

Sovereign credit ratings and central banks: Why do analysts pay attention to institutions?

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Abstract

This paper studies the effect of the governance of modern central banks on the ratings assigned by the credit rating agencies Standard and Poor's and Moody's. Until recently, the rating process was not public. Even still, the factors or precise methodologies used by the agencies remain uncertain and analyst judgment remains important. We argue that, given uncertainty over the future paths of countries, the quality of the central bank governance serves as a useful heuristic for a stable and favorable country trajectory. In particular, the central bank's independence signals that the government is committed to general macroeconomic stability, including debt repayment. Additionally, central bank transparency clarifies who is the principal of the bank and provides information about how the central bank understands the economy and monetary policy. Finally, tensions between the central bank and the government, as reflected by irregular turnover of central bank governors, raise doubts about countries' future prospects. Empirically, we use a variety of models, including mediation analysis, to ensure that the effect we identify stems from the central bank governance itself, as a heuristic for the future paths of countries, and not the central bank's direct contribution to the macroeconomy, as reflected in the available data.

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For better or worse², credit rating agencies influence countries' cost of capital.³ Prevailing economic conditions do play a role in the ratings given each year to countries. Since, however, most bonds are due for repayment in the future, agencies strive to assess whether a country will still be able and willing to repay when debt matures. Better domestic governance is thought to decrease the likelihood that a government will default on its borrowing. Indeed, in recent statements, credit rating agencies invoke the quality of a particular country's institutions and suggest they are interested in stable and sustainable policies. For example, Moody's, one of the large credit rating agencies, states that "analyzed in tandem with economic strength, the quality of a country's institutional framework and governance is a key consideration in the rating process ... This factor considers the extent to which a nation's political, social, and legal institutions act as a constraint on sudden and adverse changes to a country's ability and willingness to pay its debt" (Moody's 2008, p. 9).

This paper explores the linkages between a country's credit rating and a prominent, but overlooked, such institution--a country's central bank and its governance. The institutional design of central banks, including independence from politics and transparency, is a key aspect of good macroeconomic governance. The International Monetary Fund, for example, makes its lending conditional on central bank reform (Polillo and Guillen 2005, World Economic Outlook 2013). Also, countries appear to believe there are net benefits from adhering to global norms for central bank governance and have reformed the legal status of their central banks because peer countries have already done so (Polillo and Guillen 2005, Bodea and Hicks 2015b).

Analysts at credit rating agencies have access to retrospective data but face uncertainty over a country's macro-economic outlook and governments' incentives to repay debt. Given this

² Credit ratings may have contributed to the recent financial crisis (Pagano and Volpin. 2010) or may have significant biases (Fuchs and Gehring 2013, Hill et al. 2010).

³ See Afonso et al. (2012), Afonso et al. (2014) for EU sovereign bond yields and bond market volatility, or Andritzky et al. (2007) for emerging market bonds.

uncertainty, our argument is that the quality of the central bank governance serves as a useful signal about the future paths of countries. That is, good central bank governance can serve as a heuristic for a stable and favorable country trajectory. In particular, the central bank's independence from the political process signals to investors, more broadly, and to credit rating agencies, in particular, that the government is committed to general macroeconomic stability, of which debt repayment is a crucial component. We further argue that central bank transparency clarifies who is the principal of the central bank and provides important information about how the bank views the economy in the future and its relation to monetary policy. We expect that both independence and transparency will have a positive effect on credit ratings, distinct from the influence of macroeconomic outcomes that are shaped by the central bank. Finally, we suggest that tensions in the relationship between the central bank and the government, as reflected by abrupt and irregular turnover of central bank governors, raise doubts about countries' future prospects and will have a negative effect.

Anecdotal evidence illustrates our argument. For example, in January 2016, Standard and Poor's lowered its outlook of Poland's sovereign credit directly citing the actions of the Law and Justice party government because of "near-term concerns over a further weakening of key institutions, most importantly Poland's central bank"⁴. The same credit rating agency, however, raised its outlook in December 2016, because it considered that the threat to Poland's central bank independence had subsided. In another example, in 2001, in the run-up to joining the European Union, Hungary reformed its central bank to give it more legal independence from the government. However, after a landslide victory in the 2010 election, Hungary's Fidesz party passed a controversial law undermining this independence (December 2011). Immediately following the legislative changes, all major credit rating agencies (Standard and Poor's, Moody's, and Fitch) downgraded Hungary's credit rating to junk status. Standard and Poor's noted very specifically in their commentary of the downgrade: "In our opinion, changes to the constitution and the functioning

⁴ Cited in "S&P Unexpectedly Raises Outlook on Poland's Rating to Stable", Reuters December 2 2016.

of some independent institutions, including the central bank and the constitutional court, have undermined Hungary's institutional effectiveness".⁵ The phenomenon is not unique to European countries. South Africa's credit rating has been threatened because of concerns about government interference in the activity of the central bank. In particular, Standard and Poor's issued a very direct warning: "We would consider it critical that the operational independence of the reserve bank remains untouched... Depending on the severity of the changes (to independence), a rating action could indeed be one consequence".⁶

To test our argument, we use data from 1973 to 2010, and information on the credit ratings given to countries by two of the large credit rating agencies (Standard and Poor's and Moody's), as well as central bank independence (Bodea and Hicks 2015a), central bank turnover (Dreher et al. 2008) and central bank transparency (Eichengreen and Dincer 2010). We have several findings: Legal central bank independence (CBI) has a positive and significant effect on ratings. That is, countries with more independent central banks have better credit ratings, even focusing only on non-OECD countries. Irregular turnover of central bank governors has a negative and significant effect on ratings in both the full sample and the non-OECD sample. On the other hand, central bank transparency fails to reach conventional levels of statistical significance. Further, we use a variety of models, including mediation analysis, to ensure that it is central bank governance itself, as a heuristic for the future paths of countries, and not the central bank's direct contribution to the macroeconomy that is driving the effects. Overall, these findings are robust to different estimation methods.

In no uncertain words, White (2010) writes of credit rating agencies that, "essentially, the creditworthiness judgments of these third-party raters had attained the force of law" (p.213). At the

⁵ "Hungary's Central Bank Law Is Getting It In All Sorts Of Trouble", December 21, 2011. <http://www.businessinsider.com>.

⁶ "S&P warns South Africa over meddling with central bank independence", Reuters June 20, 2017.

same time, credit rating agencies have been historically very opaque about their methodologies. The criteria involved in ratings decisions have become clearer since the latest financial crisis. Still, agencies rely greatly on their analysts' perception of countries' willingness to repay. This continued reliance on analyst judgment warrants further exploration of the determinants of credit ratings. Our article shows that central bank governance is one such important determinant, in addition to democratic institutions (Beaulieu et al. 2012), rule of law (Biglaiser and Staats 2012) or control of corruption (Depken et al. 2011). More specifically, we show that central bank independence and lack of overt conflict between politicians and the central bank improve credit ratings. Finally, it is important to understand whether institutions influence credit ratings because of particular policy outcomes or, whether central bank governance, as we suggest, gives a sense of the future macro-economic outlook for particular countries. We show that the governance of the central bank influences credit ratings after controlling for a range of retrospective intervening variables and forecasts of these variables. This and additional mediation analysis supports our story that analysts at credit rating agencies have interpreted legal CBI and lack of overt conflict between central bankers and the government as signals of forward-looking, credible policy stability.

The rest of the paper proceeds as follows. In the next section, we discuss current explanations for credit ratings and work linking central bank governance to the costs of capital. In the third section, we explain why we expect a link between credit ratings and central bank independence, transparency and personnel changes. In the final sections we describe our data and research design, test our argument and conclude.

Countries and creditworthiness

In the last four decades more and more states, both developed and developing, have come to rely on bond financing. At the same time, the leading rating agencies (Moody's, Standard and Poor's and Fitch) have provided investors with analysis and ratings of a government's ability and willingness to

repay sovereign loans. The basic process of being rated involves countries inviting the credit rating agencies to assess risk, in the hopes that the analysis will improve the borrowing terms of public finance. Subsequently, ratings influence not only the borrowing costs of countries (Kaminsky and Schmukler 2001; Vaaler and McNamara 2004), but also the ratings of companies in those countries and the portfolio allocation of institutional investors (White 2010).

Until recently, the methodologies used by credit rating agencies to generate condensed ratings were not public. Rating agencies are private companies that compete for business and have, therefore, been far from transparent in their country analyses. Sinclair (2005), for example, discusses vague notions like “mental frameworks” that help explain how agencies view countries. This historical lack of transparency led to a burgeoning scholarly literature attempting to explain rankings.

Broadly speaking, the literature separates out the likelihood of bond repayment into an *ability* to repay and a *willingness* to do so. Early work emphasized a country’s *ability* to repay debt. That is, do countries have the resources available to ensure that they will not default? As a result, scholars focused on the economic determinants of credit ratings, explaining country credit ratings through macro-economic conditions like per capita income, GDP growth, inflation, external debt, level of economic development, currency crises and default history.⁷

Yet governments must also be *willing* to repay their debt. Even if resources exist, they may choose to default for ideological reasons, as Ecuador did in 2008. Willingness to repay debt, then, results from political factors that make defaulting more or less costly, both economically and in terms of political survival. North and Weingast (1989) argue that constraints on executive power in 17th century England increased the credibility of promises to repay sovereign debt. In a similar vein, Schultz and Weingast (2003) argue that voters in democracies punish violations of international debt contracts, which enhances the credibility of sovereign borrowing by democratic countries. Recent

⁷ Cantor and Packer (1996); More recent evidence is in Afonso et al. (2011), Nogués and Grandes (2001).

work provides evidence that democracies and countries that have the characteristics of democracy, including rule of law, respect for property rights and constraints on executive authority have better credit ratings (Butler and Fauver 2006, Beaulieu et al. 2012, Biglaiser and Staats 2012).⁸ In addition, credit rating agencies appear to consider directly electoral and partisan cycles (Vaaler et al. 2006).

During the most recent financial crisis, credit rating companies came under pressure to publish the details behind their scores. Although not an exhaustive “methodology”, in 2008 Moody’s explained how it rated sovereign bonds, as did Standard and Poor’s in 2010. In 2013, Moody’s used criteria related to economic, institutional, and fiscal strength and susceptibility to events risk, and published the kinds of data and weights used to aggregate these criteria (Moody’s 2013). Similarly, Standard and Poor’s ratings include political, economic, external, fiscal and monetary scores (SP 2012). Still, while the criteria involved have become clearer, Moody’s (2008) allows its analysts a significant amount of leeway to determine the cost-benefit calculations of governments’ willingness to repay its debt.⁹ Standard and Poor’s also notes specifically that ratings come from a committee decision based on the published criteria, but “rather than providing a strictly formulaic assessment, Standard & Poor’s factors into its ratings the perceptions and insights of its analysts based on their consideration of all of the information they have obtained” (2011, p.6).

The continued reliance on analyst judgments requires further exploration of the more subjective factors behind credit ratings. Democracy, constraints and rule of law certainly match credit rating agencies’ focus on institutions and are broadly related to the credibility of repayment.

Nevertheless, there are domestic institutions more directly related to the macro-economic conditions that credit agencies care about and that increase the ability (and perhaps the willingness) of countries

⁸ Democracy is also important for countries being rated by rating agencies in the first place (Beaulieu et al. 2012). Studies that do not account for credit rationing find that democracies do not enjoy better ratings (Archer et al. 2007).

⁹ For example: “There is a point where a government will decide that the economic, social and political cost of repaying the debt is higher than the economic, social and political cost of not repaying it. There are no quantitative-based approaches that satisfactorily replace disciplined analysts’ judgment on this question” (Moody’s 2008, p. 7).

to service loans. Previous research relates central banks' governance to countries' cost of capital or investor behavior (Maxfield 1997, Spiegel 1998, Moser and Dreher 2010, Bodea and Hicks 2015b). Given the prominence of central banks within the line-up of a country's domestic institutions, we argue in the next section that central bank governance influences a country's credit rating.

Central bank governance

As trade and investment became global by the late 1990s, legal central bank independence became an undisputed metric of good economic governance. In the 1990s, for example, the International Monetary Fund (IMF) made its lending decisions conditional on central bank reform (Polillo and Guillen 2005, World Economic Outlook 2013). Recently, two of the main credit rating agencies, Moody's and Standard and Poor's, have started to directly mention the central bank: Moody's (2008) writes that "the independence of central banks, the improvement in the regulatory and supervisory frameworks of the financial system, and increased transparency have improved the quality of governance in many countries" (p. 8). Moody's (2013) notes that it uses the World Bank's Worldwide Governance Indicators as a measure of institutional strength, which are complemented with "with an assessment of the policy effectiveness of a country, focusing on the central bank's credibility and scope for action" (p.12). Standard and Poor's (2011) also gives countries high scores for a "strong and long established track record of full operational independence, clear monetary policy objectives and a wide array of monetary instruments" (p.32).¹⁰

Given the lack of research on the topic, two questions need answers: Is central bank governance important to the rating agencies' analysts and, if so, why does governance matter? We argue that central bank governance and the de jure and de facto relationship between the government

¹⁰ Standard and Poor's goes on to note that "the independence of central banks is itself not a measurable variable, but it usually goes hand in hand with institutional settings such as the nomination of members of the monetary policy board for defined terms, the protection of board members from political interference, and the independence of central banks' budgets within the confines of applicable public sector guidelines" (p. 34).

and the central bank has an effect beyond the immediate macroeconomic impact, and that they serve as a forward-looking signal of policy and institutional stability. Below we develop hypotheses related to the independence and transparency of modern central banks, as well as the de facto tensions between the government and the central bank, as reflected in abrupt replacements of central bankers.

Central bank independence

There are plausible reasons for analysts at credit rating agencies to interpret central bank independence from politics as a signal of broad, forward-looking, policy stability. The independence of the central bank, as we detail below, has been associated with outcomes that investors consider favorable, including low inflation and a predictable monetary policy, conservative fiscal policy, as well as pro-investor views of property rights.

Research in psychology and behavioral economics shows that people use simple rules of thumb to reduce complexity and improve prediction (Tversky and Kahneman, 1974; Kahneman and Frederick, 2002; Kahneman, 2003; Orphanides and Wieland, 2008). Moreover, recent research has shown that investors do rely on heuristics about countries' trajectory, including membership in an international institution (Gray 2009, 2013) or "peer" country groups (Brooks et al. 2014). In other words, because of the prominence of central bank governance in what globally can be described as good housekeeping of the macroeconomy, central bank independence is more than just the sum of past outcomes and, likely, serves as a heuristic for stable and favorable future broad policies. Given the uncertainty faced by analysts about the ability and willingness of governments to repay debt, the quality of the central bank governance, including its independence from politics, serves as a useful signal about the future paths of countries.

First and foremost, independence is a useful signal because reforms aimed at increasing the independence of the central bank increase the confidence of credit rating agencies that countries will enjoy macroeconomic stability and, thus, will be able to repay their debt prospectively into the future. More broadly, an independent central bank has also been shown to be a reliable source of

information about government's policies and a reason for legislators and coalition partners with diverse preferences to favor delegation in the first place (Bernhard 1998, Crowe 2008). An independent central bank removes a key policy area from political wrangling, increasing policy effectiveness, the chance of agreement on other issue areas, and the probability of successful management of diverse political coalitions.

Consistent with a price stability mandate, greater central bank independence suggests that domestic inflation will be low and predictable into the future. A large body of evidence shows that CBI is indeed associated with low and stable inflation in developed countries (Cukierman et al. 1992, Grilli et al. 1991) or countries with transparent political systems and multiple veto players (Keefer and Stasavage 2003, Broz 2002, Bodea and Hicks 2015a). The independence of the central bank, if credible, can also act as a deterrent on fiscal deficits and thus help credit rating agencies better anticipate the path of countries' debt. Independent central banks focused on price stability prefer budget discipline because of the long run connection between deficits and inflation. Such independent banks can constrain the government through threats of interest rate increases or actual rate hikes, and by refusing to lend to the government.¹¹ While early evidence on the connection between CBI and fiscal deficits is mixed (Grilli et al 1991, Franseze 2002), more recent evidence

¹¹ Although fiscal choices are not part of central bank de jure mandates, in industrial countries fiscal policy is the topic of 40% of high level talks between the central bank and the government (Moser-Boehm 2006). Also, central bank official communication on fiscal policy increases as a reaction to fiscal deficits, showing concern for fiscal policy (Allard et al. 2013). Very directly, in 2011 the European Central Bank (ECB) used secret correspondence to demand sweeping deficit cuts from Ireland, Italy and Spain. These and additional measures were conditions for the ECB buying Italian and Spanish bonds on the market to reduce the high interest rates markets demanded of these countries. Also, in 2009 Mervyn King (Bank of England Governor) delivered a speech at the traditional official Mansion House Dinner in which he took a controversially public position on the British government's fiscal position, noting that "fiscal policy too will have to change" to develop a "clear path to show how prospective deficits will be reduced" (Irwin, p. 234).

shows that when the central bank can credibly focus on inflation, it deters deficit spending (Bodea 2013, Bodea and Higashijima 2017).

At the same time, credit rating agencies may view central bank independence and reforms as a signal that a country will be more *willing* to repay its debt. First, central bank reform may act as a step in strengthening the broad domestic rule of law and agencies might view an independent central bank as a veto player with respect to investor rights protection.¹² For example, during the eurozone debt crisis, the European Central Bank president Jean Claude Trichet was firmly against a Franco-German plan to make bond-holders take a loss in any future eurozone bailouts. Trichet's position was that "introducing the prospect of losses for creditors was shortsighted ... essentially begging bond investors to shun government debt across the eurozone, making the need for bailouts self-fulfilling" (Irwin 2013, p. 291). Also, in one of the eurozone bailouts, 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.¹³ More formally, Banaian and Luksetich (2001) show that countries with greater economic freedom, of which secure property rights is a key component, tend to have more independent central banks.¹⁴ This is not direct evidence that CBI leads to less expropriation, yet central banks, if independent, can be part of what Elkins et al. (2006, p. 827) call "institutions and practices that are favorable to investors, transparent and predictable."

Following our discussion, the first hypothesis is: *Controlling for the state of the economy, countries with more independent central banks will see higher credit ratings. (H1)*

Central bank transparency

¹² Biglaiser and Staats (2012) argue that broad respect for domestic rule of law is a theoretical indicator of the likelihood of sovereign debt repayment.

¹³ "ECB, Eurogroup at odds over Cyprus rescue as a model", Associated Press 3-2-2013.

¹⁴ 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.

Broadly, credit rating agencies value countries' transparency. Standard and Poor's (2011) states that "the transparency and accountability of institutions, data, and processes, as well as the coverage and reliability of statistical information" (p. 10) is an important criterion for assigning countries' political scores. S&P goes on to say that "transparent and accountable institutions, processes, and data are important because they enhance the reliability and accuracy of information, and help make known in a timely manner any significant shifts in a country's policymaking or the occurrence of risks relevant to sovereign credit risk" (Standard and Poor's 2011, p. 14). Moody's similarly includes transparency as a key category of institutional strength arguing that its analysts have "gained over time a precious experience in assessing governments' transparency" (Moody's 2008, p.10).

In addition to our argument above about independence, the transparency of central banks has the potential to reduce the uncertainty of credit rating agency analysts. In the past, when engaged in commercial banking business or as fiscal agents to the government, central banks thrived in secrecy. In the past fifteen years, however, central bank transparency has become more prevalent in both developed and developing countries (Eichengreen and Dincer 2010). More transparent central banks have clear mandates, publish their macroeconomic forecasts, explain how they reach monetary policy decisions and give a sense of the deliberation around such decisions (Eijffinger and Geraats 2006, Eichengreen and Dincer 2010).

Transparency increases the predictability of monetary policy and demystifies a bureaucracy that remains opaque even to the most experienced central bank watchers (Broz 2002, Bodea 2010). While independence should allow central banks to decide on monetary policy without political interference, transparency provides information about how the central bank views the economy in the future and how monetary policy relates to the state of the economy. This increases the predictability of monetary policy reactions, and therefore the predictability of the business cycle and inflation. The ability of economic agents to anticipate the central bank's reaction function is shown to help stabilize inflation expectations and prices (Eichengreen and Dincer 2010, van der Crujnsen and Demertzis

2007). Finally, transparency has the potential to clarify who is the principal of the central bank and, in this sense, reduces the potential for corruption and undue influence from interest groups.

Following, we hypothesize that: *Controlling for the state of the economy, countries with more transparent central banks will see higher credit ratings. (H2)*

Irregular replacement of central bankers

The consequence of the global trend towards CBI in the past three decades is that governments have less reliable access to monetary policy, which is still perceived as a powerful means to influence the economy. Thus, even with all the legal reforms to insulate monetary policy from politicians, there is little argument that CBI remains contested in the political arena. We suggest that tensions in the relation between the central bank and the government, as reflected by abrupt changes in high level personnel at the central bank, raise concerns about economic stability and doubts about countries' prospects. As we explain below, central bank replacements have various explanations. Yet we suggest that, from the perspective of credit rating analysts, unexpected replacement acts as an indicator of "trouble down the road".

Politicians can use subtle means to influence nominally independent central bankers, including threats to change the law and working around the law through the process of appointment of central bank governors and boards. At other times, politicians' conflicts with the central bank can take a more overt form. Central bank governors usually serve a fixed term in office and most will be replaced when their terms eventually expire. But some central bank laws also give the government the upper hand in the resolution of disputes with the central bank and leave unspecified the conditions under which a central bank governor's employment can be terminated. Consequently, especially in developing countries, there are a significant number of abrupt and irregular firings of central bank governors. For example, in 2001, prime minister Thaksin Shinawatra of Thailand, fired the central bank governor over a dispute over interest rates. Similarly, in 2010, Argentina's president

Cristina Kirchner fired the head of the central bank because of disagreements over the use of central bank international reserves.

Some of the early economics literature on CBI suggests that central bank governor turnover or, in other words, the premature replacement of central bank governors, is a metric able to distinguish de facto central bank autonomy in developing countries (Cukierman et al. 1992). Long tenures, however, may be a result of either autonomy or the lack of it. For example, the sitting governor of the Central Bank of Romania has been in office for over two decades, during periods of de facto subservience to politics (in the 1990s) and relative autonomy (in the 2000s). Even more important, Dreher et al. (2008) show that central bankers lose their jobs for high inflation, which makes central bank governor turnover a poor indicator of de facto CBI. For our argument, we do not need to assume that abrupt departures by central bank governors from their positions are related to government's interference with central bank independence or, to the contrary, to central banker's inability to deliver stable prices. We argue that the irregular replacement of central bank governors sends a broader and very visible signal of conflict over macroeconomic policy and raises uncertainty over future policy choices, leading rating agencies to reevaluate countries' outlooks.

Following this discussion we hypothesize that: *Controlling for the state of the economy, the irregular replacement of central bank governors will be associated with lowered credit ratings. (H3)*

Data and variable operationalization

The dependent variable in this paper is a country's credit rating (given by either Moody's or Standard & Poor's).¹⁵ The ratings are in the form AAA, AA, A, BBB, etc. As usual in empirical studies, we convert the ratings to a 17-point numeric scale, where a higher number represents a better rating. Our initial source for the credit ratings is Beaulieu et al. (2012). Their information ends in 2007 so we extend it through 2013, though data availability for other variables limits the years in our sample to

¹⁵ We use sovereign issuer ratings for foreign currency denominated debt.

2010.¹⁶ Standard & Poor ratings were updated from its report “Sovereign Rating and Country T&C Assessment Histories” (January 2014). The Moody’s ratings were updated based on press releases available on their website.

Independent variables

Our first key explanatory variable is a country’s level of central bank independence, which we measure in several ways. First, we use a country’s legal independence from Bodea and Hicks (2015a). They code the level of central bank independence based on the Cukierman et al. (1992) original index for 78 countries for the years 1973 to 2012.¹⁷ The CBI scores are based on a weighted calculation of 16 indicators in 4 categories regarding the Chief Executive Officer, Policy Formation, Objectives, and Limitations on Lending to the Government. The overall CBI index ranges from 0 to 1, with 1 representing the most independent central bank. We include in our models both a country’s current level of legal independence and its 5-year average.

Credit rating agencies may also respond to institutional reforms to increase the independence of the central bank. That is, countries may receive a bump in their ratings when they institute reforms that keep the government out of monetary policy. To test this, we include a variable equal to 1 if a country has reformed their central bank in the last 5 years. In the robustness section, we report on results when we vary the reform window from 3 to 6 years.

For central bank transparency we use the measure from Eichengreen and Dincer (2010). Central bank transparency is a relatively recent governance innovation, so the measure only covers the years 1998 to 2010. Values range from 1 to 14.5 with a mean of 6.3; higher scores represent greater transparency. More transparent central banks are more likely to have a clear mandate; explain what data is relevant for their deliberations; disclose their macro-economic model for policy analysis; publish macroeconomic forecasts; have a rule for monetary policy; give an account of deliberations;

¹⁶ We were not able to consistently update the Fitch ratings.

¹⁷ Polillo and Guillen (2005) and Dincer and Eichengreen (2013) cover specific decades.

promptly announce decisions on changes to policy instruments (e.g. interest rates), explain changes and give a sense of future changes; relate policy outcomes to its mandated objectives. The correlation between transparency and independence is 0.11.

Finally, we use data on the irregular turnover or replacement of central bank governors from Dreher et al. (2008) and the 2010 data update. Irregular turnover is an instance where the central bank governor leaves office before the expiration of his or her term. This is the opposite of regular turnover, which happens when central bank governors finish their term in office.

Control variables

A number of other political and economic variables are thought to influence a country's credit rating. To construct a baseline model we include a large number of these variables based in part on those that Credit Rating Agencies include in their latest publications (Moody's 2013, S&P 2012). Other variables are excluded from the baseline model due to data availability, but are discussed subsequently in the robustness section. Our baseline model includes a country's level of democracy, measured with the Polity score, as democracies are expected to have better political and economic institutions, and, therefore, to receive better ratings. We also include a number of variables that measure a country's economic fundamentals, and thus the ability to repay. All models include the lagged values of GDP growth (World Bank's World Development Indicators - WDI), GDP per capita (WDI), trade openness (imports plus exports divided by GDP - WDI), the log of inflation¹⁸ (WDI), the central government's fiscal balance¹⁹, the log of foreign direct investment (FDI) flows in millions of current US dollars (WDI), the change in a country's foreign reserves (International Monetary

¹⁸ We use the log of one plus the absolute value of inflation, and for negative inflation observations, we add a minus sign.

¹⁹ This is the budget deficit/surplus relative to GDP (IMF IFS, EBRD transitional reports, OECD statistics, Brender & Drazen 2005).

Fund's International Financial Statistics), an indicator for capital account openness (Chinn and Ito 2008)²⁰ and a dummy variable for a fixed exchange rate regime²¹.

We have argued that some of the control variables are affected by central bank governance, our key independent variable. Our baseline specification is consistent with the idea that institutions, including the central bank, have an effect on credit rating agencies' expectations about the future behavior of macro-economic outcomes and the future stability of the economy. Central bank governance should thus be expected to have an independent effect beyond the effect of lagged macro-economic outcomes.

We include two additional variables to control for adverse economic conditions. First, we include a dummy variable equal to 1 if a country has defaulted on its sovereign debt since the start of the sample.²² As with the ratings data, our initial source for this variable is Beaulieu et al. (2012), updated to cover more years and countries based on Reinhart and Rogoff (2010) and S&P's "Sovereign Rating and Country T&C Assessment Histories."²³ When we restrict our sample to non-OECD countries, we also include a dummy variable equal to 1 if the country received International Monetary Fund assistance in the year (Dreher and Vreeland 2009).

Estimation method

The empirical model takes the following form:

$$CR_{i,t} = r_1 + r_2 CR_{i,t-1} + r_3 CB\ governance_{i,t} + [Controls] + v_{i,t}$$

Where, CR stands for the credit rating and CB governance can be the legal central bank independence, bank transparency or the irregular replacement of bank governors. We expect r_3 to be

²⁰ Values range from -1.85 to 2.5 with larger numbers indicating more openness.

²¹ The variable is based on Ilzetzki, Reinhart, and Rogoff's coding of the IMF's official classification. We code an observation as having a fixed regime if it is coded as 1 under the IMF's coarse coding. All other values are considered non-fixed regimes.

²² Alternatively, we code the years since default, with no change in our results.

²³ For countries in neither source, we rely on Grittersova (2014).

positive when the key independent variable is legal central bank independence, bank reform, or transparency (H1 & H2), while r_3 should be negative when we estimate the effect of irregular banker turnover (H3).

The basic models are ordinary least squares estimations with random effects, the lagged dependent variable, a year time trend (or half-decade fixed effects) and country clustered standard errors. The lagged dependent variable captures the fact that most countries experience little change in ratings over time and also addresses potential autocorrelation (Beck and Katz 2004). In our data, for 82% of the Moody's observations (79% for S&P) there is no change in the credit rating and an additional 13% of Moody's observations show a credit rating change of only one point (17% of observations for S&P). For a data set like ours (sluggish dependent variable, about 70 countries over an average span of 13 years and a correlation between the independent variable and the country fixed effects somewhere between 0.2 and 0.3), a random effects specification is preferable because it is likely to have a Root Mean Squared Error that is lower or the same as a fixed effects specification (Clark and Linzer 2015).

Moreover, in small-T panels like ours, fixed-effects estimation is not optimal (Roodman 2009, Afonso et al. 2011) because a shock to the country's fixed effect does not decline with time and there is significant correlation between the lagged dependent variable and the error term (the Nickell bias; Nickell, 1981). Also, both credit ratings and the CBI index vary little, so fixed-effects models lead to greatly inefficient estimations. To address these shortcomings of our data, we also show estimations from system generalized method of moments (GMM) models.²⁴ This estimation is

²⁴ Arellano and Bover 1995; Blundell and Bond 1998. System GMM uses lagged values of the dependent and independent variables as instrument and combines regressions in differences with regressions in levels to better address issues of weak instrumentation. We use the orthogonal deviations transformation that preserves sample size in panels with gaps (Arellano and Bover 1995) and only up to the second lag of the variables for the regression in differences, to reduce the number of instruments and the risk of over-fitting the data. The lag of the dependent variable is considered endogenous in our GMM models, while all other variables are considered exogenous.

designed for small-T large-N panels (Roodman 2009) and eliminates country fixed effects through first differencing, thus reducing bias concerns and identifying the within-country relationship between the variables of interest. The consistency of the GMM system estimator is assessed with two standard specification tests: The Hansen test of over-identifying restrictions tests the overall validity of the instruments and failure to reject the null hypothesis gives support for the model, including our choice of endogenous variables. The Arellano–Bond test for AR(2) in first differences tests whether the residuals from the regression in differences is second order serially correlated and failure to reject the null hypothesis supports the model specification.

With relatively little movement in the credit rating one concern is unit root. Madalla, Wu and Pesaran panel unit root tests, however, reject the hypothesis of unit root in our dependent variables. In small-T panels, unit root tests may have little power. Thus we also estimate error correction models (ECMs) which difference our independent and dependent variables to minimize the risk of spurious results due to non-stationarity in the data. While error correction models are useful with cointegrated data, their applicability goes beyond that (De Boef and Keele 2008). ECMs include both the levels of the independent variables as well as their change. This will usefully allow us to separate out short-term effects (change) from long-term effects (levels).

Results and discussion

We present our results in Tables 1-3, and the additional (Online) Appendix Tables. Table 1 shows models using the legal central bank independence measure. Table 2 shows models using irregular central bank governor turnover. Table 3 shows results from the first 2 models of Table 1 but using the central bank transparency index as well as our other measures of central bank governance: legal CBI average over the previous 5 years and central bank reform in the last 5 years.

Table 1 shows consistently strong results for the legal measure of CBI. The first six models use the full sample of countries while Models 7 and 8 restrict the sample to non-OECD countries. Models 3 and 4 use system GMM while Models 5 and 6 replace the year trend with half decade dummy variables, to better control for global shocks. The GMM models fail to reject the null hypothesis for both the Hansen test and the AR2 test, supporting our model specification. Across all models, legal CBI has a positive and significant effect on ratings. The inclusion of the lagged dependent variable means that the coefficients on the other variables show the effect on the change in the dependent variable. In Model 1, moving from the 10th percentile (a score of 0.25) to the 90th percentile (a score of 0.84) of CBI shows an improved credit rating of a fifth of a point. This is a relatively large contribution to credit rating changes, because 95 percent of Moody's rating changes are either zero or a mere one point change (96 percent for S&P). In fact, Figure 1 shows that the effect of CBI on either Moody or S&P ratings is similar to the effect of other variables in the model.

The control variables behave largely as expected. Democracy, openness, GDP growth, GDP per capita, FDI inflows, and changes in foreign reserves all have positive and significant effects on a country's ratings in the full sample. Default and inflation both have negative and significant effects in most models, even though default does not reach conventional levels of statistical significance in the GMM models. Fixed exchange rates and fiscal balance each has a positive effect, but one which is only significant for the Moody's ratings.

Credit rating agencies may be especially sensitive to the relationship between governments and central banks in developing countries, so columns 7 and 8 show our results for non-OECD countries. In such countries, markets might be on the lookout for institutional weaknesses and lack of credible commitment to repay debt. Also, given the non-negligible risk of default in developing countries, the irregular firing of central bankers has the potential to be a more important cue when credit rating agencies evaluate countries outside the OECD. In the empirical models restricted to non-OECD countries we also include a dichotomous variable for an IMF loan.

Table 1: Effect of Legal CBI on Credit Agency Ratings

	OLS Models		GMM Models		OLS & Half decade dummies		Non OECD	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Lagged Moody's	0.942*** (0.013)		0.942*** (0.030)		0.943*** (0.013)		0.925*** (0.016)	
Lagged S&P		0.933*** (0.018)		0.893*** (0.057)		0.936*** (0.020)		0.884*** (0.028)
CBI	0.353** (0.147)	0.289** (0.142)	0.337** (0.162)	0.315** (0.150)	0.307** (0.155)	0.271* (0.147)	0.419** (0.183)	0.389* (0.218)
Polity	0.030** (0.013)	0.034** (0.015)	0.036** (0.015)	0.042** (0.017)	0.029** (0.013)	0.034** (0.015)	0.028** (0.013)	0.030** (0.014)
De jure XR	0.108** (0.048)	0.071 (0.052)	0.122** (0.052)	0.096* (0.057)	0.096** (0.046)	0.074 (0.049)	0.169*** (0.061)	0.160* (0.092)
Default to present	-0.165** (0.070)	-0.169** (0.080)	-0.171 (0.116)	-0.279 (0.181)	-0.176** (0.070)	-0.167** (0.081)	-0.212*** (0.066)	-0.226** (0.110)
IMF							-0.544*** (0.164)	-0.780*** (0.261)
Lag openness	0.001** (0.000)	0.001** (0.001)	0.001*** (0.000)	0.002** (0.001)	0.001** (0.000)	0.001** (0.001)	0.001 (0.001)	0.001** (0.001)
Lagged GDP growth	1.953** (0.900)	2.784** (1.125)	2.032** (0.948)	2.992*** (1.124)	1.868* (0.961)	2.748** (1.129)	1.104 (0.899)	2.129 (1.432)
Lag GDP pc	0.000** (0.000)	0.000*** (0.000)	0.000 (0.000)	0.000** (0.000)	0.000* (0.000)	0.000*** (0.000)	0.000** (0.000)	0.000*** (0.000)
Fiscal balance	0.016** (0.007)	0.005 (0.007)	0.016** (0.008)	0.007 (0.008)	0.015** (0.007)	0.006 (0.007)	0.011 (0.011)	0.005 (0.012)
Lag Cap. controls	-0.017 (0.027)	-0.044 (0.027)	-0.014 (0.028)	-0.032 (0.033)	-0.017 (0.026)	-0.042 (0.027)	-0.005 (0.034)	-0.054 (0.041)
Lag log inflation	-0.080*** (0.026)	-0.066* (0.036)	-0.079** (0.032)	-0.069* (0.042)	-0.077*** (0.026)	-0.054 (0.035)	-0.064* (0.034)	-0.078 (0.056)
Log FDI inflows	0.062*** (0.018)	0.038** (0.018)	0.049** (0.023)	0.041 (0.031)	0.067*** (0.019)	0.044** (0.019)	0.083** (0.033)	0.050 (0.035)
Change in foreign reserves	0.207*** (0.079)	0.307*** (0.099)	0.199** (0.082)	0.295*** (0.092)	0.211*** (0.074)	0.310*** (0.100)	0.269*** (0.103)	0.351** (0.141)
Constant	35.864*** (9.808)	23.762** (11.918)	32.276* (16.786)	37.386 (23.504)	75.723** (29.964)	5.928 (19.566)	24.851 (16.230)	-0.786 (24.837)
N	1023	986	1023	986	1023	986	566	526
Countries	71	69	71	69	71	69	49	46
Hansen p-value			0.363	0.261				
AR2 p-value			0.681	0.148				

Note: The dependent variable is a country's credit rating: Moody's for Models 1, 3, 5 & 7; S&P's for Models 2, 4, 6 & 8. A year time trend is included in Models 1-4 & 7-8 but not shown to conserve space. Standard errors are in parentheses.

Table 2: Effect of CB Governor Turnover of Credit Agency Ratings

	OLS Models		GMM Models		OLS & Half decade dummies		Non OECD	
	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
Lagged Moody's	0.942*** (0.013)		0.912*** (0.031)		0.943*** (0.013)		0.926*** (0.017)	
Lagged S&P		0.932*** (0.018)		0.835*** (0.042)		0.937*** (0.019)		0.886*** (0.029)
Irregular turnover	-0.448*** (0.103)	-0.357*** (0.113)	-0.442*** (0.102)	-0.364*** (0.112)	-0.426*** (0.100)	-0.355*** (0.114)	-0.537*** (0.143)	-0.390** (0.189)
Polity	0.031 (0.021)	0.036** (0.018)	0.043* (0.024)	0.052** (0.022)	0.030 (0.020)	0.036** (0.018)	0.030 (0.021)	0.034** (0.016)
De jure XR	0.114*** (0.043)	0.092** (0.042)	0.127*** (0.049)	0.144*** (0.050)	0.098** (0.041)	0.091** (0.042)	0.196*** (0.065)	0.162* (0.084)
Default to present	-0.149* (0.077)	-0.139* (0.081)	-0.255* (0.136)	-0.423** (0.192)	-0.161** (0.076)	-0.133* (0.080)	-0.154** (0.075)	-0.168 (0.114)
IMF							-0.448*** (0.161)	-0.719*** (0.264)
Lag openness	0.001** (0.001)	0.001** (0.000)	0.001*** (0.001)	0.002*** (0.001)	0.001** (0.000)	0.001* (0.001)	0.002** (0.001)	0.002** (0.001)
Lagged GDP growth	1.748* (0.932)	2.597** (1.027)	1.994** (1.012)	3.070*** (1.029)	1.846* (0.977)	2.641** (1.031)	1.039 (1.004)	1.987 (1.354)
Lag GDP pc	0.000 (0.000)	0.000*** (0.000)	0.000 (0.000)	0.000*** (0.000)	0.000 (0.000)	0.000*** (0.000)	0.000 (0.000)	0.000*** (0.000)
Fiscal balance	0.011 (0.007)	0.004 (0.006)	0.014* (0.008)	0.009 (0.010)	0.010 (0.007)	0.006 (0.006)	0.008 (0.012)	0.005 (0.012)
Lag Cap. controls	-0.012 (0.025)	-0.029 (0.025)	-0.003 (0.027)	0.004 (0.034)	-0.014 (0.025)	-0.029 (0.025)	-0.014 (0.035)	-0.039 (0.041)
Lag log inflation	-0.069*** (0.026)	-0.068* (0.035)	-0.082*** (0.031)	-0.092** (0.040)	-0.065** (0.026)	-0.053 (0.034)	-0.052 (0.035)	-0.073 (0.056)
Log FDI inflows	0.048*** (0.017)	0.038** (0.017)	0.046** (0.022)	0.066** (0.026)	0.051*** (0.018)	0.040** (0.019)	0.052 (0.038)	0.046 (0.035)
Change in foreign reserves	0.178** (0.076)	0.271*** (0.088)	0.170** (0.078)	0.249*** (0.080)	0.185*** (0.071)	0.279*** (0.090)	0.259** (0.108)	0.326** (0.132)
_cons	24.819*** (8.027)	19.362* (10.176)	33.864** (14.196)	56.723*** (16.896)	66.610** (27.718)	3.271 (19.566)	20.995 (16.844)	-0.380 (22.421)
N	1103	1086	1103	1086	1103	1086	549	529
Countries	69	69	69	69	69	69	48	47
Hansen p-value			0.243	0.497				
AR2 p-value			0.610	0.113				

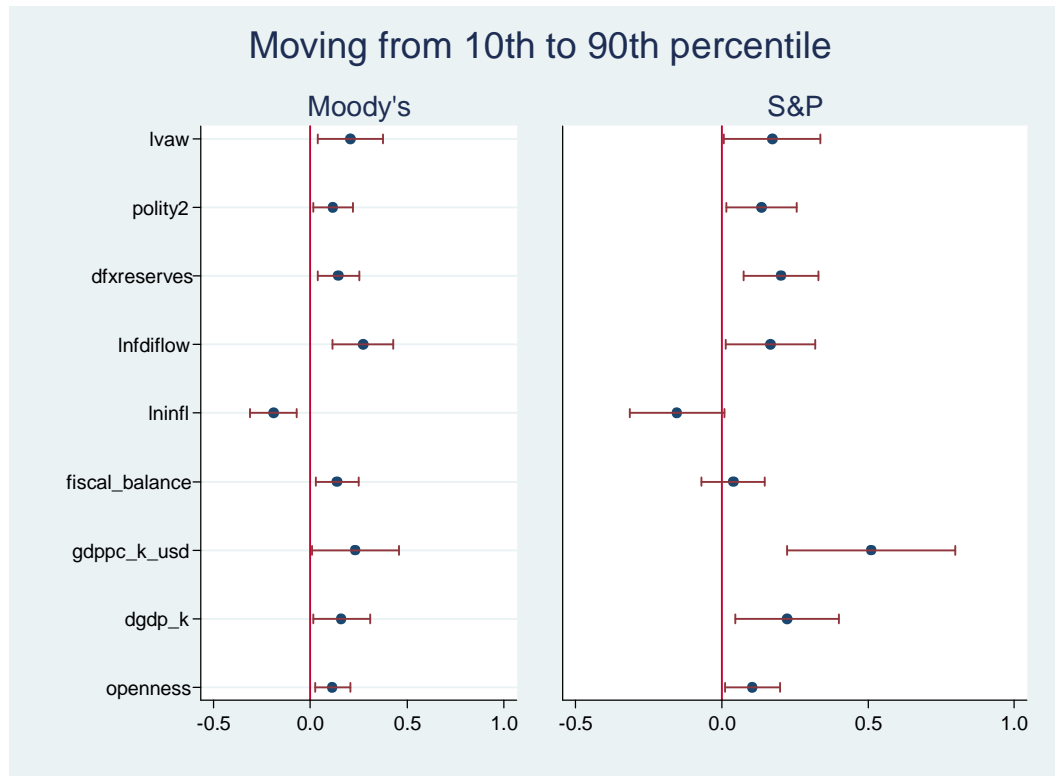
Note: The dependent variable is a country's credit rating: Moody's for Models 9, 11, 13 & 15; S&P's for Models 10, 12, 14 & 16. A year time trend is included in Models 1-4 & 7-8 but not shown to conserve space. Standard errors are in parentheses.

Table 3: Effect of Transparency and other Central Bank Measures on Credit Agency Ratings

	Transparency		Past CBI average		CB Reform	
	(17)	(18)	(19)	(20)	(21)	(22)
Lagged Moody's	0.937*** (0.021)		0.942*** (0.013)		0.949*** (0.012)	
Lagged S&P		0.934*** (0.021)		0.934*** (0.018)		0.939*** (0.017)
5-year CBI average			0.326** (0.156)	0.303** (0.153)		
Reform (last 5-years)					0.122** (0.062)	0.112** (0.052)
CB Transparency	0.024 (0.016)	0.024 (0.015)				
Polity	0.038 (0.026)	0.047* (0.027)	0.029** (0.013)	0.033** (0.015)	0.031** (0.013)	0.038** (0.015)
De jure XR	0.108 (0.080)	0.185** (0.082)	0.092** (0.045)	0.071 (0.050)	0.103** (0.041)	0.083** (0.042)
Default to present	-0.026 (0.097)	-0.026 (0.106)	-0.188** (0.073)	-0.186** (0.082)	-0.172** (0.078)	-0.155* (0.085)
Lag openness	0.001 (0.001)	0.001 (0.001)	0.001** (0.000)	0.001** (0.000)	0.001** (0.000)	0.001** (0.000)
Lagged GDP growth	2.956* (1.790)	2.837* (1.455)	1.862** (0.867)	2.735** (1.104)	1.958** (0.864)	2.852*** (1.069)
Lag GDP pc	0.000 (0.000)	0.000*** (0.000)	0.000* (0.000)	0.000*** (0.000)	0.000 (0.000)	0.000*** (0.000)
Fiscal balance	0.017* (0.010)	0.017 (0.011)	0.015** (0.007)	0.004 (0.006)	0.013* (0.007)	0.004 (0.007)
Lag Cap. controls	-0.040 (0.047)	-0.120*** (0.045)	-0.017 (0.027)	-0.043 (0.028)	-0.005 (0.025)	-0.033 (0.026)
Lag log inflation	-0.108** (0.047)	-0.075** (0.031)	-0.078*** (0.025)	-0.065* (0.035)	-0.080*** (0.024)	-0.068** (0.034)
Log FDI inflows	0.060 (0.039)	0.006 (0.029)	0.059*** (0.017)	0.035** (0.017)	0.058*** (0.016)	0.038** (0.016)
Change in foreign reserves	0.244* (0.148)	0.177 (0.117)	0.201*** (0.076)	0.303*** (0.095)	0.195*** (0.076)	0.285*** (0.093)
_cons	11.120 (32.928)	16.338 (24.515)	33.660*** (9.766)	21.755* (11.465)	25.466*** (7.853)	17.567* (10.060)
N	511	513	1077	1040	1141	1100
Countries	53	53	71	69	72	70

Note: The dependent variable is a country's credit rating: Moody's for Models 17, 19 & 21; S&P's for Models 18, 20 & 22. A year time trend is included in all models but not shown to conserve space. Standard errors are in parentheses.

Graph 1: Predicted change in credit ratings



Note: The graph use Models 1 and 2 and shows the predicted effect (and 95% confidence interval) of moving the statistically significant independent variables from the 10th percentile to the 90th percentile, while holding all other variables at their respective means.

Asking the IMF for a loan may affect a country’s credit rating as much as a default, and the variable does have a negative and significant effect on credit ratings across all models .There are few changes in the other control variables. Fiscal balance and GDP growth lose significance in both models. Openness is significant only for S&P ratings while inflation and FDI are significant only for Moody’s. On the other hand, the effect of a fixed exchange rate is stronger in non-OECD countries, perhaps reflecting a stronger commitment mechanism. Legal central bank independence is significant in both Models 7 and 8.

We present the results from error correction models (ECMs) in Table A2 in the Appendix.

Columns 1 and 2 show the estimated for the legal CBI index. The coefficient on the lagged dependent variable is the error correction term and it shows how long it takes for the dependent variable to return to equilibrium after a shock. We calculate the long-run propensity, or cumulative effect, of each level variable by dividing its coefficient by the absolute value of the error correction term. In the ECMs, a

change in credit rating takes a long time to return to equilibrium: each year only about 6% of the shock is corrected for. There is little evidence in columns 1 and 2 that legal CBI has a short-term effect on credit ratings. The coefficients for the change in CBI are positive but insignificant. As in the models from Table 1 however, there is evidence of a sizeable long-term effect, at least for Moody's ratings. Overall, moving from 0 to 1 for legal independence will lead to a total increase in Moody's rating of about 5.2 points. Each year about 6 percent of that effect will be felt. The first year will see an increase of about 0.32 points; the second year a slightly smaller increase of 0.29 points, until after about 16 years, the entire effect is felt.

Alternative measurements of central bank independence do not change our findings. Models 19 to 20 in Table 3 use a country's lagged 5-year average of legal CBI. The measure is positive and significant in both models with an effect similar to that found in Models 1 and 2 from Table 1. Models 21 and 22 include a dummy variable equal to 1 if the country has reformed their central bank in the last five years. This alternative measure is significant in both models as well. The substantive effect is relatively small: reform will increase the rating by about 0.12 points.

Next we discuss the effect central bank replacement on Moody's and S&P's credit ratings. Table 2 follows the same structure as Table 1 but includes the irregular turnover of central bank governors. Across Models 9 to 16, irregular turnover has a negative and statistically significant effect, and reduces a country's rating by between 0.35 and 0.54 points. The GMM models (Models 11 and 12) fail to reject the null hypothesis for both the Hansen test and the AR2 test (p values above 0.1), supporting our model specification. There is little change in the control variables. The only difference is that democracy measured by Polity loses significance in 3 of the 4 models using Moody's credit ratings.

While they are often seen as substitutes, recent research raises doubt whether the legal bank independence and turnover capture the same concept (Dreher et al. 2008). In our sample the correlation between the two measures is low, and as a robustness check, we include the legal independence of the central bank alongside the irregular replacement of central bank governors. Both irregular turnover and a

country's legal CBI remain statistically significant in all models except two of the S&P models where legal CBI just misses significance at the 0.10 level.

ECM models that include irregular turnover are shown in columns 3 and 4 of Table A2 (Appendix). Irregular turnover has both a short and a long-term effect on credit ratings and both effects are negative. There is an immediate decrease in credit ratings after a central bank governor is fired of about 0.4 points for Moody's and 0.3 points for Standard & Poor's. The long run multiplier again exhibits a sizable impact of turnover on credit ratings. For Moody's ratings, irregular turnover will result in a long-term 6.4 point loss in Moody's rating and 4.6 points in S&Ps; in both cases about 6% of the effect will be felt each year.

Finally, in Table 3 we include the measure of transparency and our other measures of central bank governance. First, we examine whether central bank transparency influences credit ratings (Models 17 and 18). Perhaps because of the much shorter time frame, transparency has no effect on either credit rating. Moreover, many of the control variables also lose significance. Only inflation and GDP growth have effects similar to their effect in Table 1. We do not show additional models because transparency remains insignificant in the GMM specifications, models with half-decade dummies and the non-OECD sample. Error correction models including transparency are in the last two columns of Appendix Table A2. As in the other models, there is no evidence that central bank transparency has an effect on credit ratings.

Robustness

We further test the robustness of our results by addressing potential biases arising from (i) model misspecification due to omitted variables; (ii) different measures of central bank governance; and (iii) country selection into being rated by the credit rating agencies in the first place. Finally, we examine whether factors such as inflation or FDI, have a mediating effect on central bank governance as we know that central bank independence does affect these variables. Results are shown in the Appendix.

First, we examine whether our findings are robust to the inclusion of additional control variables. Results are shown in Tables A3 (Moody's) and A4 (S&P). High indebtedness is a large risk factor for

repayment, yet measures of debt have poor coverage. We include a measure of external debt (percentage of GDP; WDI) that reduces our sample by almost 200 observations and about 20 countries. External debt is negative and significant across the models. The effects of our central bank governance measures also remain statistically significant except for reform in the last five years. To reduce the problem of missing data, we also use the sum of central government fiscal deficits in the past ten years as a proxy for high debt accumulation and our results continue to hold.

An additional concern may be that estimates of central bank governance reflect broader institutional and political variables or forecasts of specific policy outcomes. To minimize this possibility we control for additional political institutions and conditions. We include the International Country Risk Guide's composite risk measure, to broadly control for additional institutional country features. The composite risk aggregates 22 variables in three subcategories of political, financial, and economic risk.²⁵ Composite risk is measured such that higher values mean lower risk. The measure has a positive and statistically significant effect in most models. Its inclusion tends to somewhat weaken the effect of our central bank independence measure on S&P ratings in three (out of eight) models, but has little impact on the effect of our measures on Moody ratings. We also include in our models measures of election years²⁶ and government partisanship (World Bank Database of Political Institutions). The coefficient on election years is negative and significant but only for the S&P ratings and its inclusion does not affect our measures of central bank independence. Including dummy variables for executive partisanship also does not affect our results.²⁷ Left wing government partisanship is sometimes positive and significant, but not consistently so, while right wing partisanship is never statistically significant.

²⁵ <http://www.prsgroup.com/wp-content/uploads/2012/11/icrgmethodology.pdf>

²⁶ Parliamentary and presidential elections are included. Goemans' election dates dataset, NELDA (v3) and author corrections.

²⁷ The Database of Political Institutions has 4 categories: left, center, right, and undefined. We use undefined as the base category.

Similarly, irregular governor turnover might be picking up general political instability and unrest which obviously will affect a country's credit rating. That is, rather than having an independent effect on a country's rating, turnover might simply reflect greater political turmoil. To determine whether this is the case, we include several variables to indicate political unrest, including several measures from Banks's data (riots, anti-government demonstrations, the weighted conflict index, and the sum of the political unrest measures). None of these variables affect the significance of irregular turnover. It remains positive and highly significant in all the models.

It might also be the case that the rating agencies' analysts base their country ratings on forecasts of inflation and fiscal deficits and not just past values of these variables. To the extent that some of the effect of CBI is attributable to the forecasts, we might be overstating our findings and the mechanism through which we relate central bank governance to credit ratings. Forecasts of inflation and deficits are difficult to find for a large sample of countries. Instead, we use the realized levels of inflation and fiscal deficits two years in the future. The two forward-looking measures are almost always significant in the S&P models, but only occasionally in the Moody models. More importantly, including them does not affect our results about central bank independence or governor turnover.

Second, to ensure that our reform findings are not dependent on the length of time chosen since the reform, we vary the reform window for central bank reforms from 3 years to 6 years (Table A5). The reform variable is significant at the 0.05 confidence level for the 4-year and 6-year windows. With the 3-year window, reform is statistically significant in explaining Moody's credit ratings, but not significant in explaining S&P ratings.

Third, we also test whether our results are robust to selection into being rated in the first place by the rating agencies (Table A6). Bealieu et al. (2012) argue that access to credit ratings is also important and run models for selection into the ratings, i.e. they model countries' access to credit in the first stage and the level of the rating in the second stage. Following Bealieu et al. (2012) and Fuchs and Gehring (2014) we include in the first stage half decade dummies and the lagged number of countries rated by the

credit rating agency worldwide. When taking potential selection into account, our central bank governance measures continue to be statistically significant. Also, we cannot reject the null hypothesis that the equations are independent, implying that selection is not a threat to our inferences thus far.

Finally, Table 4 examines whether the effect of central bank governance works through different political, institutional or economic variables. In other words, such variables might be mediating the effect of central banks on credit ratings (Baron and Kenny 1986). One way to determine whether mediation occurs is to compare the effect of central banks when inflation and FDI are included and when they are not. The total effect is the effect of legal independence or turnover when the mediating variable is excluded from the model. The direct effect is the effect of legal independence or turnover when the mediating variable is included in the model. The indirect effect is the total effect minus the direct effect.

Previous research shows that CBI is negatively correlated with inflation and positively correlated with FDI. Thus, CBI might have a large indirect effect on a country's credit rating through its effect on these macroeconomic variables. In addition, CBI might be more common in democracies or CBI and fixed exchange rates may be substitutes (Bodea 2010). CBI might have an indirect effect through Polity because CBI stands in for adherence to the rule of law or for a commitment to the type of economic policies preferred by investors. To be clear, this does not mean that we think that CBI causes democracy, only that some of the effect of central banks is working through the democracy, or "other good institutions" channel.

In Table 4, the direct effect estimated from the full models in Tables 1 and 2 will be the same for legal independence for each rating and for turnover for each rating. They are the same coefficients reported in Tables 1 and 2. Yet some of the total effect of central bank governance might be working through other variables, and, compared to the direct effect, the indirect effect may be large. Table 4 shows that the CBI index has a positive indirect effect on credit ratings through inflation and FDI. Turnover, on the other hand, has a negative indirect effect through the same mediating variables. The indirect effect is relatively small - somewhere in between 1% and 6%. This is consistent with our argument that analysts

will consider a country's central bank governance as a forward looking indicator of policy stability, distinct from its retrospective effect on the economy.

Table 4: Mediation results

Mediating variable			Total effect	Direct effect	Indirect effect	% mediated
			Mediating variable excluded	Full model		
Moody	CBI	Polity	0.409	0.353	0.055	0.136
SP	CBI	Polity	0.364	0.289	0.075	0.206
Moody	CBI	Exchange rate	0.370	0.353	0.016	0.044
SP	CBI	Exchange rate	0.303	0.289	0.013	0.044
Moody	CBI	Inflation	0.364	0.353	0.010	0.028
SP	CBI	Inflation	0.292	0.289	0.003	0.010
Moody	CBI	FDI	0.362	0.353	0.009	0.024
SP	CBI	FDI	0.307	0.289	0.018	0.057
Moody	Turnover	Polity	-0.459	-0.448	-0.010	0.023
SP	Turnover	Polity	-0.374	-0.357	-0.017	0.047
Moody	Turnover	Exchange rate	-0.445	-0.448	0.003	-0.007
SP	Turnover	Exchange rate	-0.355	-0.357	0.002	-0.006
Moody	Turnover	Inflation	-0.463	-0.448	-0.014	0.031
SP	Turnover	Inflation	-0.358	-0.357	-0.001	0.003
Moody	Turnover	FDI	-0.460	-0.448	-0.012	0.026
SP	Turnover	FDI	-0.364	-0.357	-0.007	0.020

For central bank independence we identify a stronger mediated effect for the Polity score (13.6% - 20.6%) and the exchange rate choice variable (4.4%). The CBI index has a stronger total effect when either Polity or the exchange rate dummy is treated as a mediating variable (i.e. is excluded from the model) which suggests that rating agencies view as important commitment mechanisms like central bank independence, fixed exchange rates, or democratic institutions, and that such commitment mechanisms work through each other to some extent. For turnover, the mediation results for commitment mechanisms are less clear. There is some effect through Polity, especially for the S&P ratings (4.7%), but overall, the effect of turnover is not related as much to institutions that act as potential commitment mechanisms.

Conclusion

Credit ratings issued by agencies such as Moody's or Standard and Poor's affect a sovereign's access to capital markets and its cost of borrowing. The literature has made advances in understanding the factors behind sovereign credit ratings and, during the most recent financial crisis, rating companies started to publish the details behind their scores (Moody's 2008, Standard and Poor's 2011). However, both Moody's and Standard and Poor's still rely heavily on analysts' perceptions and insights into what makes countries able and willing to repay debt. This introduces an element of human bias and warrants further investigations into the factors behind credit ratings. The arguments about the effect institutions have on sovereign credit ratings suggest that credibility and expectations about economic policy are important. When a government can tie its hands - either through democracy, political constraints or respect to the rule of law - its promises to pay back debt appear more believable and, thus, its credit rating is higher.

In this paper, we argue that the de jure and de facto relationship between the government and the central bank has an effect on credit ratings that goes beyond the immediate macroeconomic impact, and that central bank governance serves as a forward-looking signal of policy and institutional stability. We argue that the more independent the central bank, the greater the expectation of stable future economic conditions, which should please investors and analysts and lead to higher credit ratings. We find strong evidence that this is the case. Higher legal central bank independence and central bank reforms improve sovereign credit ratings. In contrast, we make the argument that open conflict between the government and the central bank, as proxied by the irregular replacement of central bankers, should reduce the credibility of countries' policies, reducing sovereign ratings. Again, the findings support our argument.

Globally, central bank independence has come with calls for more transparency. In developed countries there are fears that the financial sector is the real principal of central banks, while in developing nations there are fears of corruption. Credit rating agencies have also explicitly stated that they value the transparency of policies, data reporting and institutions. We do not find that sovereign ratings are higher for countries with more transparent central banks, very likely due to the limited data for central bank

transparency. Further research is needed to discover whether the transparency of rated countries broadly speaking and, more specifically, the transparency of central banks, matter for credit ratings.

Finally, we find differences between the effects of central bank governance for the two credit rating agencies: Moody's and Standard and Poor's. The legal independence of the central bank is robustly associated with higher credit ratings by Moody's across all our model specifications. For Standard and Poor's, the same legal CBI index lacks robustness in some of our models, including the addition of governance indicators or error correction models. Research has recently noted the differences in methodology among credit rating agencies (Fuchs and Gehring 2013), and our findings further suggest that this is a fruitful avenue for future research, as are the potential differences in reaction between rating agencies and actual investors.

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Online Appendix Tables (For online publication only)

Table A1: Descriptive statistics

	N	Mean	Std. Dev	Min	Max
S&P rating	1004	10.281	5.054	0	16
Moody rating	1038	9.948	5.292	0	16
CBI	1083	0.551	0.218	0.173	0.960
Polity	1083	8.223	3.334	-9	10
Irregular turnover	1056	0.115	0.319	0	1
Reform in last 5 years	1083	0.257	0.437	0	1
Transparency	537	6.671	3.035	1	14.5
Lagged default to present	1083	0.329	0.470	0	1
Lag openness	1083	74.885	45.992	13.615	445.911
Lagged GDP growth	1083	0.039	0.036	-0.113	0.204
Lagged GDP per capita	1083	11021.090	10117.460	296.627	41904.210
Lag fiscal balance	1083	-1.295	4.033	-19.306	20.142
Lag Cap. Controls	1083	0.971	1.421	-1.831	2.500
Lag log inflation	1083	1.718	1.184	-4.074	8.033
Lag log FDI inflows	1083	7.515	1.749	1.740	12.657
Lag change in foreign reserves	1083	0.176	0.391	-0.752	4.097
De jure XR	1083	0.236	0.425	0	1
IMF program	606	0.134	0.341	0	1

Table A2: Effect of Central Banks on Credit Rating Agencies, Error Correction Models

	(23)	(24)	(25)	(26)	(27)	(28)
	b/se	b/se	b/se	b/se	b/se	b/se
Lagged Moody's	-0.062*** (0.013)		-0.064*** (0.013)		-0.046*** (0.015)	
Lagged S&P		-0.066*** (0.020)		-0.062*** (0.019)		-0.042*** (0.016)
CBI	0.323** (0.135)	0.183 (0.142)				
Irregular turnover			-0.410*** (0.130)	-0.285** (0.117)		
CB Transparency					-0.001 (0.016)	0.005 (0.016)
Polity	0.039*** (0.015)	0.022 (0.014)	0.030* (0.016)	0.022 (0.014)	0.017 (0.013)	0.032*** (0.012)
De jure XR	0.125** (0.057)	0.084 (0.069)	0.135*** (0.049)	0.107* (0.055)	0.138* (0.076)	0.151* (0.080)
Default to present	-0.173** (0.079)	-0.203** (0.091)	-0.198** (0.086)	-0.183** (0.091)	-0.157 (0.102)	-0.055 (0.102)
Lag openness	0.001* (0.001)	0.001 (0.001)	0.001 (0.001)	0.000 (0.001)	0.000 (0.001)	0.001 (0.001)
Lagged GDP growth	6.155*** (1.437)	9.539*** (1.346)	6.893*** (1.379)	9.012*** (1.284)	5.361** (2.644)	6.945*** (2.271)
Lag GDP pc	0.000* (0.000)	0.000*** (0.000)	0.000** (0.000)	0.000*** (0.000)	-0.000 (0.000)	0.000** (0.000)
Fiscal balance	0.015* (0.008)	0.003 (0.006)	0.009 (0.008)	0.001 (0.006)	0.012 (0.008)	0.008 (0.008)
Lag Cap. Controls	0.002 (0.024)	-0.001 (0.029)	0.003 (0.024)	0.010 (0.028)	0.012 (0.030)	-0.064* (0.034)
Lag log inflation	-0.088*** (0.026)	-0.101*** (0.034)	-0.073** (0.029)	-0.092*** (0.033)	-0.095** (0.042)	-0.060* (0.035)
Log FDI inflows	0.085*** (0.021)	0.058** (0.024)	0.060*** (0.020)	0.051** (0.023)	0.116*** (0.035)	0.057* (0.032)
Change in foreign reserves	0.125 (0.108)	0.420*** (0.139)	0.082 (0.098)	0.363*** (0.132)	0.610*** (0.158)	0.613*** (0.178)
Short-term						
CBI	0.377 (0.324)	0.175 (0.292)				
Irregular turnover			-0.386*** (0.088)	-0.268*** (0.099)		
CB Transparency					0.033 (0.041)	-0.068* (0.038)

Polity	-0.004 (0.030)	0.016 (0.019)	-0.004 (0.031)	0.017 (0.022)	0.015 (0.019)	0.021* (0.012)
De jure XR	0.081 (0.184)	0.260*** (0.091)	0.056 (0.146)	0.265*** (0.078)	-0.109 (0.195)	0.196 (0.159)
Default to present	-1.116** (0.480)	-4.834** (2.283)	-0.738*** (0.189)	-4.935** (2.275)		
Lag openness	-0.007 (0.005)	-0.004 (0.005)	-0.008* (0.005)	-0.003 (0.004)	-0.003 (0.005)	0.000 (0.003)
Lagged GDP growth	7.218*** (1.482)	9.873*** (1.334)	7.614*** (1.257)	9.260*** (1.195)	3.921* (2.071)	6.809*** (1.633)
Lag GDP pc	-0.000 (0.000)	-0.000*** (0.000)	-0.000* (0.000)	-0.000*** (0.000)	-0.000 (0.000)	-0.000 (0.000)
Fiscal balance	0.001 (0.013)	0.004 (0.008)	0.003 (0.014)	0.006 (0.007)	-0.020 (0.012)	0.009 (0.010)
Lag Cap. Controls	-0.031 (0.054)	0.148** (0.073)	-0.012 (0.057)	0.153** (0.070)	0.019 (0.085)	0.044 (0.065)
Lag log inflation	-0.105** (0.043)	-0.137*** (0.040)	-0.111** (0.043)	-0.137*** (0.037)	-0.134** (0.066)	-0.093** (0.047)
Log FDI inflows	0.112*** (0.042)	0.054** (0.027)	0.085** (0.036)	0.050** (0.022)	0.135*** (0.040)	0.030 (0.038)
Change in foreign reserves	0.046 (0.097)	0.247** (0.114)	0.038 (0.089)	0.219** (0.110)	0.405** (0.160)	0.478*** (0.117)
_cons	43.612*** (10.479)	32.695** (13.614)	29.443*** (9.008)	23.235** (11.605)	108.215*** (29.372)	69.890*** (21.427)
N	929	896	995	983	406	407
Countries	70	67	69	68	52	52

Note: The dependent variable is the change in a country's credit rating: Moody's for Models 23, 25 & 27; S&P's for Models 24, 26 & 28. Standard errors are in parentheses.

Table A3: Moody's ratings

		External debt	Election year	Partisanship	ICRG
CBI	OLS	0.383** (0.167)	0.348** (0.147)	0.342** (0.149)	0.311** (0.144)
	GMM	0.442** (0.189)	0.331** (0.162)	0.322* (0.164)	0.319* (0.167)
	OLS & half decade	0.355** (0.175)	0.302* (0.154)	0.324** (0.154)	0.316** (0.150)
	Non-OECD	0.553** (0.249)	0.418** (0.180)	0.406** (0.173)	0.389** (0.175)
Turnover	OLS	-0.479*** (0.111)	-0.447*** (0.102)	-0.452*** (0.103)	-0.444*** (0.104)
	GMM	-0.479*** (0.108)	-0.441*** (0.102)	-0.450*** (0.102)	-0.439*** (0.103)
	OLS & half decade	-0.456*** (0.108)	-0.425*** (0.099)	-0.432*** (0.101)	-0.432*** (0.102)
	Non-OECD	-0.639*** (0.160)	-0.536*** (0.141)	-0.545*** (0.144)	-0.582*** (0.145)
Transparency		0.024 (0.022)	0.025 (0.017)	0.014 (0.017)	0.032** (0.016)
Past CBI		0.397** (0.170)	0.323** (0.156)	0.312** (0.157)	0.347** (0.156)
CB Reform		0.041 (0.063)	0.121** (0.062)	0.337** (0.160)	0.113** (0.057)

Note: The dependent variable in all models is the Moody's credit rating. The rows replicate the columns in Tables 1 through 3 of the text. The models in column 1 contain external debt as another variable; those in column 2 election year; column 3 partisanship; and column 4 ICRG risk. The rows show the coefficient for each of the central bank measures from that model.

Table A4: S&P ratings

		External debt	Election year	Partisanship	ICRG
CBI	OLS	0.345** (0.170)	0.305** (0.143)	0.309** (0.145)	0.244* (0.147)
	GMM	0.378** (0.174)	0.330** (0.151)	0.337** (0.152)	0.264* (0.145)
	OLS & half decade	0.344** (0.175)	0.285* (0.149)	0.299** (0.151)	0.245 (0.155)
	Non-OECD	0.587* (0.334)	0.434** (0.218)	0.405* (0.215)	0.347 (0.220)
Turnover	OLS	-0.384*** (0.131)	-0.364*** (0.112)	-0.364*** (0.113)	-0.396*** (0.120)
	GMM	-0.393*** (0.128)	-0.372*** (0.111)	-0.367*** (0.112)	-0.389*** (0.122)
	OLS & half decade	-0.379*** (0.132)	-0.362*** (0.113)	-0.360*** (0.114)	-0.392*** (0.121)
	Non-OECD	-0.449* (0.233)	-0.409** (0.185)	-0.397** (0.187)	-0.481*** (0.186)
Transparency		0.029 (0.021)	0.023 (0.015)	0.012 (0.016)	0.032** (0.016)
Past CBI		0.399** (0.186)	0.310** (0.154)	0.337** (0.160)	0.302* (0.157)
CB Reform		0.049 (0.055)	0.115** (0.053)	0.115** (0.054)	0.071 (0.052)

Note: The dependent variable in all models is the S&P credit rating. The rows replicate the columns in Tables 1 through 3 of the text. The models in column 1 contain external debt as another variable; those in column 2 election year; column 3 partisanship; and column 4 ICRG risk. The rows show the coefficient for each of the central bank measures from that model.

Table A5: Different reform years

	(1)	(2)	(3)	(4)	(5)	(6)
Lagged Moody's	0.948*** (0.012)		0.949*** (0.012)		0.949*** (0.012)	
Lagged S&P		0.938*** (0.017)		0.939*** (0.017)		0.940*** (0.017)
Reform (last 3-years)	0.125* (0.064)	0.100 (0.066)				
Reform (last 4-years)			0.150** (0.062)	0.132** (0.055)		
Reform (last 6-years)					0.140*** (0.052)	0.133** (0.054)
Polity	0.031** (0.013)	0.038** (0.015)	0.031** (0.013)	0.038** (0.015)	0.031** (0.013)	0.038** (0.015)
De jure XR	0.099** (0.040)	0.080* (0.042)	0.101** (0.040)	0.082* (0.042)	0.103** (0.040)	0.083* (0.042)
Default to present	-0.172** (0.077)	-0.156* (0.084)	-0.169** (0.077)	-0.153* (0.085)	-0.174** (0.077)	-0.156* (0.085)
Lag openness	0.001* (0.000)	0.001** (0.000)	0.001* (0.000)	0.001** (0.000)	0.001** (0.000)	0.001** (0.000)
Lagged GDP growth	1.942** (0.866)	2.876*** (1.063)	2.011** (0.878)	2.904*** (1.087)	1.971** (0.864)	2.885*** (1.090)
Lag GDP pc	0.000 (0.000)	0.000*** (0.000)	0.000 (0.000)	0.000*** (0.000)	0.000 (0.000)	0.000*** (0.000)
Fiscal balance	0.014** (0.007)	0.005 (0.007)	0.013** (0.007)	0.004 (0.007)	0.013* (0.007)	0.004 (0.007)
Lag Cap. controls	-0.003 (0.025)	-0.032 (0.026)	-0.005 (0.025)	-0.033 (0.026)	-0.007 (0.025)	-0.034 (0.026)
Lag log inflation	-0.080*** (0.023)	-0.068** (0.033)	-0.080*** (0.024)	-0.068** (0.033)	-0.079*** (0.024)	-0.068** (0.034)
Log FDI inflows	0.057*** (0.017)	0.037** (0.016)	0.057*** (0.016)	0.038** (0.016)	0.058*** (0.016)	0.038** (0.016)
Change in foreign reserves	0.193** (0.076)	0.285*** (0.094)	0.192** (0.076)	0.283*** (0.093)	0.195*** (0.075)	0.286*** (0.093)
_cons	25.254*** (7.878)	17.383* (10.025)	25.195*** (7.852)	17.340* (10.030)	25.825*** (7.893)	17.808* (10.098)
N	1141	1100	1141	1100	1141	1100
Countries	72	70	72	70	72	70

Note: Note: The dependent variable is a country's credit rating: Moody's for Models 1, 3 & 5; S&P's for Models 2, 4 & 6. Standard errors are in parentheses. Year variable included but not shown to conserve space

Table A6: Selection models

	(1)	(2)	(3)	(4)	(5)	(6)
Main Model						
Lagged Moody's	0.949*** (0.011)		0.953*** (0.011)		0.943*** (0.011)	
Lagged S&P		0.943*** (0.015)		0.947*** (0.015)		0.940*** (0.015)
CBI	0.312** (0.141)	0.245* (0.132)			0.307** (0.143)	0.204 (0.132)
Reform (last 5-years)			0.127** (0.061)	0.113** (0.051)		
Irreg. turnover					-0.474*** (0.109)	-0.389*** (0.121)
Polity	0.028** (0.013)	0.032** (0.014)	0.030** (0.013)	0.036** (0.014)	0.028 (0.018)	0.030* (0.015)
De jure XR	0.100** (0.048)	0.065 (0.051)	0.098** (0.039)	0.076* (0.040)	0.097* (0.050)	0.066 (0.051)
Default to present	-0.171** (0.071)	-0.170** (0.080)	-0.176** (0.078)	-0.156* (0.084)	-0.146** (0.072)	-0.148* (0.079)
Lag openness	0.001* (0.000)	0.001* (0.000)	0.001 (0.000)	0.001* (0.000)	0.001** (0.000)	0.001* (0.000)
Lagged GDP growth	1.814** (0.892)	2.729** (1.118)	1.884** (0.857)	2.846*** (1.057)	1.880* (0.985)	2.588** (1.067)
Lag GDP pc	0.000** (0.000)	0.000*** (0.000)	0.000 (0.000)	0.000*** (0.000)	0.000** (0.000)	0.000*** (0.000)
Fiscal balance	0.013** (0.007)	0.002 (0.006)	0.012* (0.007)	0.002 (0.006)	0.010 (0.007)	0.000 (0.006)
Lag Cap. controls	-0.024 (0.026)	-0.049* (0.026)	-0.012 (0.024)	-0.040* (0.024)	-0.034 (0.025)	-0.045* (0.025)
Lag log inflation	-0.074*** (0.025)	-0.054 (0.034)	-0.077*** (0.023)	-0.058* (0.032)	-0.062** (0.029)	-0.052 (0.035)
Log FDI inflows	0.049*** (0.016)	0.025* (0.014)	0.049*** (0.014)	0.027** (0.013)	0.036** (0.017)	0.021 (0.015)
Change in foreign reserves	0.206*** (0.078)	0.306*** (0.098)	0.195*** (0.075)	0.287*** (0.092)	0.188** (0.079)	0.289*** (0.093)
_cons	-0.461** (0.214)	-0.317 (0.257)	-0.281 (0.189)	-0.248 (0.229)	-0.297 (0.282)	-0.177 (0.271)
Selection eq.						
Lag Moody count	0.031*** (0.005)		0.035*** (0.004)		0.030*** (0.005)	
Lag S&P count		0.029*** (0.004)		0.032*** (0.004)		0.029*** (0.004)
N	2146	2168	2264	2282	2119	2165
Rho	0.338	0.135	0.268	0.100	0.360	0.135

Note: Note: The dependent variable is a country's credit rating: Moody's for Models 1, 3 & 5; S&P's for Models 2, 4 & 6. Standard errors are in parentheses. Half decade dummies also included in selection equation but not shown to conserve space