.004<br>(0.008)       | 0.002<br>(0.009)     | 0.024*<br>(0.012)   | -0.013<br>(0.018)   | 0.002<br>(0.008)    | -0.055*<br>(0.031)      | -0.059**<br>(0.023)     | -0.042*<br>(0.021)   | 0.171<br>(0.111)         | 0.015<br>(0.033)         | -0.055*<br>(0.031)    |
| Lagged GDP growth                   | 1.208<br>(5.299)     | -0.379<br>(5.750)      | 0.287<br>(4.989)     | 5.393***<br>(2.077) | -5.130<br>(7.233)   | 1.429<br>(4.682)    | -1.934<br>(6.542)       | -3.497<br>(9.346)       | -3.187<br>(8.993)    | -8.776<br>(22.819)       | 2.947<br>(7.822)         | 1.058<br>(8.519)      |
| Lag GDP pc                          | -1.425<br>(1.048)    | -1.360<br>(1.120)      | -0.936<br>(0.956)    | -2.385*<br>(1.324)  | 1.588<br>(3.139)    | -0.821<br>(0.993)   | -21.73**<br>(9.780)     | -31.27***<br>(8.299)    | -31.01***<br>(7.052) | 117.915<br>(68.209)      | -26.785**<br>(11.570)    | -14.556**<br>(5.719)  |
| Fiscal balance                      | 0.028<br>(0.033)     | 0.019<br>(0.041)       | 0.012<br>(0.039)     | -0.016<br>(0.025)   | 0.078<br>(0.090)    | 0.023<br>(0.039)    | 0.017<br>(0.178)        | 0.167<br>(0.125)        | 0.137<br>(0.112)     | 0.307*<br>(0.162)        | -0.101<br>(0.172)        | 0.161<br>(0.134)      |
| Lag capital controls                | 0.210*<br>(0.111)    | 0.212*<br>(0.110)      | 0.142<br>(0.105)     | 0.037<br>(0.088)    | 0.116<br>(0.299)    | 0.144<br>(0.108)    | 1.651**<br>(0.622)      | 2.163*<br>(1.202)       | 2.440*<br>(1.266)    | 1.471*<br>(0.812)        | 1.501***<br>(0.469)      | 1.906**<br>(0.927)    |
| Lag log inflation                   | -0.223*<br>(0.120)   | -0.243*<br>(0.138)     | -0.177*<br>(0.102)   | -0.053<br>(0.106)   | -0.311<br>(0.396)   | -0.130<br>(0.101)   | -1.246*<br>(0.631)      | -0.223<br>(0.280)       | -0.242<br>(0.259)    | -2.640*<br>(1.360)       | -0.622**<br>(0.296)      | -0.176<br>(0.227)     |
| Lag change in US Fed.<br>Funds Rate | 0.582***<br>(0.153)  | 0.704***<br>(0.178)    | 0.691***<br>(0.180)  | 0.186<br>(0.302)    | 0.865***<br>(0.257) | 0.717***<br>(0.186) | -1.023*<br>(0.555)      | -0.367<br>(0.876)       | -0.437<br>(0.864)    | -2.306<br>(3.274)        | -0.347<br>(0.304)        | -0.948<br>(0.898)     |
| Lag change in foreign<br>reserves   | 0.006<br>(0.076)     | -0.006<br>(0.091)      | 0.039<br>(0.103)     | -0.016<br>(0.076)   | -0.120<br>(0.369)   | 0.027<br>(0.103)    | -0.287<br>(0.550)       | -0.305<br>(0.640)       | -0.540<br>(0.763)    | -0.566<br>(0.705)        | -0.938<br>(0.673)        | -0.327<br>(0.609)     |
| _cons                               | -97.87**<br>(39.596) | -94.088<br>(56.386)    | -87.410*<br>(52.244) | 16.118<br>(9.686)   | -4.725<br>(25.174)  | 6.665<br>(7.445)    | -105.918<br>(227.921)   | 724.256**<br>(347.819)  | 533.396<br>(319.875) | -5558.92**<br>(2442.869) | 2512.118***<br>(619.970) | -48.499<br>(97.149)   |
| N                                   | 1584                 | 1073                   | 1073                 | 561                 | 512                 | 1073                | 807                     | 317                     | 317                  | 122                      | 195                      | 317                   |
| Countries                           | 79                   | 58                     | 58                   | 50                  | 58                  | 58                  | 49                      | 28                      | 28                   | 12                       | 27                       | 28                    |
| R2                                  | 0.164                | 0.158                  | 0.190                | 0.364               | 0.073               | 0.204               | 0.262                   | 0.265                   | 0.301                | 0.348                    | 0.470                    | 0.339                 |

Note: \*\*\* p<0.01, \*\* p<0.05, \* p<0.1; All models include country fixed effects with standard errors clustered by country; Polity transformed to range from -20 to 0.

Figure 2 (a-d): Marginal effect of CBI conditional on democracy (Polity2) and time: Non-OECD countries



## Online appendix

### Appendix 1a: Central bank years covered and years of reform

|                    | CB years  | Reforms          |
|--------------------|-----------|------------------|
| Albania            | 1992-2008 | 1997             |
| Argentina          | 1972-2008 | 1975, 1992, 2002 |
| Armenia            | 1993-2008 | 1996, 2001       |
| Australia          | 1972-2008 | --               |
| Austria            | 1972-1998 | 1984             |
| Azerbaijan         | 1992-2008 | 1996, 2004       |
| Belarus            | 1992-2008 | 2001             |
| Belgium            | 1972-1998 | 1993             |
| Bolivia            | 1972-2008 | 1977, 1995       |
| Botswana           | 1975-2008 | --               |
| Brazil             | 1972-2008 | --               |
| Bulgaria           | 1991-2008 | 1997, 2005       |
| Canada             | 1972-2008 | --               |
| Chile              | 1972-2008 | 1975, 1989       |
| Colombia           | 1972-2008 | 1993             |
| Costa Rica         | 1972-2008 | 1996             |
| Croatia            | 1992-2008 | 2001, 2002, 2008 |
| Czech Republic     | 1992-2008 | 2001             |
| Denmark            | 1972-2008 | --               |
| Dominican Republic | 1990-2008 | 2002             |
| El Salvador        | 1994-2008 | --               |
| Estonia            | 1993-2008 | 2006             |
| European Union     | 1999-2008 |                  |
| Finland            | 1972-1998 | 1998             |
| France             | 1972-1998 | 1972, 1993       |
| Georgia            | 1995-2008 |                  |
| Germany            | 1972-1998 | --               |
| Greece             | 1972-2000 | 1995             |
| Guatemala          | 1990-2008 | 2002             |
| Guyana             | 1990-2008 | 1998             |
| Honduras           | 1972-2008 | 1997             |
| Hungary            | 1991-2008 | 2001             |
| Iceland            | 1972-1998 | --               |
| India              | 1972-2008 | --               |
| Indonesia          | 1972-2008 | 1998             |
| Ireland            | 1972-1998 | --               |
| Israel             | 1972-2008 | --               |
| Italy              | 1972-1998 | 1994             |
| Jamaica            | 1993-2008 | --               |

|                     |           |                              |
|---------------------|-----------|------------------------------|
| Japan               | 1972-2008 | 1998                         |
| Kazakhstan          | 1993-2008 | 1995, 1997, 2003, 2006       |
| Kenya               | 1972-2008 | 1985, 1996                   |
| Korea, Rep.         | 1972-2008 | 1998                         |
| Kyrgyz Republic     | 1992-2008 | 1997                         |
| Latvia              | 1992-2008 | 1998, 2001, 2002             |
| Lithuania           | 1991-2008 | 1996                         |
| Macedonia, FYR      | 1995-2008 | 2002                         |
| Malaysia            | 1972-2008 | --                           |
| Mexico              | 1972-2008 | 1985, 1994                   |
| Moldova             | 1991-2008 | 1995, 2006                   |
| Mongolia            | 1991-2008 | 1996                         |
| Netherlands         | 1972-1998 | --                           |
| New Zealand         | 1972-2008 | 1990                         |
| Nicaragua           | 1972-2008 | 1992, 1999                   |
| Norway              | 1972-2008 | 1972, 2003                   |
| Paraguay            | 1990-2008 | 1995, 2003                   |
| Peru                | 1972-2008 | 1993                         |
| Philippines         | 1972-2008 | 1993                         |
| Poland              | 1991-2008 | 1997                         |
| Portugal            | 1972-1998 | 1975, 1980, 1990, 1995, 1998 |
| Romania             | 1991-2008 | 1998, 2004                   |
| Russian Federation  | 1993-2008 | 1995, 2002                   |
| Singapore           | 1972-2008 | --                           |
| Slovak Republic     | 1992-2008 | 1999, 2002                   |
| Slovenia            | 1991-2007 | 2002, 2007                   |
| South Africa        | 1972-2008 | 1989, 1996                   |
| Spain               | 1972-1998 | 1980, 1994                   |
| Sweden              | 1972-2008 | 1998                         |
| Switzerland         | 1972-2008 | 1979, 2003                   |
| Tajikistan          | 1993-2008 | 1996                         |
| Thailand            | 1972-2008 | 2008                         |
| Trinidad and Tobago | 1990-2008 | --                           |
| Turkey              | 1972-2008 | 1990, 2001                   |
| Turkmenistan        | 1992-2008 | 1994                         |
| Ukraine             | 1991-2008 | 1999                         |
| United Kingdom      | 1972-2008 | 1997                         |
| United States       | 1972-2008 | --                           |
| Uruguay             | 1972-2008 | 1995, 1997, 2008             |
| Uzbekistan          | 1992-2008 | 1995                         |
| Venezuela, RB       | 1972-2008 | 1975, 1987, 1993, 2001       |
| Zimbabwe            | 1972-2008 | 1984, 1999                   |

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## **Appendix 1b: Creation of the CBI index**

For each of the indicators, possible scores run in intervals from 0 to 1 with the intervals depending on the number of categories. For example, there are five categories in the central bank governor's term of office indicator: 0=under four years or at the discretion of the appointer; .25=4 year appointment; 0.50=5 years; 0.75=6 to 8 years; 1=more than 8 years. Scores from the individual indicators are then aggregated into their broader categories as such: the four indicators in the CEO category are averaged; policy formation is a weighted average of the 3 components with who formulates monetary policy and role in government's budgetary process worth a quarter and resolution of conflict worth one half; objectives and the first four indicators in limitations on lending were each treated separately; finally the last four indicators in limitations on lending were averaged. These aggregate scores were then summed to get an unweighted average independence score.<sup>37</sup> To get the weighted average used in most studies, including this one, the weights listed in the Appendix were applied to each of the aggregate scores and then the totals were summed. The aggregate CWN scores range from a possible 0 to a possible 1, with 1 representing the most independent possible central bank.

### **Components of the Cukierman, Webb, and Neyapti index**

#### **Chief Executive Officer** (weight = .20)

- (a) Term of office (6 categories)
- (b) Who appoints CEO? (6 categories)
- (c) Dismissal (7 categories)
- (d) May CEO hold other offices in government (3 categories)

#### **Policy Formation** (weight = .15)

- (a) Who formulates monetary policy? (4 categories)
- (b) Resolution of conflict (6 categories)
- (c) Role in government's budgetary process (2 categories)

#### **Objectives** (weight = .15; 6 categories)

### ***Limitations on lending to the government***

#### *Part 1* (weight = .40)

- (a) Advances (weight = .15; 4 categories)

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<sup>37</sup> If the legislation does not cover one of the indicators, it is not coded as 0. Instead, "the weights of the missing variables are allocated proportionally to the remaining variables within the subgroup" (Cukierman, Webb, and Neyapti 1992, p. 12).

(b) Securitized lending (weight = .10; 4 categories)

(c) Terms of lending (weight = .10; 4 categories)

(d) Potential borrowers from bank (weight = .05; 4 categories)

*Part 2* (weight = .10)

(e) Limits on central bank lending determined by? (weight = .025; 4 categories)

(f) Maturity of loans (weight = .025; 4 categories)

(g) Interest rates on loans must be? (weight = .025; 5 categories)

(h) Is central bank prohibited from buying or selling government securities in primary market?  
(weight = .025; 2 categories)



## Appendix 2: Summary statistics

|                                  | N    | Mean   | Std.<br>Dev | Min     | Max     |
|----------------------------------|------|--------|-------------|---------|---------|
| FDI inflows/GDP                  | 1584 | 2.386  | 3.021       | -14.369 | 28.133  |
| Real 10 year bond rate           | 807  | 1.610  | 7.635       | -47.475 | 38.318  |
| CBI                              | 1595 | 0.487  | 0.206       | 0.091   | 0.960   |
| Polity                           | 1595 | 6.385  | 5.289       | -9      | 10      |
| Lag change in US Fed. Funds Rate | 1595 | 0.043  | 0.384       | -0.570  | 1.385   |
| Lag change in foreign reserves   | 1595 | 0.195  | 0.521       | -0.965  | 6.657   |
| Lag openness                     | 1595 | 68.702 | 38.504      | 9.102   | 413.455 |
| Lagged GDP growth                | 1595 | 0.038  | 0.041       | -0.265  | 0.345   |
| Lag logged GDP pc                | 1595 | 8.291  | 1.332       | 4.845   | 10.627  |
| Lag Fiscal balance               | 1595 | -2.159 | 4.742       | -36.655 | 26.132  |
| Lag capital controls             | 1595 | 0.430  | 1.516       | -1.831  | 2.500   |
| Lag log inflation                | 1595 | 2.149  | 1.404       | -4.074  | 9.372   |
| Lagged BITS signed               | 1595 | 18.754 | 21.919      | 0       | 121     |
| Lag log GDP                      | 1595 | 24.826 | 1.929       | 20.250  | 30.069  |
| Average world inflation          | 1595 | 6.844  | 2.804       | 3.401   | 16.668  |
| De jure XR                       | 1595 | 0.268  | 0.443       | 0       | 1       |

### Appendix 3: Determinants of CB reform – measures of spatial lags

Here we provide a more in-depth discussion of how the market and political pressure spatial lags were created in the section on the determinants of CBI reform. We use the method in Elkins, Guzman, and Simmons (2006) to construct our measures of market and political pressure by identifying the countries that are most similar to the reference country. The idea behind the measures is that reference countries will respond to partners that are more similar to themselves along varied dimensions.

The first step is to calculate correlations between each country in the sample on a set of variables in each year. For market pressure, we chose four variables: Standard & Poor rating, Moody's rating, the real 3 month bond rate, and FDI inflows as a percentage of GDP.<sup>38</sup> For the political pressure measure, we chose the 6 components of the Polity measure<sup>39</sup> as well as Henisz's political constraints measure (Henisz 2002). We calculate the correlation across all variables for each pair of countries. A higher correlation indicates a higher degree of similarity. We use these correlations in the second step to identify the group of most similar countries for each country and year. We chose countries in the top 25<sup>th</sup> percentile of the reference country in each year. Since we have 78 countries in the sample, this is about 20 countries. Once those countries have been identified, we multiply their CBI level by the similarity to the reference country, so countries that are more similar have a greater weight. The weighted values are averaged by reference country and year to derive our market pressure measures.

The combination of the political and market pressure is treated a little differently. We identify similar countries based on the market pressure variables described above. We also create a rough political similarity weight by dividing countries into 1 of 4 groups based on their Polity score. Country pairs in the same group receive a score of 1; pairs in contiguous categories (category 3 and category 4, for example) receive a score of .5 and those in non-adjacent categories receive a score of .25. The partners' average CBI is then weighted by both the market similarity and the political weighting and then averaged as before by reference country and year.

The regional and global averages are constructed differently as correlations cannot be run on region or globally. Instead, we weight a partner's CBI level<sup>40</sup> by its geographical distance from the reference country. Specifically, we weight by the ratio of the minimum distance between the reference country and a partner country (closest capital to the reference country) and the distance between the reference country and each partner:  $\exp(\ln(\text{DIST}_{\min}) - \ln(\text{DIST}_{\text{dyad}}))$ . For the closest neighbor to the reference country, the value inside the parentheses will equal 0 and after exponentiating, we get a value of 1 for its weight. The farther away from the reference country, the more negative the value inside the parentheses and the closer to 0 after exponentiation. This measure is different than a simple average because it gives significant more importance to countries that are geographically close versus countries that are distant.

A simpler measure of capital market pressure is based only on Standard and Poor country risk ratings. To compute this spatial lag we split the S&P ratings into four categories and then calculate the average CBI level in each category for each year, excluding the reference country. The categories are: Ratings

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<sup>38</sup> There is too much missing data for us to include the real 10-year bond rate as well.

<sup>39</sup> These are: Regulation of Chief Executive Recruitment; Competitiveness of Executive Recruitment; Openness of Executive Recruitment; Executive Constraints; Regulation of Participation; The Competitiveness of Participation

<sup>40</sup> Partners are all countries for the global norm spatial lag and countries in the region for the regional norm.

BB+ and lower; ratings between BBB- and AA; ratings AA+ and AAA; and Non-rated countries share a distinct category.

The table of correlations is below:

Table 3.1: Correlation of spatial weight measures

|   | Market pressure | Political regime peers | Weighted global average | Weighted regional average | IGO similarity | Genetic similarity | Market pressure and functional learning | S&P category similarity | Weighted OECD average |
|---|-----------------|------------------------|-------------------------|---------------------------|----------------|--------------------|---|-------------------------|-----------------------|
| Market pressure                         | 1               |                        |                         |                           |                |                    |   |                         |                       |
| Political regime peers                  | 0.559           | 1                      |                         |                           |                |                    |   |                         |                       |
| Weighted global average                 | 0.201           | 0.311                  | 1                       |                           |                |                    |   |                         |                       |
| Weighted regional average               | 0.183           | 0.244                  | 0.605                   | 1                         |                |                    |   |                         |                       |
| IGO similarity                          | 0.607           | 0.646                  | 0.426                   | 0.277                     | 1              |                    |   |                         |                       |
| Genetic similarity                      | 0.029           | -0.025                 | 0.077                   | 0.074                     | -0.111         | 1                  |   |                         |                       |
| Market pressure and functional learning | 0.730           | 0.530                  | 0.266                   | 0.250                     | 0.645          | -0.135             | 1                                       |                         |                       |
| S&P category similarity                 | 0.764           | 0.707                  | 0.354                   | 0.263                     | 0.818          | -0.009             | 0.672                                   | 1                       |                       |
| Weighted OECD average                   | 0.210           | 0.175                  | 0.076                   | 0.243                     | 0.229          | 0.259              | 0.028                                   | 0.271                   | 1                     |

Table 3.2: Determinants of CB Reform: Robustness

|                                     | All      |          |          | Non-OECD |          |          |                  |
|-------------------------------------|----------|----------|----------|----------|----------|----------|------------------|
|                                     | Naive    | Dem      | Reg      | OECD wt  | Naive    | Indep    | CBI cutoff -0.65 |
|                                     | b/se     | b/se     | b/se     | b/se     | b/se     | b/se     | b/se             |
| Polity                              | 0.058*   | -0.033   | 0.029    | 0.017    | 0.059*   | 0.028    | 0.032            |
|                                     | (0.035)  | (0.078)  | (0.042)  | (0.042)  | (0.035)  | (0.043)  | (0.039)          |
| S&P category similarity             | 7.621*** |          |          |          | 7.266*** |          |                  |
|                                     | (1.995)  |          |          |          | (2.224)  |          |                  |
| Market pressure (25%)               |          |          | 2.263*   | 2.064    |          |          | 3.690**          |
|                                     |          |          | (1.176)  | (1.489)  |          |          | (1.787)          |
| Market pressure-non-dem (25%)       |          | 0.566    |          |          |          |          |                  |
|                                     |          | (1.957)  |          |          |          |          |                  |
| Market pressure-dem (25%)           |          | 2.212*   |          |          |          |          |                  |
|                                     |          | (1.184)  |          |          |          |          |                  |
| Market pressure-non-indep CB (25%)  |          |          |          |          |          | 2.790*   |                  |
|                                     |          |          |          |          |          | (1.609)  |                  |
| Market pressure-indep CB (25%)      |          |          |          |          |          | 1.414    |                  |
|                                     |          |          |          |          |          | (1.474)  |                  |
| Political pressure (25%)            | -1.243   | 0.659    | 0.655    | -0.226   | -1.895   | -0.249   | -4.363*          |
|                                     | (1.842)  | (2.084)  | (2.146)  | (2.500)  | (2.146)  | (2.487)  | (2.586)          |
| Weighted global average             | -6.470*  | -6.524*  |          |          | -5.691   |          |                  |
|                                     | (3.346)  | (3.657)  |          |          | (3.793)  |          |                  |
| Weighted regional average           |          |          | -1.418   |          |          |          |                  |
|                                     |          |          | (1.802)  |          |          |          |                  |
| Weighted OECD average               |          |          |          | -4.600** |          | -4.568** | -2.726           |
|                                     |          |          |          | (2.266)  |          | (2.199)  | (2.318)          |
| IGO similarity (25%)                | 1.941    | 7.918**  | 6.866**  | 6.637**  | 1.251    | 7.094**  | 11.178***        |
|                                     | (3.808)  | (3.358)  | (3.300)  | (3.307)  | (4.279)  | (3.219)  | (3.604)          |
| Lagged CBI                          | -2.33*** | -1.350   | -1.083   | -0.790   | -2.068*  |          | 1.734            |
|                                     | (0.848)  | (0.921)  | (0.852)  | (1.208)  | (1.081)  |          | (1.782)          |
| Lag log inflation                   | 0.200    | 0.373**  | 0.411*** | 0.496*** | 0.216    | 0.496*** | 0.374*           |
|                                     | (0.142)  | (0.156)  | (0.154)  | (0.181)  | (0.159)  | (0.181)  | (0.208)          |
| Lag change in US Federal Funds Rate | -0.150   | -0.226   | -0.243   | -0.273   | -0.202   | -0.270   | -1.222**         |
|                                     | (0.316)  | (0.346)  | (0.348)  | (0.389)  | (0.345)  | (0.394)  | (0.565)          |
| Lag change in foreign reserves      | -0.134   | -0.326   | -0.339   | -0.442   | -0.152   | -0.425   | -0.251           |
|                                     | (0.242)  | (0.299)  | (0.311)  | (0.374)  | (0.277)  | (0.378)  | (0.291)          |
| Lag FDI (% of GDP)                  | 0.079*** | 0.087*** | 0.084*** | 0.089*** | 0.080*** | 0.090*** | 0.078***         |
|                                     | (0.025)  | (0.023)  | (0.024)  | (0.024)  | (0.026)  | (0.026)  | (0.027)          |
| Lag openness                        | 0.000    | 0.003    | 0.003    | 0.001    | 0.001    | 0.001    | 0.001            |
|                                     | (0.003)  | (0.004)  | (0.003)  | (0.004)  | (0.003)  | (0.004)  | (0.004)          |
| Lagged GDP growth                   | -1.067   | 2.227    | 1.802    | 1.746    | -0.980   | 1.886    | -0.199           |
|                                     | (3.321)  | (3.623)  | (3.607)  | (3.811)  | (3.326)  | (3.701)  | (4.297)          |
| Lag GDP pc                          | -0.034   | -0.223   | -0.191   | -0.213   | -0.012   | -0.264   | -0.170           |
|                                     | (0.177)  | (0.150)  | (0.159)  | (0.197)  | (0.202)  | (0.210)  | (0.228)          |
| De jure XR                          | -0.686*  | -0.599   | -0.580   | -0.361   | -0.538   | -0.328   | -0.426           |
|                                     | (0.364)  | (0.406)  | (0.406)  | (0.402)  | (0.389)  | (0.439)  | (0.564)          |
| Fiscal balance                      | 0.012    | -0.006   | -0.002   | 0.025    | 0.034    | 0.022    | -0.008           |
|                                     | (0.030)  | (0.022)  | (0.022)  | (0.028)  | (0.036)  | (0.028)  | (0.029)          |
| Lag capital controls                | -0.043   | -0.003   | 0.020    | 0.025    | -0.075   | 0.071    | -0.134           |
|                                     | (0.110)  | (0.112)  | (0.112)  | (0.129)  | (0.132)  | (0.141)  | (0.179)          |
| _cons                               | -6.53*** | -5.07*** | -6.09*** | -4.80*** | -6.37*** | -5.05*** | -6.151***        |
|                                     | (1.928)  | (1.760)  | (1.839)  | (1.785)  | (1.972)  | (1.693)  | (2.113)          |
| N                                   | 1514     | 1280     | 1280     | 804      | 1021     | 839      | 547              |

#### Appendix 4: Correlation of investor decision variables

|                           | FDI inflows | 10 year bond | CBI    | CBI dif. w/ glob | Polity | Δ US Fed Funds | Δ For. reserves | Openness | GDP growth | GDP pc | Fiscal balance | Wd. inflation | Capital controls | Log inflation | De jure XR |
|---------------------------|-------------|--------------|--------|------------------|--------|----------------|-----------------|----------|------------|--------|----------------|---------------|------------------|---------------|------------|
| FDI inflows               | 1           |              |        |                  |        |                |                 |          |            |        |                |               |                  |               |            |
| 10 year bond              | -0.045      | 1            |        |                  |        |                |                 |          |            |        |                |               |                  |               |            |
| CBI                       | 0.421       | 0.007        | 1      |                  |        |                |                 |          |            |        |                |               |                  |               |            |
| CBI dif. w/ glob. average | 0.311       | 0.012        | 0.922  | 1                |        |                |                 |          |            |        |                |               |                  |               |            |
| Polity                    | -0.008      | -0.001       | 0.314  | 0.225            | 1      |                |                 |          |            |        |                |               |                  |               |            |
| Δ US Fed Funds            | 0.146       | 0.011        | 0.088  | 0.040            | 0.040  | 1              |                 |          |            |        |                |               |                  |               |            |
| Δ For. reserves           | 0.008       | 0.086        | 0.031  | 0.002            | -0.042 | -0.029         | 1               |          |            |        |                |               |                  |               |            |
| Openness                  | 0.478       | -0.025       | 0.131  | 0.025            | -0.134 | 0.046          | -0.012          | 1        |            |        |                |               |                  |               |            |
| GDP growth                | 0.152       | 0.165        | 0.079  | 0.101            | -0.100 | 0.226          | 0.099           | 0.116    | 1          |        |                |               |                  |               |            |
| GDP pc                    | 0.248       | 0.017        | 0.344  | 0.221            | 0.283  | 0.071          | -0.057          | 0.420    | -0.096     | 1      |                |               |                  |               |            |
| Fiscal balance            | 0.207       | 0.216        | 0.240  | 0.181            | 0.030  | 0.171          | 0.180           | 0.004    | 0.315      | 0.145  | 1              |               |                  |               |            |
| Wd. inflation             | -0.260      | -0.014       | -0.409 | -0.178           | -0.190 | 0.204          | -0.041          | -0.190   | 0.112      | 0.297  | -0.136         | 1             |                  |               |            |
| Capital controls          | 0.340       | 0.048        | 0.415  | 0.364            | 0.174  | 0.101          | -0.092          | 0.374    | 0.166      | 0.335  | -0.010         | -0.197        | 1                |               |            |
| Log inflation             | -0.174      | -0.146       | -0.087 | -0.029           | -0.108 | -0.008         | 0.153           | -0.324   | -0.242     | 0.175  | -0.021         | 0.302         | -0.460           | 1             |            |
| De jure XR                | 0.011       | -0.095       | -0.036 | 0.098            | -0.168 | 0.010          | -0.016          | 0.144    | 0.097      | 0.103  | -0.043         | 0.245         | 0.115            | -0.010        | 1          |

## Appendix 5: Further results

**Table 5.1: Log of FDI inflows/GDP**

|                            | Model 7                | Model 8                | Model 9                | Model 10            | Model 11          | Model 12            |
|----------------------------|------------------------|------------------------|------------------------|---------------------|-------------------|---------------------|
|                            | b/se                   | b/se                   | b/se                   | b/se                | b/se              | b/se                |
| Lag CBI                    | -0.073<br>(0.228)      | 0.153<br>(0.319)       | 0.748**<br>(0.295)     | 1.285***<br>(0.357) | -0.324<br>(0.460) | 4.861***<br>(1.168) |
| Polity                     | 0.001<br>(0.009)       | -0.002<br>(0.009)      | -0.059*<br>(0.035)     |                     |                   | -0.176<br>(0.120)   |
| Lag CBI * Polity           |                        |                        | 0.140<br>(0.086)       |                     |                   | 0.452<br>(0.302)    |
| Year>1997                  |                        |                        |                        |                     |                   | 1.605*<br>(0.806)   |
| Lag CBI * Year>1997        |                        |                        |                        |                     |                   | -0.853<br>(1.486)   |
| Polity * Year>1997         |                        |                        |                        |                     |                   | -0.043<br>(0.151)   |
| Lag CBI *Polity* Year>1997 |                        |                        |                        |                     |                   | 0.483<br>(0.384)    |
| _cons                      | -38.477***<br>(10.884) | -45.387***<br>(15.572) | -44.168***<br>(14.775) | 4.227*<br>(2.363)   | 0.671<br>(4.466)  | 6.665<br>(7.445)    |
| N                          | 1584                   | 1073                   | 1073                   | 561                 | 512               | 1073                |
| Countries                  | 79                     | 58                     | 58                     | 50                  | 58                | 58                  |
| R2                         | 0.289                  | 0.280                  | 0.301                  | 0.377               | 0.075             | 0.204               |

Note: \*\*\* p<0.01, \*\* p<0.05, \* p<0.1; All models include country fixed effects with standard errors clustered by country; Polity transformed to range from -20 to 0. Other control variables from 2 included but not shown

Table 5.2. Effect of central bank independence on FDI: Robustness

|                                  | 5-year CBI          | GMM                  | Driscoll-<br>Kraay SE | PCSE                    | 5-year CBI<br>interaction | Dif. from<br>global CBI |
|----------------------------------|---------------------|----------------------|-----------------------|-------------------------|---------------------------|-------------------------|
|                                  | b/se                | b/se                 | b/se                  | b/se                    | b/se                      | b/se                    |
| Lag CBI                          |                     | 1.671<br>(2.196)     | 4.268***<br>(1.140)   | 3.216***<br>(1.068)     |                           |                         |
| 5 year CBI                       | 2.004*<br>(1.117)   |                      |                       |                         | 4.564***<br>(1.440)       |                         |
| CBI dif. w/ glob. average        |                     |                      |                       |                         |                           | 3.085**<br>(1.281)      |
| Polity                           | 0.002<br>(0.028)    | -0.004<br>(0.032)    | -0.305***<br>(0.106)  | -0.282***<br>(0.102)    | -0.282*<br>(0.159)        | -0.035<br>(0.032)       |
| Lag CBI * Polity                 |                     |                      | 0.766***<br>(0.242)   | 0.704***<br>(0.255)     |                           |                         |
| 5 year CBI * Polity              |                     |                      |                       |                         | 0.728*<br>(0.416)         |                         |
| CBI dif * Polity                 |                     |                      |                       |                         |                           | 0.614<br>(0.392)        |
| Lagged BITS signed               | 0.014<br>(0.016)    | -0.002<br>(0.009)    | 0.015<br>(0.011)      | 0.018*<br>(0.011)       | 0.015<br>(0.017)          | 0.018<br>(0.017)        |
| De jure XR                       | -0.801**<br>(0.397) | -0.425<br>(0.346)    | -0.860***<br>(0.259)  | -0.624**<br>(0.287)     | -0.879**<br>(0.410)       | -0.840**<br>(0.401)     |
| Lag openness                     | 0.004<br>(0.008)    | 0.003<br>(0.005)     | 0.002<br>(0.006)      | 0.001<br>(0.008)        | 0.003<br>(0.009)          | 0.001<br>(0.009)        |
| Lagged GDP growth                | -0.488<br>(5.856)   | -3.452<br>(3.835)    | 0.287<br>(2.864)      | -0.528<br>(1.846)       | 0.045<br>(5.379)          | 0.288<br>(5.046)        |
| Lag GDP pc                       | -1.321<br>(1.063)   | -0.210<br>(0.134)    | -0.936<br>(0.805)     | -1.057*<br>(0.643)      | -0.962<br>(0.953)         | -0.986<br>(0.915)       |
| Fiscal balance                   | 0.019<br>(0.041)    | 0.121**<br>(0.049)   | 0.012<br>(0.028)      | 0.020<br>(0.022)        | 0.014<br>(0.039)          | 0.010<br>(0.039)        |
| Lag capital controls             | 0.201*<br>(0.110)   | -0.065<br>(0.095)    | 0.142*<br>(0.082)     | 0.188**<br>(0.079)      | 0.143<br>(0.106)          | 0.185*<br>(0.107)       |
| Lag log inflation                | -0.225<br>(0.135)   | 0.412**<br>(0.186)   | -0.177**<br>(0.067)   | -0.102<br>(0.085)       | -0.182<br>(0.113)         | -0.219*<br>(0.115)      |
| Lag change in US Fed. Funds Rate | 0.687***<br>(0.179) | 2.424**<br>(1.156)   | 0.691***<br>(0.142)   | 0.500**<br>(0.227)      | 0.645***<br>(0.184)       | 0.710***<br>(0.176)     |
| Lag change in foreign reserves   | 0.000<br>(0.089)    | -6.675***<br>(1.886) | 0.039<br>(0.044)      | -0.074<br>(0.073)       | 0.027<br>(0.097)          | 0.030<br>(0.102)        |
| Lag FDI inflows/GDP              |                     | 0.835***<br>(0.173)  |                       |                         |                           |                         |
| _cons                            | -82.331<br>(55.943) | 33.540<br>(47.443)   | -87.410**<br>(33.301) | -115.128***<br>(37.373) | -76.380<br>(53.229)       | -101.875*<br>(56.693)   |
| Hansen                           |                     | 5.73<br>Pr=0.57      |                       |                         |                           |                         |
| AR(2)                            |                     | -0.12<br>Pr=0.90     |                       |                         |                           |                         |
| N                                | 1073                | 1073                 | 1073                  | 1073                    | 1073                      | 1073                    |
| Countries                        | 58                  | 58                   | 58                    | 58                      | 58                        | 58                      |
| R2                               | 0.161               |                      |                       | 0.379                   | 0.180                     | 0.177                   |

Note: \*\*\* p<0.01, \*\* p<0.05, \* p<0.1; All models except GMM include country fixed effects with standard errors clustered by country; Polity transformed to range from -20 to 0.

The Hansen test of over-identifying restrictions tests the validity of the instruments. The Arellano–Bond test for AR(2) in first differences tests whether the residuals from the regression in differences is second order serially correlated. For both, failure to reject the null hypothesis supports the model specification, including the choice of endogenous variables.



Table 5.3: Effect of central bank independence on 10-year bonds: Robustness

|                                     | 5-year CBI            | GMM                    | Driscoll-Kraay<br>SE  | PCSE                  | 5-year CBI<br>interaction | Dif. from global<br>CBI |
|-------------------------------------|-----------------------|------------------------|-----------------------|-----------------------|---------------------------|-------------------------|
|                                     | b/se                  | b/se                   | b/se                  | b/se                  | b/se                      | b/se                    |
| Lag CBI                             |                       | -15.721<br>(16.597)    | -24.437**<br>(11.893) | -24.227**<br>(10.977) |                           |                         |
| 5 year CBI                          | -4.807<br>(6.855)     |                        |                       |                       | -16.228**<br>(6.815)      |                         |
| CBI dif. w/ glob. average           |                       |                        |                       |                       |                           | -32.448***<br>(6.445)   |
| Polity                              | 0.261<br>(0.304)      | 0.106<br>(0.206)       | 1.032**<br>(0.389)    | 0.905**<br>(0.363)    | 1.093***<br>(0.366)       | -0.044<br>(0.274)       |
| Lag CBI * Polity                    |                       |                        | -2.165**<br>(0.822)   | -1.831***<br>(0.646)  |                           |                         |
| 5 year CBI * Polity                 |                       |                        |                       |                       | -2.378**<br>(1.017)       |                         |
| CBI dif * Polity                    |                       |                        |                       |                       |                           | -2.633***<br>(0.771)    |
| De jure XR                          | 2.129**<br>(0.887)    | -0.358<br>(1.581)      | 2.693*<br>(1.430)     | 2.882**<br>(1.347)    | 2.390**<br>(0.870)        | 2.737***<br>(0.836)     |
| Lag openness                        | -0.057**<br>(0.024)   | -0.033<br>(0.026)      | -0.042***<br>(0.015)  | -0.038<br>(0.025)     | -0.044*<br>(0.024)        | -0.031<br>(0.023)       |
| Lagged GDP growth                   | -2.607<br>(9.616)     | 9.066<br>(15.685)      | -3.187<br>(8.210)     | -2.341<br>(12.259)    | -1.747<br>(9.405)         | -0.518<br>(7.723)       |
| Lag GDP pc                          | -31.688***<br>(8.944) | 0.762<br>(1.108)       | -31.011***<br>(6.918) | -30.854***<br>(8.247) | -29.392***<br>(7.528)     | -28.500***<br>(6.132)   |
| Fiscal balance                      | 0.154<br>(0.127)      | 0.029<br>(0.291)       | 0.137<br>(0.152)      | 0.208<br>(0.166)      | 0.126<br>(0.119)          | 0.185<br>(0.114)        |
| Lag capital controls                | 2.115*<br>(1.164)     | 1.715<br>(1.148)       | 2.440***<br>(0.631)   | 2.570***<br>(0.537)   | 2.303*<br>(1.210)         | 2.477**<br>(1.157)      |
| Lag log inflation                   | -0.281<br>(0.321)     | -0.452<br>(0.874)      | -0.242<br>(0.322)     | 0.059<br>(0.383)      | -0.448<br>(0.330)         | -0.469**<br>(0.223)     |
| Lag change in US Fed.<br>Funds Rate | -0.354<br>(0.869)     | -11.628<br>(12.570)    | -0.437<br>(0.591)     | -0.231<br>(0.702)     | -0.505<br>(0.855)         | -0.502<br>(0.825)       |
| Lag change in foreign<br>reserves   | -0.395<br>(0.688)     | 1.235<br>(2.756)       | -0.540<br>(0.414)     | -0.380<br>(0.564)     | -0.578<br>(0.773)         | -0.538<br>(0.639)       |
| Lag world inflation                 | -0.922**<br>(0.353)   | 1.059<br>(1.717)       | -0.892***<br>(0.295)  | -0.872***<br>(0.226)  | -0.886***<br>(0.320)      | -0.907***<br>(0.281)    |
| Lag log GDP                         | 31.573***<br>(10.302) | -0.705<br>(0.865)      |                       | 26.378**<br>(10.740)  | 27.149***<br>(9.143)      | 22.668***<br>(7.013)    |
| Lag 10-year rate                    |                       | 0.233<br>(0.188)       |                       |                       |                           |                         |
| _cons                               | 824.278*<br>(424.045) | -846.528<br>(1183.368) | 533.396<br>(363.323)  | 508.603<br>(440.711)  | 672.644<br>(396.198)      | 795.409***<br>(230.918) |
| Hansen                              |                       | 5.97<br>Pr=0.54        |                       |                       |                           |                         |
| AR(2)                               |                       | 1.64<br>Pr=0.10        |                       |                       |                           |                         |
| N                                   | 317                   | 317                    | 317                   | 317                   | 317                       | 317                     |
| Countries                           | 28                    | 28                     | 28                    | 28                    | 28                        | 28                      |
| R2                                  | 0.259                 |                        |                       | 0.489                 | 0.288                     | 0.344                   |

Note: \*\*\* p<0.01, \*\* p<0.05, \* p<0.1; All models except GMM include country fixed effects with standard errors clustered by country; Polity transformed to range from -20 to 0.

The Hansen test of over-identifying restrictions tests the validity of the instruments. The Arellano–Bond test for AR(2) in first differences tests whether the residuals from the regression in differences is second order serially correlated. For both, failure to reject the null hypothesis supports the model specification, including the choice of endogenous variables.

Figure 2e:

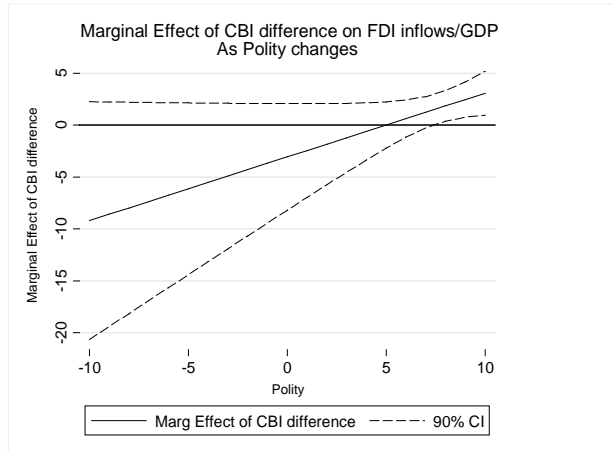
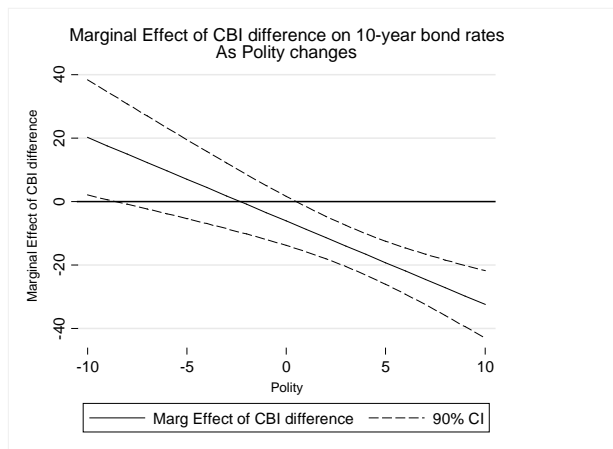


Figure 2f:



Graphs are based on the models in the last columns in Tables 5.2, and, respectively 5.3. Graphs show the marginal effect of (CBI – Global average CBI) when varying the Polity 2 level.

Figure 2g

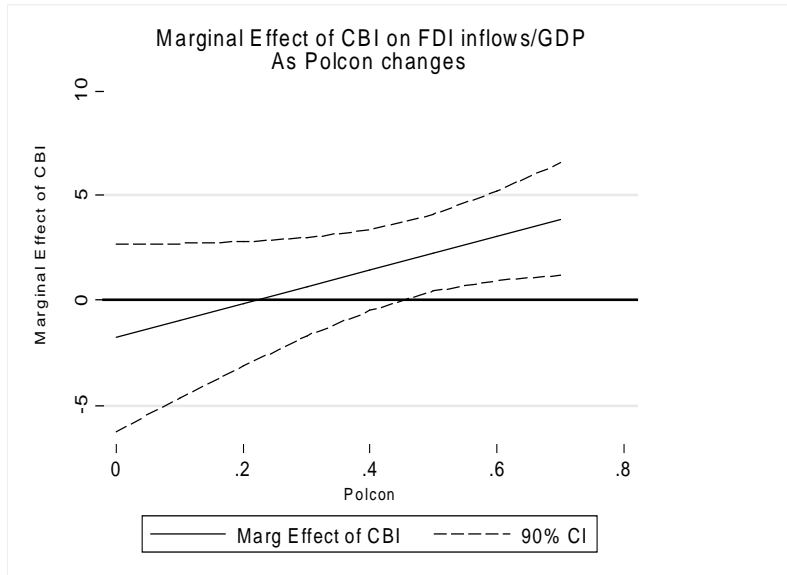
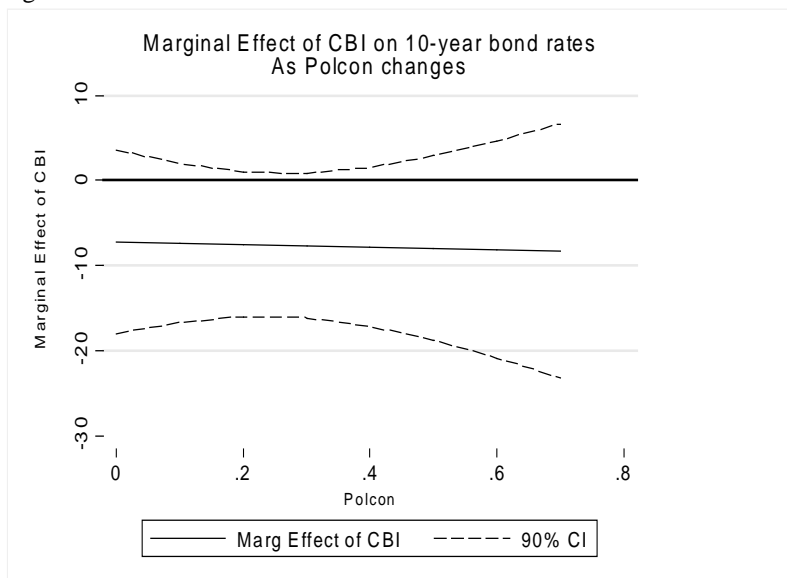


Figure 2h:



Graphs the marginal effect of CBI when varying the polcon iii, from models that include an interaction of CBI and polcon iii, for FDI inflows / GDP and 10-year bond yields.

## Appendix 6:

### FDI and 10-year real bond yields – Is CBI's effect contingent on the exchange rate regime?

Are CBI and FX substitutes? It is certainly possible that there is a trade-off or substitution relationship between a fixed exchange rate and CBI. This is suggested by the 2002 (fall) issue of International Organization. The two monetary institutions may be substitutes because theoretically they deliver the same desired low inflation (as they are theoretical solutions to the same time inconsistency problem). A complementarity relationship may exist as well, however, as suggested by the same 2002 (fall) issue of International Organization (Bernhard, Broz and Clark 2002, Broz 2002, Clark 2002). Complementarity may emerge because both monetary institutions have shortcomings that diminish the ability of each individual institution to deliver increased credibility in monetary policy (Bodea 2010): Central bank procedures and performance remain vague when compared to fixed rates, and are harder to monitor in the short run. Fixed exchange rates, on the other hand, can be and are being devalued, with examples in the developing world stretching from Bolivia in the 1980s, to Slovakia and Russia in the 1990s. The aftermath of elections is a clear period of high probability of fixed exchange rate devaluation or depreciation (Klein and Marion 1997, Frieden et al. 2001). This risk is quite high especially for longer term investment of the type we investigate (FDI or 10-year bonds). And the effect of fixed exchange rates on real interest rates remains unclear (Levy-Yeyati and Sturzenegger 2001), with de jure fixed exchange rates lowering short term real interest rates probably due to unexpected devaluations.

Under these conditions, even if both CBI and FX are solutions to the time inconsistency problem, they can serve a complementary function, and after Bretton Woods roughly 26% of country-years have had both fixed rates and CBI (Bernhard, Broz and Clark 2002). This means that, theoretically, CBI can be actually expected to have an effect on inflation independent of fixed rates (evidence in Ghosh et al. 1997 and 2011; Bodea forthcoming), as it can have an effect on bond rates just *controlling* for fixed exchange rates, but not necessarily *conditioning* on the exchange rate regime. This is an empirical question that we investigate below, first for 10-year bond rates and then for FDI.

We investigate this important issue by including in our models of developing countries (non-OECD) bond rate models an interaction between CBI and the exchange rate regime. The marginal effect of CBI for flexible and fixed exchange rates is shown in Table 6.1 below. The marginal effect is statistically insignificant for both flexible and fixed rates. We also include a triple interaction between our indicator of CBI, a time dummy that takes value of 1 for periods after 1997, and the dummy variable indicator for fixed exchange rates. Coefficient results are in Table 6.5 below (Models 1-8), but since triple interactions are hard to interpret, we show a table of marginal effects and confidence intervals of CBI when varying fixed rates and time. In Table 6.2 below, there is some evidence that post 1997 CBI lowers bond rates in the absence of fixed rates. This finding should assuage concern that our results apply only the years before 1997 and in countries with flexible exchange rates. Still, this finding may suggest that in the more recent past central banks in developing countries have built-up some credibility that may allow them to substitute for fixed rates as anchors for inflation expectations [we believe this to be another paper, however, as we explain below]. As an additional test we also restrict the sample to democracies (countries when CBI can be argued to actually increase the credibility of monetary policy), CBI's marginal effect is negative and statistically significant for both fixed and flexible exchange rates post 1997. Further evidence is in Figure 6.1 which plots the marginal effect of CBI when varying democracy (Polity) and the exchange rate regime. The graph is based on Model 4 below, which includes a three-way interaction of CBI, Polity and the exchange rate regime. Figure 1 shows that CBI reduces bond rates in democracies under both fixed and flexible exchange rates, just with a

somewhat smaller substantive effect under fixed rates. This, on the whole, we consider to be evidence that does not show a large conditional effect of CBI on the exchange rate regime.

For FDI, the effect of CBI conditional on the exchange rate regime is explored in Tables 6.3-6.4 and Figure 6.2. The tables show the marginal effect of CBI when varying the exchange rate regime (Table 6.3), time and the exchange rate regime (Table 6.4), and, respectively time and the exchange rate regime in democracies only (Table 6.4). There is little evidence of a conditional effect of CBI. With one exception (pre-1997 for countries with fixed exchange rates), the marginal effects are indistinguishable from zero. Figure 6.2 shows the marginal effect of CBI when varying the polity score and the exchange rate regime. The marginal effect is only statistically significant for very democratic countries and is higher under fixed rates, but only for the maximal values of the Polity index. Again, considering this evidence on the whole, we are not convinced that there are systematic conditional effects.

Table 6.1. Marginal effect of CBI when varying the exchange rate regime (fixed and flexible)

| Full sample of developing countries: Effect on 10 year bond rates |                            |
|---|----------------------------|
| Flexible exchange rate  | Fixed exchange rate        |
| -9.8<br>(6.7); [-20.8, 1.26]                                      | -6.3<br>(6); [-16.3, 3.64] |

Note: First number is the mean marginal effect; the standard error in parentheses; the interval is the 90% confidence interval. Marginal effects are based on Model 1 below.

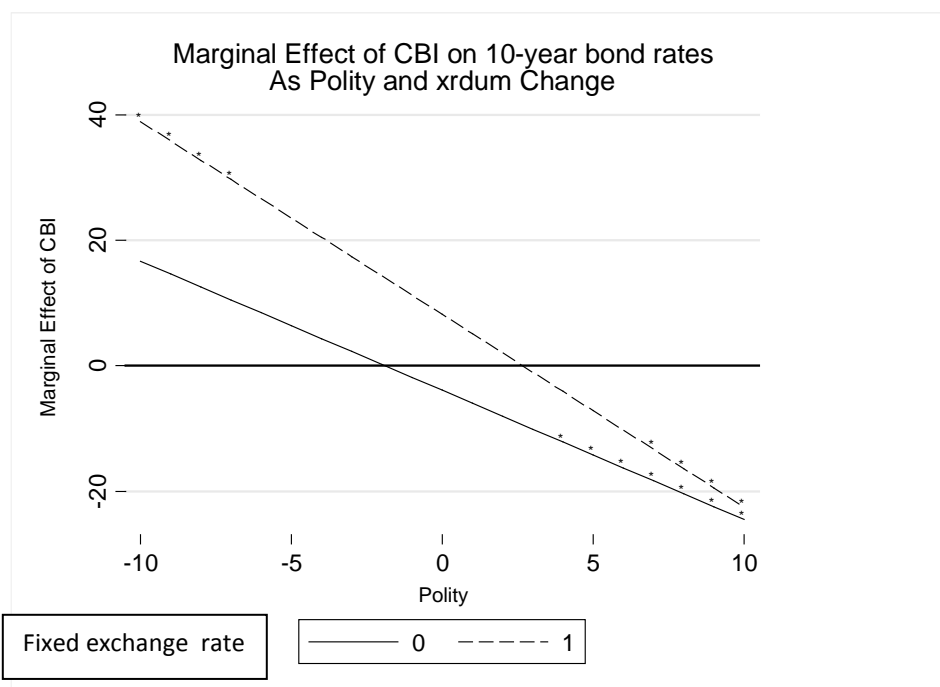
Table 6.2. Marginal effect of CBI when varying time (pre and post 1997) and the exchange rate regime (fixed and flexible)

| Full sample of developing countries: Effect on 10 year bond rates |                               |                              |
|---|-------------------------------|------------------------------|
|   | Flexible exchange rate        | Fixed exchange rate          |
| Pre 1997  | -17.5<br>(16.3); [-44.5, 9.3] | 1.5<br>(5.6); [-7.7, 10.9]   |
| Post 1997   | -10<br>(5.3); [-18.7, -1.3]   | -10.2<br>(9.1); [-25.4, 4.8] |

| Developing countries, democracies only: Effect on 10 year bond rates |                                |                                |
|--|--------------------------------|--------------------------------|
|  | Flexible exchange rate         | Fixed exchange rate            |
| Pre 1997   | -25.5<br>(20.1); [-64.7, 13.4] | -1.8<br>(8.7); [-18.9, 15.2]   |
| Post 1997  | -17<br>(9.27); [-32.8, -2.33]  | -51.3<br>(28.4); [-97.9, -4.6] |

Note: First number is the mean marginal effect; the standard error in parentheses; the interval is the 90% confidence interval. Marginal effects are based on Models 2 and 3 below.

Figure 6.1. Marginal effect of CBI when varying Polity and the exchange rate regime



Based on Model 4

Table 6.3. Marginal effect of CBI when varying time the exchange rate regime (fixed and flexible)

| All sample of developing countries: Effect on FDI |                               |
|---|-------------------------------|
| Flexible exchange rate                            | Fixed exchange rate           |
| 1.01<br>(1.39); [-1.27, 3.29]                     | 1.02<br>(2.30); [-2.76, 4.81] |

Note: First number is the mean marginal effect; the standard error in parentheses; the interval is the 90% confidence interval. Marginal effects are based on Model 5 below.

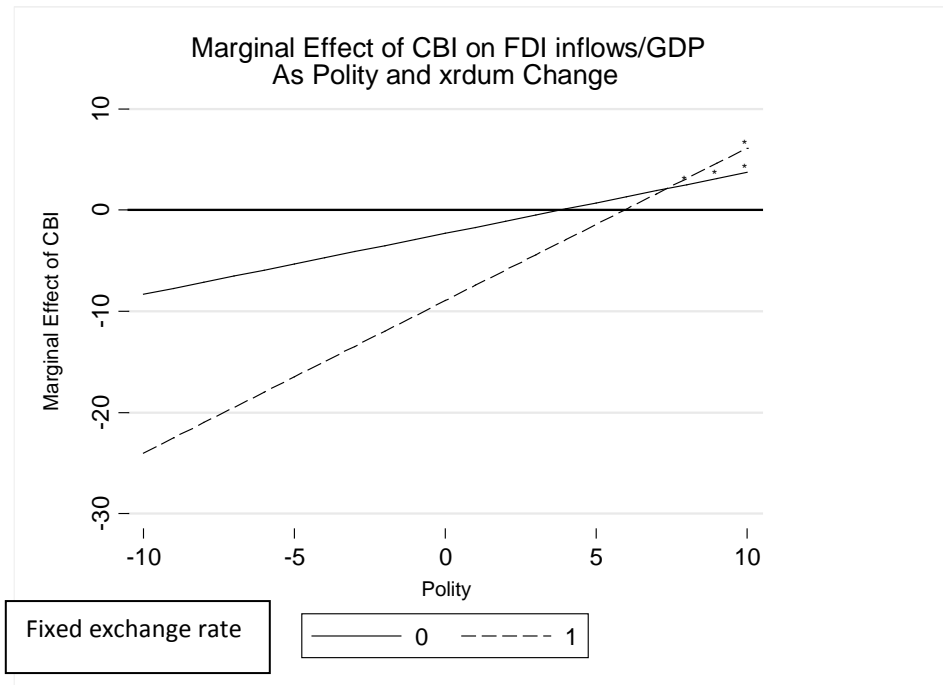
Table 6.4. Marginal effect of CBI when varying time (pre and post 1997) and the exchange rate regime (fixed and flexible)

| All sample of developing countries: Effect on FDI |                               |                               |
|---|-------------------------------|-------------------------------|
|   | Flexible exchange rate        | Fixed exchange rate           |
| Pre 1997  | 1.68<br>(1.80); [-1.28, 4.65] | 0.67<br>(1.92); [-2.49, 3.83] |
| Post 1997   | 0.13<br>(1.36); [-2.11, 2.37] | 2.32<br>(2.55); [-1.88, 6.53] |

| Developing countries, democracies only: Effect on FDI |                               |                               |
|---|-------------------------------|-------------------------------|
|   | Flexible exchange rate        | Fixed exchange rate           |
| Pre 1997  | 2.97<br>(1.99); [-0.31, 6.25] | 2.86<br>(1.58); [0.26, 5.46]  |
| Post 1997   | 1.84<br>(1.21); [-0.15, 3.82] | 1.06<br>(3.00); [-3.88, 6.00] |

Note: First number is the mean marginal effect; the standard error in parentheses; the interval is the 90% confidence interval. Marginal effects are based on Model 6 and 7 below.

Figure 6.2: Marginal effect of CBI when varying Polity and the exchange rate regime



Based on Model 8

Table 6.5

|                        | 10-year Bonds |          |          |            | FDI     |         |         |         |
|------------------------|---------------|----------|----------|------------|---------|---------|---------|---------|
|                        | Mod. 1        | Mod. 2   | Mod. 3   | Mod. 4     | Mod. 5  | Mod. 6  | Mod. 7  | Mod. 8  |
| Lag CBI                | -9.780        | -17.185  | -28.645  | -24.502*** | 1.007   | 1.684   | 2.967   | 5.414** |
|                        | (6.718)       | (16.383) | (19.693) | (8.109)    | (1.387) | (1.804) | (1.995) | (2.518) |
| Polity                 | 0.236         | 0.282    | -2.729*  | 0.975**    | 0.004   | 0.004   | 0.245   | -0.448  |
|                        | (0.328)       | (0.302)  | (1.485)  | (0.364)    | (0.028) | (0.029) | (0.185) | (0.417) |
| Year≥1998              |               | 1.240    | 2.497    |            |         | 1.149   | 1.455   |         |
|                        |               | (3.762)  | (3.317)  |            |         | (0.766) | (0.870) |         |
| Fixed XR               | 0.732         | -5.085   | -6.169   | 1.622      | -0.780  | -0.246  | -0.544  | -2.845* |
|                        | (2.572)       | (6.288)  | (10.703) | (4.153)    | (0.657) | (0.587) | (0.756) | (1.665) |
| CBI*Fixed XR           | 3.451         | 18.477   | 23.667   | 1.998      | 0.015   | -1.014  | -0.110  | 3.348   |
|                        | (4.549)       | (15.645) | (23.939) | (5.808)    | (1.677) | (1.249) | (1.549) | (3.519) |
| Year≥1998*Fixed XR     |               | 7.779    | 25.406   |            |         | -2.045  | 1.433   |         |
|                        |               | (9.507)  | (30.074) |            |         | (1.437) | (1.926) |         |
| CBI*Year≥1998*Fixed XR |               | -18.833  | -41.725  |            |         | 3.209   | -0.664  |         |
|                        |               | (19.625) | (42.690) |            |         | (2.321) | (3.017) |         |
| CBI*Polity             |               |          |          | -2.060**   |         |         |         | 1.479*  |
|                        |               |          |          | (0.789)    |         |         |         | (0.834) |
| Polity*Fixed XR        |               |          |          | 0.322      |         |         |         | -1.211  |
|                        |               |          |          | (0.249)    |         |         |         | (0.731) |
| CBI*Polity*Fixed XR    |               |          |          | -1.010     |         |         |         | 1.398   |
|                        |               |          |          | (0.646)    |         |         |         | (1.354) |
| CBI* Year≥1998         |               | 8.489    | 7.846    |            |         | -1.554  | -1.129  |         |
|                        |               | (12.783) | (11.421) |            |         | (1.281) | (1.642) |         |
| N                      | 317           | 317      | 220      | 317        | 1073    | 1073    | 718     | 718     |
| Countries              | 28            | 28       | 23       | 28         | 58      | 58      | 47      | 47      |
| R2                     | 0.267         | 0.316    | 0.435    | 0.305      | 0.158   | 0.161   | 0.225   | 0.229   |