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Johannes Fedderke

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Enquiries

Head: Research Department
South African Reserve Bank
P O Box 427
Pretoria 0001

Tel. no.: +27 12 313-3911
0861 12 SARB (0861 12 7272)

Promotion and Relegation between Country Risk Classes as Maintained by Country Risk Rating Agencies*

Johannes Fedderke†

June 18, 2014

Abstract

Credit rating agency assessments of sovereign risk bear weak statistical association with the quality of country policies. This paper demonstrates that where endogenous responses by policy makers to credit rating outcomes, and the degree of responsiveness of credit rating agencies to policy changes are accounted for, strong associations between policy quality and ratings should be present. The paper verifies these associations on panel data for 60 countries over the 1980-2012 period.

JEL Codes: G23, G24, G14.

Keywords: credit rating agencies, policies.

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†Pennsylvania State University, Research Fellow of the South African Reserve Bank, Economic Research Southern Africa, University of the Witwatersrand, jwf15@psu.edu, +1-814-867-2793

1 Introduction

The global financial crisis of 2008 has again shifted attention onto the significance of sound macroeconomic stabilization policy. Credit rating agencies provide services to capital markets concerning the risk of sovereign debt.

Surprisingly, however, good economic policy does not show as strong an association with international credit ratings of countries as one might expect. For instance, for a sample of 60 countries for which ratings are available consistently for a period of at least 12 years, Moody's rating of government bonds shows little relation to the growth performance of the economy and inflationary pressure. Figure 1 provides summary illustration by reference to Moody ratings for the periods available[1] and associated real GDP growth rates, while Figure 2 repeats for the inflation rate. Our choice of policy variables is dictated by the fact that growth is the most fundamental determinant of long term productivity changes, while inflation is a useful indicator of price and policy distortions confronting an economy.[2]

One response to this observation might be that it provides evidence of the inefficiency of ratings agencies. However, consider some market-based indicators of risk such as the interest rate differential between any specified country and US government debt yields.[3] Once again, these market-based risk measures and growth performance show little sign of systematic association. In the case of the inflation rate, the association is stronger, but nevertheless continues to show considerable dispersion and influence by outlier observations, suggesting non-negligible imprecision in any relationship present between the variables. See Figures 3 and 4. Since agents in markets have strong profit incentives to eliminate asset mispricing, it is difficult to argue that the absence of a strong systematic association between the quality of policy and interest rate differentials is simply due to market inefficiencies or information asymmetries.

Consider also the market incentives that ratings agencies face. Since ratings agencies provide assessments of risk to market participants, consistent failure to respond to either negative or positive relevant information

[1] Moody ratings from C through Aaa were assigned numeric scores over the 1 through 21 range, in order to render them numeric. Appendix 1 provides the precise coding values.

[2] Note that other policy variables that might be of interest, such as the ratio of debt to GDP, are more difficult to interpret. Thus a high Moody rating may allow for a higher level of borrowing in the market, while a low rating precludes borrowing. The result is that any interpretation of the association cannot infer causality running from policy to rating outcome.

[3] For most countries we employed yields on long-term government bonds. Due to data constriants, in some instances we employed Treasury Bill rates, or lending rates instead.

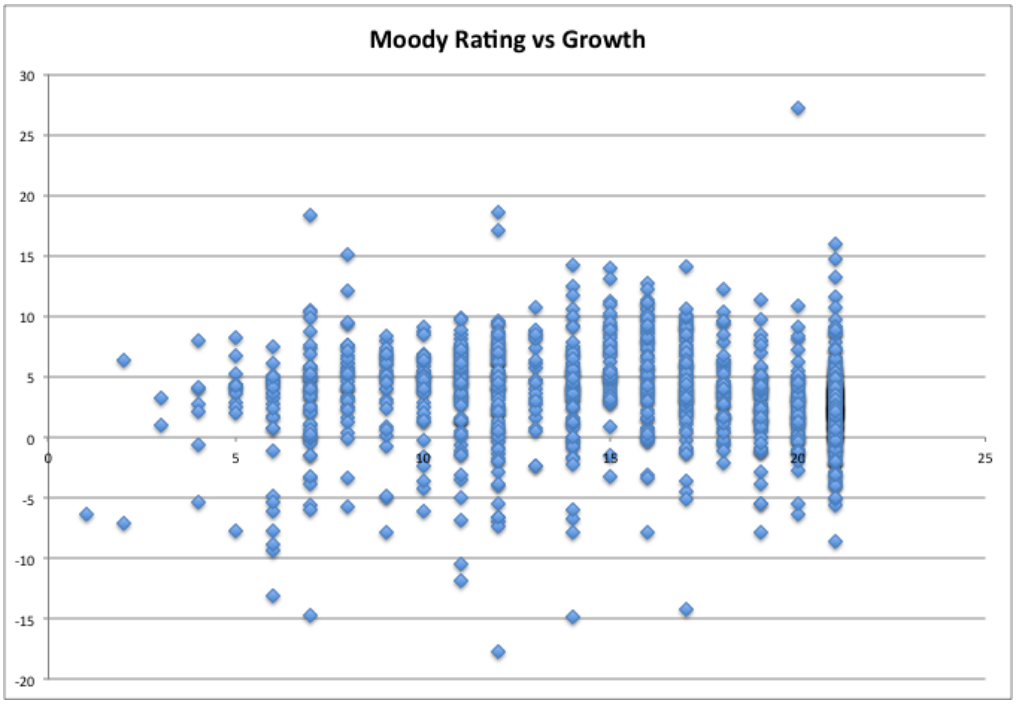

Figure 1:

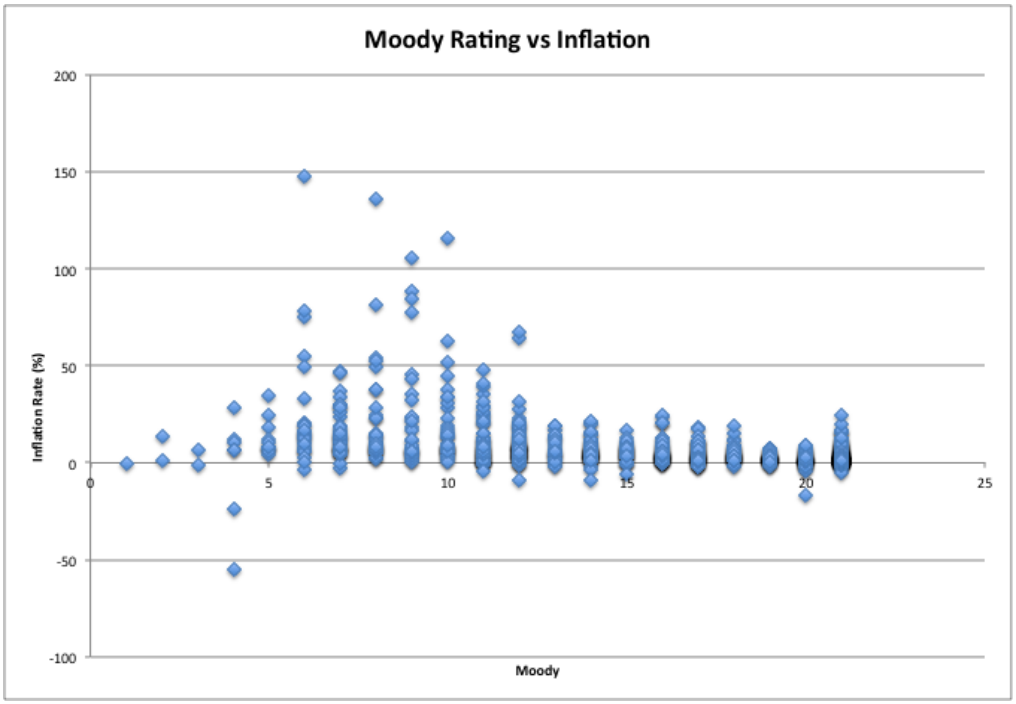

Figure 2: Due to scale distortions, we have omitted the hyperinflationary period in Brazil during the late-1980s and early 1990s.

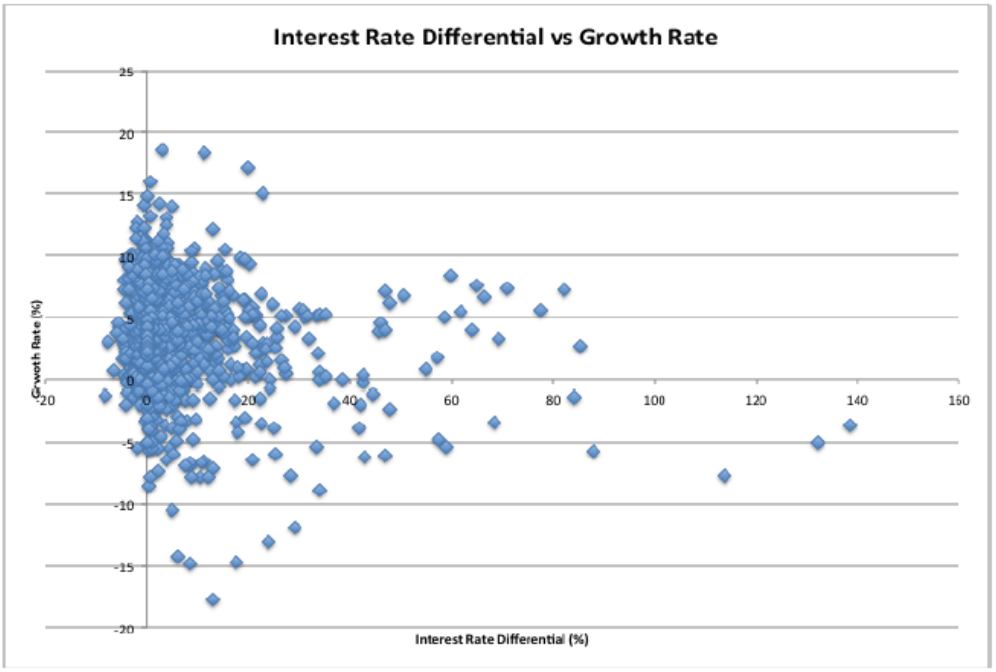

Figure 3:

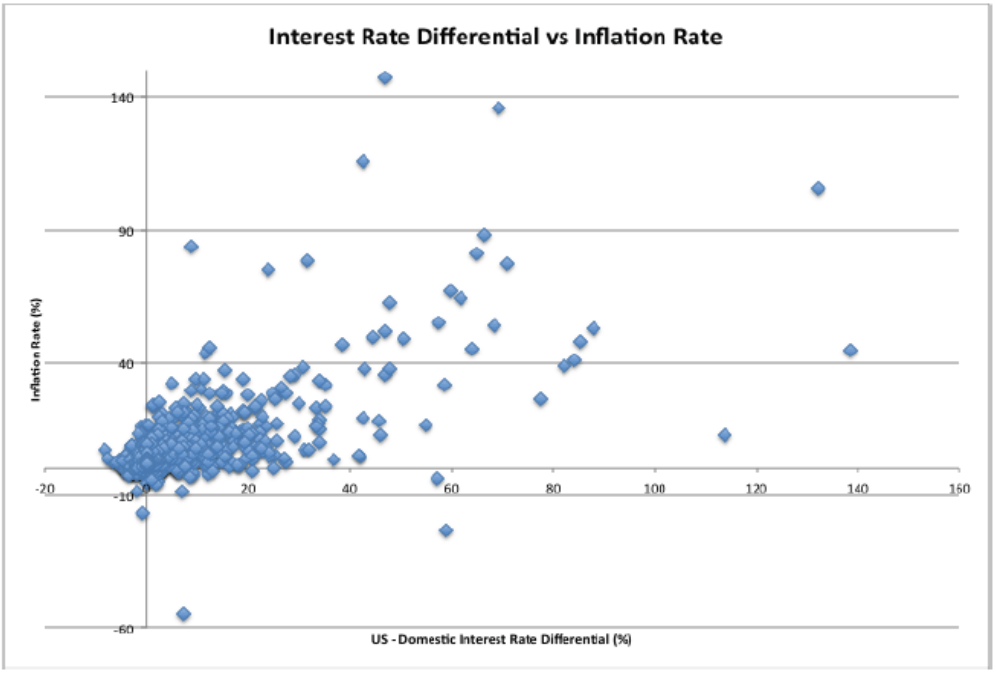

Figure 4:

would be unlikely to sustain demand for the ratings agency's services. This does not preclude the possibility of temporary failures on the part of ratings agencies, but it reduces the probability of systematic and protracted deviations.

Of course, it may be additional dimensions of policy that matter for markets and the rating agencies. However, as the discussion under Section 2 demonstrates, even when the range of macroeconomic fundamentals is expanded considerably, the proportion of the variation in ratings reported remains limited. This is true irrespective of which rating agency is considered - incidentally Moodys records the closest match between fundamentals and rating outcomes. The point that the association between fundamentals and ratings outcomes is imprecise, thus readily generalizes beyond growth and inflation.

This paper therefore explores another possibility. Its starting point is the proposition that if credit ratings matter (say for the cost of borrowing), and if policy quality impacts on the rating, then the policy outcome and the credit rating come to be endogenous to one another. In the model the paper presents, ratings agencies place countries into distinct risk categories. Quality of policy choices do affect the categorizing decisions of ratings agencies. As a result, policy makers will seek to influence ratings through the policy choices they make. Crucial to the decision making of the policy maker, will be the extent to which the credit rating will prove to be responsive to the changes in policy. The model demonstrates that for both policy makers in countries with favorable risk ratings, and for those with unfavorable ratings, it is possible that policy makers will respond rationally either by sound, or by unsound policy choices. The major determinant of the distinction will be the sensitivity of the ratings agency to changes in policy.

2 Background and Problem Statement

There exists an extended literature on credit rating agencies (CRAs) and sovereign default risk.[4]

The fundamental rationale of CRAs is that in the presence of asymmetric information, they produce and disseminate costly information, useful to investors in pricing information-sensitive securities, reducing information costs and increasing the pool of borrowers and raising liquidity of credit markets - see Millon and

[4]For historical background material on the credit rating agencies, see Levich et al (2002), White (2012), and for the methodologies they employ see Bhatia (2002).

Thakor (1985). Alternative justifications identify certification functions used in the classification of assets for financial regulatory purposes either by central banks or under Basel II capital adequacy assessments (Canuto et al, 2012; Kiff et al, 2012), and monitoring and coordination functions in the presence of multiple equilibria (Boot et al, 2006).

Consistent with the understanding of CRAs as providing information, a number of studies have attempted to account for ratings outcomes on the basis of macroeconomic fundamentals.[5] A foundational study by Cantor and Packer (1996b) controlled for real per capita GDP, inflation, growth, the ratio of total external debt to exports, the absence of default history, the level of economic development, and fiscal and current account deficits. But after accounting for real GDP per capita, real GDP growth, inflation, central government deficits, central government gross debt, openness and total net external debt, Canuto et al (2012) account for a minimum of 3.8% (for the S&P rating) and a maximum of 27% (for the Moody rating) of the variation in the ratings outcomes (the average is 11%), once unobserved country heterogeneity is controlled for.[6]

The implication is that while a wide array of macroeconomic fundamentals is correlated with the ratings provided by CRAs, such fundamentals account for only a limited proportion of the variation of the ratings.

One response has been to extend consideration of determinants of the ratings to additional dimensions, such as political risk (see Georgievska et al, 2008; Valler et al, 2006).

Another interpretation of this evidence is that there is a decoupling between macroeconomic fundamentals and the ratings that CRAs provide, suggesting an *inefficiency* of ratings agencies in assessing the risk of sovereign default.[7] But given the correspondence of credit ratings with market-based signals, and the willingness of market participants to pay for CRA ratings, this is too naïve an assessment.

An alternative reading of the evidence is therefore to suggest that the fact that macroeconomic fundamentals incompletely account for rating outcomes, demonstrates precisely that CRAs provide informational

[5] See for instance Afonso (2003), Bisoondoyal-Bheenick (2005), Butler and Fauver (2006), Cantor and Packer (1996b), Canuto et al (2004, 2012), Cavallo et al (2008), Gärtner et al (2011), Georgievska et al (2008), Larraín et al (1997), McNamara and Vaaler (2000) and Valler and McNamara (2004). Note that there is a separate literature that addresses a symmetrical set of questions with respect to corporate debt - we omit further discussion since corporate debt lies beyond the scope of our concern with sovereign risk.

[6] Similar explanatory power to the fixed effects estimation is reported for first difference estimators. The authors report much higher R^2 values under a pooled cross-sectional model. But this effectively leaves the majority of the explanatory power attributable to unobservable (and time-invariant) heterogeneity (they suggest level of development and default) that is *not* due the wide array of macroeconomic fundamentals that they do explicitly control for.

[7] This response is not unpopular. See for instance the discussion in Arezki et al (2011), Cannata (2012), Frost (2006), Gärtner et al (2012), Hunt (2012), Ryan (2012a,b), Schwartz (2012), Tichy (2011).

content beyond that which can be inferred from publicly available macroeconomic indicators, perhaps because CRAs focus on long time horizons thereby avoiding excessive influence from temporary cyclical volatility in macroeconomic indicators (for instance see Altman and Rijken, 2004), or the ability of CRAs to capture the credibility of policy (see for instance Hauner et al, 2010, with respect to the new member states of the EU in contrast to other emerging markets).

That CRAs ratings contain information not publicly available was precisely an inference drawn from the original Cantor and Packer (1996b) results,[8] and would serve to explain the market's willingness to pay for CRAs services. The inference that CRAs provide valuable information to markets is reinforced by a range of empirical findings that demonstrate that CRAs ratings influence spreads (see Eichengreen and Mody, 1998; Reisen and Von Maltzan, 1999; Dell'Arriccia et al, 2006; Mauro et al, 2006; Afonso et al, 2007, Jamarillo and Tejada, 2011) and the cost of borrowing of sovereigns (see Gande and Parsely, 2005; Kiff et al, 2012).[9] It would also explain the use of CRA-ratings in linear and other transforms in order to construct measures of sovereign risk in a range of studies (see Ul-Haque et al, 1996; Sy, 2002; Eichengreen et al, 2003; Reinhart et al, 2003; Borio and Packer, 2004; Baek et al, 2005; Kim and Wu, 2006; Remolona et al, 2008).

But the literature has also highlighted a range of shortcomings that attach to the information signals of CRAs. For instance, the literature notes that CRAs frequently disagree in their assessments (more frequently for sovereigns than for corporate bonds), raising concerns over the credibility of ratings (see Cantor and Packer, 1996a). It is therefore not surprising that not all CRAs appear to generate impacts on spreads (see Reisen and Von Maltzan, 1997). In addition, CRAs on some accounts systematically underestimate risk of default, with macroeconomic fundamentals and political factors predicting a higher chance of default than implied by CRA ratings (see Georgievska et al, 2008). In similar vein, Reinhart (2002) and Rojas-Suares (2001) report poor predictive power of CRA ratings for debt defaults. Additional evidence suggests that CRAs ratings lagged market assessment of sovereign risk in the case of the Mexican crisis of the 1990s (see Larraín et al, 1997). Similar concerns have followed both the Asian (see Reinhart, 2002) and recent global

[8] Cantor and Packer (1996) find that a single rating explains 92% of bond spreads in their sample, and that the rating, while correlated with macro fundamentals, independently affects the spreads.

[9] There is also evidence that changes in ratings of emerging markets has spill-over effects across emerging markets - see Kaminsky and Schuckler (2002) and Ismailescu and Kazemi (2010). For a discussion of issues arising from the impact of ratings on credit default sawp spreads for corporate debt, see Finnerty et al (2013). Given our focus on sovereign risk ratings, and the differential functions of CRAs in the two markets (see Canuto et al, 2012), we do not pursue discussion of this literature further.

crisis (see Kiff et al, 2012).

The upshot of the evidence in the literature is therefore two-fold: first, macroeconomic fundamentals do appear to influence ratings, but the influence is found to be incomplete and imprecise; second, ratings are found to influence the cost of borrowing for sovereigns, but again the impact is found to be incomplete, imprecise and prone to miss large shocks.

Now suppose that both elements of the story carry truth content. Fundamentals do affect ratings. Ratings do affect borrowing costs. What follows immediately is that sovereigns have an incentive to adjust policy so as to affect fundamentals, in order to influence ratings and thereby the cost of borrowing. The consequence would be that any specification either linking ratings to underlying macroeconomic fundamentals, or linking borrowing costs to CRA ratings, would face severe endogeneity problems, thereby potentially rendering empirical estimation results biased and inconsistent.

Yet the literature to the best of our reading has not corrected estimation results for this problem, which would serve to account at least in part for the imprecision in estimation.

This paper takes the possibility of a behavioral response of sovereigns to ratings seriously, and explores its consequences.

The premise of the model is that sovereigns (countries) are allocated to distinct risk "classes" by CRAs. The risk class to which a country is allocated is a function of the quality of its macroeconomic fundamentals. Macroeconomic fundamentals in turn are determined by the policy choices of the sovereign. The model of this paper shows that differential expectations over the success of policy changes in realizing improved credit ratings, can result in an incentive to either "over"- or "under" invest in the quality of policy - which would serve to explain the weak association between observed policy outcomes and credit ratings.

Since countries adjust their policy behavior so as to modify macroeconomic fundamental performance, in order to realize membership of improved risk classes and so improve the net return on borrowing in capital markets, this results in circumstances that are akin to sporting leagues, in which teams are divided into different contests, conditional on the quality of their performance.

As a consequence, while the model presented here is novel, it does have analogues in analyses of sports

leagues.[10] For instance, Noll (2002) presents a profit maximization model for sports clubs that is dependent on investment in player quality.[11] The implication of the model is that under constant market conditions and team locations, teams seek higher quality under promotion and relegation than in leagues of fixed size if teams are more profitable in higher leagues. This is similar to our model, in the sense that just as sporting teams can over- and underinvest in player quality, depending on their beliefs about conditions in the higher/lower league for whose membership they are competing, policy makers in our model can pay too much or too little attention to policy quality, in order to gain membership of more favorable risk ratings.

However, it is also important to note that our circumstances differ in important respects from sporting leagues. Of particular significance given the model we present below, is the fact that promotion and relegation between sporting leagues generates a strategic contest between teams that face the threat of relegation or promotion. This feature is absent from the ratings processes practiced by CRAs. The fact that one country achieves a better (worse) rating, does not entail that another country receives a downgrade (upgrade) in its rating. As a consequence, there is no strategic game between sovereigns in the ratings process. On the other hand, as we show in the discussion which follows, there may well be a strategic interaction between individual sovereigns, and the CRAs.

3 The Model

Our model posits benevolent policy makers that seek to make optimal policy choices. In the model, credit rating agencies that respond to the quality of policy choices of sovereigns by the likelihood with which they assign countries to different risk classes.

Choice agents are economic policy makers (governments; the President; the Minister of Finance). The objective of policy makers is to choose policies that both improve macroeconomic fundamentals, as well as the likelihood of obtaining a good credit rating from rating agencies. Denote macroeconomic fundamentals by Γ. The decision variable is the quality of policy adopted by government, denoted Q. Policy quality

[10] I am grateful to Stephen Ross for pointing out this literature to me.

[11] Note that although many European football clubs are claimed not to operate under a goal of profit maximization (Kesenne 2000, 2007), there is a widespread view that the threat of relegation leads many clubs to spend all available revenues on player talent, resulting in minimal profitability (Kuper and Szymanski 2009).

impacts the macroeconomic fundamentals of the economy, rendering them functionally dependent on policy quality, $\Gamma(Q)$. We posit benevolent policy makers that seek the best possible macroeconomic fundamentals for the economy.

Countries are assessed either by a ratings agency or by the markets in terms of their risk profile. For analytical tractability, let countries fall into two classes (A-rating, B-rating), reflecting differential risk perceptions. Notationally, denote the two risk categories into which rating agencies place countries as $i \in \{a, b\}$, where a denotes an A-rating, b a B-rating. Consistent with the empirical findings that macroeconomic fundamentals impact on CRA-ratings, policy quality impacts the probability with which a country receives an A- or B-rating. Since it is the choice of policy quality that comes to functionally determine macroeconomic fundamentals, and macroeconomic fundamentals in turn are held to functionally determine the probability of each of the two possible ratings, this renders the probability of either rating functionally dependent on policy quality. Accordingly we denote the probability of assigning a country to an A-rating, recognizing its functional dependence on the choice of policy quality, by $0 \leq p(Q) \leq 1$, and hence the probability of assignment to a B-rating by $(1 - p(Q))$. We constrain $\partial p / \partial Q > 0$, such that the probability of being placed under an A-rating increases in policy quality.

While in principle the functional dependence of macroeconomic fundamentals on policy choices may be identical across CRA risk categories, there are several good reasons to suggest that this will not be the case in general. Typically countries are not homogeneous in terms of their institutional capacity. This relates both to the degree of development of their regulatory institutions (such as the central bank, fiscal authorities, financial market regulators, etc.) and the depth of market structures in economies (for instance, typically financial markets show greater depth with higher levels of economic development). The extent of both public and private institutional development therefore carries with it the potential of a differential impact of changes in discretionary action by policy makers on macroeconomic fundamentals. The human capital capacity available to policy makers across countries is also not always homogeneous. Differences in levels of training, the absolute number of technocrats with requisite training, and the depth of exposure to relevant market conditions requiring policy action, all tend to vary across sovereign jurisdictions. Finally, the quantity, relevance, quality and reliability of data available for the formulation of policy tends to be

heterogeneous across countries. These differences may themselves substantially explain why countries fall into differential risk classes.

For these reasons, we allow for the possibility that the nature of the functional dependence of macroeconomic fundamentals, Γ, on policy choices, Q, may be distinct across the two categories of countries. This does not preclude the possibility that countries may also be homogeneous in the way their macroeconomic fundamentals depend on policy quality. But for generality we allow for heterogeneity. Then:

$$\Gamma_i(Q), \ \forall i \in \{a, b\} \tag{1}$$

under a concavity in policy quality assumption, such that $\partial\Gamma_i/\partial Q \gtreqless 0$, $\partial^2\Gamma_i/\partial Q^2 < 0$.[12]

Symmetrically, the probability of assignment to an A-rating given any choice of policy quality may be distinct for countries currently assigned to an A- or a B-rating:

$$0 \leq p_i(Q) \leq 1, \ \forall i \in \{a, b\} \tag{2}$$

with the probability of assignment to a B-rating, $(1 - p_i(Q))$, similarly differentiated across the current country categorization.

Finally by assumption there exists a strict ordering such that:

$$\Gamma_a > \Gamma_b > 0 \tag{3}$$

to reflect the intuition that countries are placed into the two distinct risk classes by the markets or rating agency by virtue of the nature of their macroeconomic fundamentals (see the review of the empirical literature).

Since our choice agents seek to influence both macroeconomic fundamentals and the likelihood of receiving

[12] Implicit in the concavity assumption is that investment in policy quality, while improving the macroeconomic fundamentals and hence economic welfare, is costly, and that the cost is convex in the investment in policy quality. Thus we may posit that $\Gamma_i(Q) = R_i(Q) - C_i(Q)$, $s.t. \frac{\partial R_i}{\partial Q} > 0, \frac{\partial^2 R_i}{\partial Q^2} < 0$, and $s.t. \frac{\partial C_i}{\partial Q} > 0, \frac{\partial^2 C_i}{\partial Q^2} > 0$, where $R_i(Q)$ denotes the welfare benefits of improving macroeconomic fundamentals, $C_i(Q)$ the cost of doing so. This provides the strict concavity implication we state. The analysis of the paper can be conducted rendering the welfare benefits and costs of investment in policy quality explicit. The inferences of the paper remain the same as those reported. For this reason we adopt the more parimonious representation.

a good credit rating, the decision problem of the policy maker is given by:[13]

$$\arg\max_{Q} V_i(Q) = p_i(Q)\,\Gamma_a(Q) + (1 - p_i(Q))\,\Gamma_b(Q)\,,\ \forall i \in \{a, b\} \tag{4}$$

with associated first order condition:[14]

$$\frac{\partial V_i(Q)}{\partial Q} = 0,\ \forall i \in \{a, b\} \tag{5}$$

3.1 Implications for Investment in Policy Quality: country heterogeneity in policy quality responsiveness

The decisions of policy makers of any one country under either an A- or a B-rating are not strategically interdependent, in the sense that the probability of relegation, and likewise the probability of promotion between categories, do not depend on what policy makers in other countries do.

Suppose that the functional dependence of macroeconomic fundamentals on policy choices are not identical across CRA risk categories, so that (1), (2) and (3) apply.[15]

Then the FOC for countries with an a-rating differ from the FOC of countries with a b-rating. For a-rated

[13] Note that while in principle the decision problem of the sovereign is one that is repeated over time, absent any non-linearities in adjustment costs, and under a time-invariant discount rate of $0 < \rho < 1$, then simply gives the expected value decision problem for policy makers of $\arg\max_{Q} \sum_{i=0}^{\infty} \rho^i E(\Gamma)_{t+i}$, trivial in any dynamic sense. For this reason we suppress any discussion of dynamics.

[14] A brief note on risk aversion on the part of policy makers. Note that for $E[\Gamma(Q)]$, we have:

$$\frac{\partial^2 E[\Gamma(Q)]}{\partial Q^2} = \frac{\partial^2 p_a(Q)}{\partial Q^2}[\Gamma_a(Q) - \Gamma_b(Q)] + p_a(Q)\frac{\partial^2 \Gamma_a(Q)}{\partial Q^2} + (1 - p_a(Q))\frac{\partial^2 \Gamma_b(Q)}{\partial Q^2}$$

By assumption, $\partial^2\Gamma_a(Q)/\partial Q^2 < 0$, $\partial^2\Gamma_b(Q)/\partial Q^2 < 0$. For risk aversion, therefore, $\partial^2 p_a(Q)/\partial Q^2 < 0$, is certainly sufficient. Where $\partial^2 p_a(Q)/\partial Q^2 > 0$ should apply, risk aversion would necessitate:

$$\frac{\partial^2 p_a(Q)}{\partial Q^2}[\Gamma_a(Q) - \Gamma_b(Q)] < -p_a(Q)\frac{\partial^2 \Gamma_a(Q)}{\partial Q^2} - (1 - p_a(Q))\frac{\partial^2 \Gamma_b(Q)}{\partial Q^2}$$

[15] Note that where the impact of improvements in policy quality on the policy environment in a-class countries is identical to that in b-class countries, $(\partial\Gamma_a/\partial Q) = (\partial\Gamma_b/\partial Q) = \partial\Gamma/\partial Q$, the FOC reduces to:

$$\frac{\partial p_a}{\partial Q}[\Gamma_a(Q) - \Gamma_b(Q)] + \frac{\partial \Gamma}{\partial Q} = 0$$

Since by assumption $[\Gamma_a(Q) - \Gamma_b(Q)] > 0$, and $\partial p_a/\partial Q > 0$, it follows that:

$$\frac{\partial \Gamma}{\partial Q} < 0$$

i.e. policy makers are compelled to invest in "good" policy beyond the policy environment optimizing point.

countries we require that:

$$\frac{\partial p_a}{\partial Q}\Gamma_a(Q) + p_a(Q)\frac{\partial \Gamma_a}{\partial Q} + \frac{\partial(1-p_a)}{\partial Q}\Gamma_b(Q) + (1-p_a(Q))\frac{\partial \Gamma_b}{\partial Q} = 0$$

while for b-rated countries:

$$\frac{\partial p_b}{\partial Q}\Gamma_a(Q) + p_b(Q)\frac{\partial \Gamma_a}{\partial Q} + \frac{\partial(1-p_b)}{\partial Q}\Gamma_b(Q) + (1-p_b(Q))\frac{\partial \Gamma_b}{\partial Q} = 0$$

such that:

$$\begin{aligned}\frac{\partial \Gamma_a}{\partial Q} &= \left(\frac{-1}{p_a(Q)}\right)\left[\frac{\partial p_a}{\partial Q}\Gamma_a(Q) + \frac{\partial(1-p_a)}{\partial Q}\Gamma_b(Q) + (1-p_a(Q))\frac{\partial \Gamma_b}{\partial Q}\right] \\ &= -\left[\left(\frac{\partial p_a/\partial Q}{p_a(Q)}\right)(\Gamma_a(Q)-\Gamma_b(Q)) + \left(\frac{1-p_a(Q)}{p_a(Q)}\right)\frac{\partial \Gamma_b}{\partial Q}\right] \qquad (6)\end{aligned}$$

and symmetrically, for b-rated countries:

$$\begin{aligned}\frac{\partial \Gamma_b}{\partial Q} &= \left(\frac{-1}{1-p_b(Q)}\right)\left[\frac{\partial p_b}{\partial Q}\Gamma_a(Q) + p_b(Q)\frac{\partial \Gamma_a}{\partial Q} + \frac{\partial(1-p_b)}{\partial Q}\Gamma_b(Q)\right] \\ &= -\left[\left(\frac{\partial p_b/\partial Q}{1-p_b(Q)}\right)(\Gamma_a(Q)-\Gamma_b(Q)) + \left(\frac{p_b(Q)}{1-p_b(Q)}\right)\frac{\partial \Gamma_a}{\partial Q}\right] \qquad (7)\end{aligned}$$

While the optimal policy choices of a- or b-rated countries are not strategically interdependent, the optimal actions of policy makers in countries in the a-rating *do* depend on the responsiveness of macroeconomic fundamentals to changes in policy quality in b-rated countries - and vice versa. Specifically, the FOC (6) makes $\partial\Gamma_a/\partial Q$ functionally dependent on $(\partial\Gamma_b/\partial Q)$, while for b-rated countries, there is a symmetrical dependence on $\partial\Gamma_a/\partial Q$.

3.1.1 The Outcome for a-rated Countries

Suppose that the policy makers are rational.

Then, a-rated country policy makers can infer the responsiveness of macroeconomic fundamentals to

changes in policy quality in b-rated countries directly by means of (7). By substitution it follows that:

$$\frac{\partial \Gamma_a}{\partial Q} = \left[\frac{(1 - p_a(Q)) \left(\frac{\partial p_b}{\partial Q} \right) - (1 - p_b(Q)) \left(\frac{\partial p_a}{\partial Q} \right)}{p_a(Q) - p_b(Q)} \right] (\Gamma_a(Q) - \Gamma_b(Q)), \; p_a(Q) \neq p_b(Q) \tag{8}$$

The marginal reduction in the probability of relegation for an a-rated country is given by:

$$\eta_a \equiv \frac{\partial p_a / \partial Q}{1 - p_a(Q)} \tag{9}$$

while the marginal reduction in the probability of remaining relegated in the b-rating is given by:

$$\eta_b \equiv \frac{\partial p_b / \partial Q}{1 - p_b(Q)} \tag{10}$$

Under the assumptions that $(\Gamma_a(Q) - \Gamma_b(Q)) > 0$, $p_a(Q) \neq p_b(Q)$, it then follows from (8) that:

$$\frac{\partial \Gamma_a}{\partial Q} \gtreqless 0 \; if \begin{cases} \frac{\eta_a}{\eta_b} < 1 \\ \frac{\eta_a}{\eta_b} = 1 \quad where \; p_a(Q) > p_b(Q) \\ \frac{\eta_a}{\eta_b} > 1 \end{cases} \quad and \quad \frac{\partial \Gamma_a}{\partial Q} \gtreqless 0 \; if \begin{cases} \frac{\eta_a}{\eta_b} > 1 \\ \frac{\eta_a}{\eta_b} = 1 \quad where \; p_a(Q) < p_b(Q) \\ \frac{\eta_a}{\eta_b} < 1 \end{cases} \tag{11}$$

In terms of whether policy makers in the a-rated countries will invest heavily in policy quality (in the sense that $(\partial \Gamma_a / \partial Q) < 0$, beyond the $(\partial \Gamma_a / \partial Q) = 0$ optimization point), weakly in policy quality (in the sense that $(\partial \Gamma_a / \partial Q) > 0$, below the $(\partial \Gamma_a / \partial Q) = 0$ optimization point), or "optimally" in policy quality (in the sense that countries simply follow standard optimization strategies, such that $(\partial \Gamma_a / \partial Q) = 0$), this results in five categories of countries in the a-rating, determined by the interplay of two factors:

- The impact of investing in policy quality in avoiding relegation from the a-rating to the b-rating (η_a), *relative to* its impact in raising the probability of promotion from the b-rating (η_b). The relative impact can be **high** ($\eta_a / \eta_b > 1$), **low** ($\eta_a / \eta_b < 1$), or **equal** ($\eta_a / \eta_b = 1$).

- The relative magnitude of the probability of maintaining an a-rating ($p_a(Q)$) to the probability of being promoted from the b- to an a-rating ($p_b(Q)$). Since by assumption $p_a(Q) \neq p_b(Q)$, the logical

possibilities are that the relative magnitude is **greater** ($p_a(Q) > p_b(Q)$), or **less** ($p_a(Q) < p_b(Q)$) than.

The five resultant categories of a-rated countries are then:

- *Escape Relegation*: Where $\eta_a/\eta_b > 1$, and $p_a(Q) > p_b(Q)$, policy makers will invest heavily in policy quality ($(\partial\Gamma_a/\partial Q) < 0$). Since there is a high return to investment in policy quality in terms of lowering the probability of relegation from the a- to the b-rating, while there is a low prospect of being promoted again from the b-rating after relegation, there is strong incentive to invest in policy quality while the country is in the a-rating in order to avoid relegation, since once demoted to the b-rating it is more difficult to return to the a-rating. Investment in policy quality is thus a preemptive strategy to avoid relegation "at all cost."

- *Ensure Re-Promotion*: Where $\eta_a/\eta_b < 1$, and $p_a(Q) < p_b(Q)$, policy makers will invest heavily in policy quality ($(\partial\Gamma_a/\partial Q) < 0$). Since there is a relatively high return to investment in policy quality in terms of raising the probability of repromotion from the a- to the b-rating, while there is a relatively high prospect of being promoted again from the b-rating after relegation, there is considerable incentive to invest in policy quality in order to maximize the probability of repromotion should the country fail to avoid relegation to the b-rating. Investment in policy quality is thus a preemptive strategy to improve the chances of re-promotion.

- *Resting on Laurels*: Where $\eta_a/\eta_b < 1$, and $p_a(Q) > p_b(Q)$, policy makers will invest weakly in policy quality ($(\partial\Gamma_a/\partial Q) > 0$). Since there is a relatively low return to investment in policy quality in terms of avoiding the probability of relegation, while the prospect of maintaining an a-rating is high regardless of investment in policy quality, there is a disincentive to invest in policy quality, since it has little impact on avoiding relegation, and the chances of remaining in the a-rating is high in any event.

- *Resignation*: Where $\eta_a/\eta_b > 1$, and $p_a(Q) < p_b(Q)$, policy makers will invest weakly in policy quality ($(\partial\Gamma_a/\partial Q) > 0$). Since the probability of re-promotion to the a-rating is viewed as being high regardless of present investment in policy quality, relegation represents insufficient risk to trigger current heavy investment in policy quality.

- *Simple Rationality*: Where $\eta_a/\eta_b = 1$, countries simply follow standard optimization strategies, such that $(\partial\Gamma_a/\partial Q) = 0$. As a result, the level of investment in policy quality will be less intensive than for Escape Relegation or Ensure Repromotion type countries, but higher than for Resignation or Resting on Laurels type countries.

Table 1 summarizes.

	$p_a(Q) > p_b(Q)$	$p_a(Q) < p_b(Q)$
$\frac{\eta_a}{\eta_b} > 1$	**Escape Relegation:** High Policy Quality	**Resignation:** Low Policy Quality
$\frac{\eta_a}{\eta_b} = 1$	**Simple Rationality:** Intermediate Policy Quality	**Simple Rationality:** Intermediate Policy Quality
$\frac{\eta_a}{\eta_b} < 1$	**Resting on Laurels:** Low Policy Quality	**Ensure Re-Promotion:** High Policy Quality

Table 1: a-rated country outcomes

3.1.2 The Outcome for *b*-rated Countries

The result for the *b*-rated countries is symmetrical to that for *a*-rated countries.

Again assume policy makers to be rational. Then, *b*-rated country policy makers can infer the responsiveness of macroeconomic fundamentals to changes in policy quality in *a*-rated countries by (6), and by substitution it follows that:

$$\frac{\partial\Gamma_b}{\partial Q} = \left[\frac{p_b(Q)\left(\frac{\partial p_a}{\partial Q}\right) - p_a(Q)\left(\frac{\partial p_b}{\partial Q}\right)}{p_a(Q) - p_b(Q)}\right](\Gamma_a(Q) - \Gamma_b(Q)) \tag{12}$$

The marginal increase in the probability of remaining promoted thanks to investment in policy quality for an *a*-rated country is given by:

$$\mu_a \equiv \frac{\partial p_a/\partial Q}{p_a(Q)} \tag{13}$$

while the marginal increase in the probability of promotion from the *b*- to the *a*-rating due to investment in policy quality is given by:

$$\mu_b \equiv \frac{\partial p_b/\partial Q}{p_b(Q)} \tag{14}$$

Under the assumptions that $(\Gamma_a(Q) - \Gamma_b(Q)) > 0$, $p_a(Q) \neq p_b(Q)$, it then follows from (8) that:

$$\frac{\partial \Gamma_b}{\partial Q} \gtreqless 0 \; if \begin{cases} \frac{\mu_b}{\mu_a} < 1 \\ \frac{\mu_b}{\mu_a} = 1 \quad where\, p_a(Q) > p_b(Q) \\ \frac{\mu_b}{\mu_a} > 1 \end{cases} \quad and \quad \frac{\partial \Gamma_b}{\partial Q} \gtreqless 0 \; if \begin{cases} \frac{\mu_b}{\mu_a} > 1 \\ \frac{\mu_b}{\mu_a} = 1 \quad where\, p_a(Q) < p_b(Q) \\ \frac{\mu_b}{\mu_a} < 1 \end{cases} \tag{15}$$

As for a-rated countries, whether policy makers in the b-rated countries will invest heavily in policy quality (so that $(\partial \Gamma_b / \partial Q) < 0$, beyond the $(\partial \Gamma_b / \partial Q) = 0$ optimization point), weakly in policy quality (so $(\partial \Gamma_b / \partial Q) > 0$, below the $(\partial \Gamma_b / \partial Q) = 0$ optimization point), or "optimally" in policy quality (in the sense that countries simply follow standard optimization strategies, such that $(\partial \Gamma_b / \partial Q) = 0$), this results in five categories of countries in the b-rating, determined by the interplay of two factors:

- The impact of investing in policy quality in raising the probability of being promoted from the b- to an a-rating (μ_b), *relative to* its impact in raising the probability of remaining promoted in the a-rating (μ_a). The relative impact can be **high** ($\mu_b/\mu_a > 1$), **low** ($\mu_b/\mu_a < 1$), or **equal** ($\mu_b/\mu_a = 1$).
- The relative magnitude of the probability of maintaining an a-rating ($p_a(Q)$) to the probability of being promoted from the b- to an a-rating ($p_b(Q)$). Since by assumption $p_a(Q) \neq p_b(Q)$, the logical possibilities are that the relative magnitude is **greater** ($p_a(Q) > p_b(Q)$), or **less** ($p_a(Q) < p_b(Q)$) than.

The five resultant categories of b-rated countries now are:

- *Strategic Investment*: Where $\mu_b/\mu_a > 1$, and $p_a(Q) > p_b(Q)$, policy makers will invest strongly in policy quality ($(\partial \Gamma_b / \partial Q) < 0$). Since there is a relatively high return to investment in policy quality in terms of increasing the probability of promotion, and a high probability of remaining promoted once a-rated, there is an incentive to invest in policy quality while the country is b-rated to achieve promotion. Investment in policy quality is a strategy to escape the lower rating, and to gain promotion to the higher rating, taking advantage of the productivity of investment in policy quality while in the lower rating.

- *Ensure Promotion*: Where $\mu_b/\mu_a < 1$, and $p_a(Q) < p_b(Q)$, policy makers will invest strongly in policy quality ($(\partial\Gamma_b/\partial Q) < 0$). Since there is a relatively high prospect of being promoted from the b-rating, and the impact of investment in policy quality will be high once promotion is secured ($\mu_a > \mu_b$) there is an incentive to invest in policy quality, to take advantage of the chances of promotion, and the ability to increase the probability of avoiding re-relegation should the a-rating be achieved.

- *Fatalism*: Where $\mu_b/\mu_a < 1$, and $p_a(Q) > p_b(Q)$, policy makers will invest weakly in policy quality ($(\partial\Gamma_b/\partial Q) > 0$). Since there is a relatively low return to investment in policy quality in terms of achieving promotion, while there is a relatively low prospect of being promoted from the b-rating, there is a disincentive to invest in policy quality, since it has little impact on achieving promotion, and the chances of promotion are low in any event.

- *Banking on Inevitability*: Where $\mu_b/\mu_a > 1$, and $p_a(Q) < p_b(Q)$, policy makers will invest weakly in policy quality ($(\partial\Gamma_b/\partial Q) > 0$). Since the probability of promotion to the a-rating is viewed as being high regardless of present investment in policy quality, policy makers await the promotion without resorting to improvement in policy quality.

- *Simple Rationality*: Where $\mu_b/\mu_a = 1$, policy makers simply follow standard optimization strategies ($(\partial\Gamma_b/\partial Q) = 0$). As a result, the level of investment in policy quality will be less intensive than for Strategic Investment or Ensure Promotion type countries, but higher than for Fatalism or Banking on Inevitability type countries.

Table 2 summarizes.

	$p_a(Q) > p_b(Q)$	$p_a(Q) < p_b(Q)$
$\frac{\mu_b}{\mu_a} > 1$	**Strategic Investment:** High Policy Quality	**Banking on Inevitability:** Low Policy Quality
$\frac{\mu_b}{\mu_a} = 1$	**Simple Rationality:** Intermediate Policy Quality	**Simple Rationality:** Intermediate Policy Quality
$\frac{\mu_b}{\mu_a} < 1$	**Fatalism:** Low Policy Quality	**Ensure Promotion:** High Policy Quality

Table 2: b-rated country outcomes

3.1.3 The Empirical Implication

Fundamentally the model above carries the empirical prediction that the association between policy quality and credit risk ratings will be conditional on both the probability of falling into the a- and b-ratings categories, and the responsiveness of the rating to policy improvements. Tables 1 and 2 illustrate. Note that this distribution of policy outcomes would be consistent with the descriptive evidence of Figures 1 and 2 of the introduction of the paper, in the sense that the model predicts that there will be no direct clear association between risk assessments and the quality of government policy performance.

Instead, the expectation is now that policy outcomes will be better under a high responsiveness of the rating agency to improvements in policy quality.

3.2 A Simple Representation of the Implied Interaction Between Policy Makers and the Rating Agency

The obvious question at this point is why the credit rating agency manifests such a range of responses to the choices of policy makers. Why not simply adopt a $\partial p_i/\partial Q, i \in (a,b)$ value that creates a strong incentive for policy makers to adopt the best possible policy?

Part of the answer to this puzzle emerges from a recognition from any rational rating agency that policy makers may themselves rationally choose to adopt poor policy regardless of the responsiveness of ratings to changes in underlying policy quality, depending on the expectation of the policy makers on realizing high or low ratings. As the previous section has shown, policy makers may adopt any of $\partial\Gamma_i/\partial Q \lessgtr 0$, conditional on $\partial p_i/\partial Q, i \in (a,b)$ as well as $p_a(Q)$ and $p_b(Q)$.

Failure of the rating agency to correctly anticipate the choice of policy quality by the policy maker, carries the risk of a loss of reputation for the rating agency. Ideally the rating agency would like to show a strong responsiveness in $\partial p_i/\partial Q, i \in (a,b)$ only where $\partial\Gamma_i/\partial Q \leq 0$ (i.e. there is a strong investment in policy quality), and a low responsiveness where $\partial\Gamma_i/\partial Q > 0$ (i.e. there is a weak investment in policy quality).

Thus, while there is no real strategic interaction between countries in their pursuit of ratings, there is a strategic interaction between countries and the rating agency.

To explore this, we allow the country policy makers to choose between the $\partial\Gamma_i/\partial Q \lessgtr 0$ alternatives.

The credit rating agency chooses how responsive it is to changes in policy quality, by allowing either $\partial p_i/\partial Q \to 0$ (low responsiveness), or $\partial p_i/\partial Q \gg 0$ (high responsiveness). Allowing the notational convention that λ represents either η_a/η_b or μ_b/μ_a, the implication is that for small changes in probability values in response to policy changes, $\partial p_i/\partial Q \to 0$, it follows that $\lambda \to 0$, while for large changes in probability values to changes in policy quality, $\partial p_i/\partial Q \gg 0$, it follows that $\lambda \to \infty$.

The most intuitive timing assumption is to allowing policy makers and rating agencies to exercise their strategic choice simultaneously and independently, to reflect the ongoing and continuous nature both of ratings evaluations and of policy decisions.[16] This provides the normal form game illustrated in Table 3, where the c_i and r_i denote the country and rating agency payoffs respectively.

		Rating Agency	
		$\lambda \to \infty$	$\lambda \to 0$
Policy	$\frac{\partial \Gamma_i}{\partial Q} < 0$	c_1, r_1	c_2, r_2
Maker	$\frac{\partial \Gamma_i}{\partial Q} > 0$	c_3, r_3	c_4, r_4

Table 3: Normal Form Interaction between Sovereigns and Rating Agencies

Provided that for reputational reasons the credit rating agency wants to get its assessments of countries "right," we can assume that $r_1 > r_2$, and $r_4 > r_3$. Similarly, if countries wish ratings to reflect their policy choices, then $c_1 > c_3$, and $c_4 > c_2$.

Under strategic uncertainty, there is no unique Nash equilibrium, hence equilibrium strategies are mixed strategies.

Denote the belief structure of the rating agency by $\theta_R = (q, 1-q)$, where q denotes the subjective probability the rating agency attaches to $\partial \Gamma_i/\partial Q < 0$ (i.e. high policy quality being played by the policy makers), such that $1-q$ denotes the subjective probability the rating agency attaches to $\partial \Gamma_i/\partial Q > 0$ (i.e. low policy quality being played by the policy makers).

Symmetrically, we denote the belief structure of the country policy makers by $\theta_C = (m, 1-m)$, where m denotes the subjective probability the country policy maker attaches to $\lambda \to \infty$ (i.e. high responsiveness of the rating agency to changes in policy quality), such that $1-m$ denotes the subjective probability the

[16] The obvious question then is why the game is not presented in dynamic form. Strictly, the game is repeated. However, since there is no change in the structure of the strategic interaction over the repeated games, any stage game solution will also be sub-game perfect. Dynamics are therefore suppressed for convenience of presentation.

policy maker attaches to $\lambda \to 0$ (i.e. low responsiveness of the rating agency to changes in policy quality).

The implied equilibrium mixed strategy probability values are then given by:

$$\begin{aligned} \sigma_C &= \left(\frac{r_4 - r_3}{(r_1 - r_2) + (r_4 - r_3)}, \frac{r_1 - r_2}{(r_1 - r_2) + (r_4 - r_3)} \right) \\ \sigma_R &= \left(\frac{c_4 - c_2}{(c_1 - c_3) + (c_4 - c_2)}, \frac{c_1 - c_3}{(c_1 - c_3) + (c_4 - c_2)} \right) \end{aligned}$$

where σ_C denotes the equilibrium mixed strategy for country policy makers, and σ_R denotes the equilibrium mixed strategy for the rating agency.

Note the implications. It is increases in the payoffs that attach to low rating responsiveness to changes in policy quality (high r_4 and r_2), that serve to increase the $(r_4 - r_3)$ difference, or lower the $(r_1 - r_2)$ difference, so as to raise the equilibrium likelihood of high policy quality $\partial \Gamma_i / \partial Q < 0$ and lower the probability of poor policy quality $\partial \Gamma_i / \partial Q > 0$ being played by policy makers respectively. Hence, the rating agency has good reason to emphasize the payoffs that attach to low rating responsiveness to changes in policy quality (high r_4 and r_2), since it serves to emphasize the need for policy makers to be particularly vigilant on policy quality, and hence raises the associated probability value.

On the other hand, it is increases in c_4 and c_3 that serve to increase the $(c_4 - c_2)$ difference and lower the $(c_1 - c_3)$ difference, that serve to raise the equilibrium likelihood of high responsiveness of the rating agency to changes in policy quality $\lambda \to \infty$, and lower the equilibrium likelihood of low responsiveness of the rating agency to changes in policy quality $\lambda \to 0$ respectively. Hence policy makers have good reason to emphasize the attractiveness of poor policy choices, so as to increase the responsiveness of the rating agency to improvements in policy.

The net empirical implication of this is that even if we account for the possibility of strategic interaction between policy makers and the rating agency, the positive association between the responsiveness of the rating agency to changes in policy and the quality of policy should be maintained. However, we note that the inference is also that the quality of policy, and the responsiveness of the rating agency codetermine one another - causality does not run simply from one to the other.

4 Empirical Evaluation

In what follows, we explore the empirical implications of the model we have presented. We consider evidence both from sample means, as well as more analytical evidence.

4.1 Data

We employ the following data:

- The Moody rating of sovereign government debt. Moody ratings from C through Aaa were assigned numeric scores over the 1 through 21 range, in order to render them numeric. Appendix 1 provides the precise coding values.
- IMF international Financial Statistics on the following: the interest rate;[17] the growth rate of real GDP; the GDP-deflator based inflation rate.

Data was collected on a total of 60 countries. Unavailability of Moody ratings on sovereign government debt for more than 5 annual observations limited the sample to 60 countries. The list of countries included in the study is reported in Appendix 2 of the paper.

The sample period was set to 1980 through 2013, though for a range of countries particularly Moody ratings on sovereign government debt were available only for sub-sample periods.

4.2 Baseline Evaluation

In our baseline evaluation of the empirical evidence, we classify data points of countries as falling either into the a-rating category, or the b-rating category, as well as whether the responsiveness of the rating of a country is high or low.

In our data sample, where we include the hyperinflationary periods of Brazil and Bulgaria, the mean Moody rating is 15.99 (median 17.00), while under exclusion of the hyperinflationary period the mean Moody rating is 16.07 (median 17.00). We then classify each observation as falling into either a high or low Moody

[17] WE employed data as consistently as possible across coutnries. However, due to differential data availability, we employed the lending rate, the Treasury Bill rate as well as the government bond rate.

rating (corresponding to our a-rating or b-rating categories), conditional on whether the observed Moody rating for that year falls above or below the sample mean value.

Unfortunately we are not able to observe the beliefs that policy makers hold about the impact on both the probability of maintaining the existing rating a country holds, nor their beliefs concerning the impact of policy quality on probability structures should the country be recategorized to alternative risk profiles. Our recourse is to proxy the responsiveness of the Moody ratings to the quality of policy maintained[18] by means of the correlation between changes in Moody ratings and changes in either the growth rate in real GDP, or the inflation rate (as determined by the GDP deflator). High responsiveness is allocated to cases where the correlation falls above the sample mean, low responsiveness where it falls below the sample mean.[19] Note that the correlations across the two policy variables have different interpretations. For growth, a positive correlation implies that higher growth is associated with an improved rating. For inflation, a positive correlation implies that improved ratings are associated with higher inflation. To aid interpretation, in this section we report results employing reversed signs in the case of inflation, to render interpretation consistent across the two policy measures.

In the introduction, we have already reported the weak association between policy quality and Moody ratings outcomes. In Table 4, we report the mean growth rate in our sample for all data points for which the country Moody rating lay above, and below the sample mean value of the Moody rating. Where the data includes the hyperinflationary period in Brazil and Bulgaria, note that the mean growth rate of countries highly rated by Moody's is 3.15% per annum; that of countries with low Moody ratings 3.74%. Where we exclude the hyperinflationary period, the differential is even more marked - with highly rated countries reporting 2.92% growth on average, poorly rated countries 3.98% on average. We also report these growth averages after eliminating outlier observations in the sample growth rate, that appear particularly large - while the reported averages change marginally, they do not change the underlying pattern: that countries that obtain low Moody ratings, on average report higher growth rates than do countries with high Moody ratings. This accords with the findings of our introduction: with respect to growth, good policy does not

[18] The the η_a/η_b and μ_b/μ_a ratios of the model.

[19] This is a simplification from the model: it really captures only the extent to which the rating changes in the existing risk class - not the counterfactual of what would happen if the country was reassigned to the alternative risk class. The latter is unobservable.

readily translate into better Moody ratings.

	With Hyperinflation		Without Hyperinflation	
	Below Mean Moody	Above Mean Moody	Below Mean Moody	Above Mean Moody
Growth	3.74	3.15	3.98	2.92
	Removing Growth Outliers		Removing Growth Outliers	
Growth	3.74	3.12	3.79	2.62

Table 4: Growth Performance of Countries with High and Low Moody Ratings

In Table 5 we report the mean inflation rates in our sample for all data points for which the country Moody rating lay above, and below the sample mean value of the Moody rating. Where we include the hyperinflationary periods in Brazil and Bulgaria, there does appear to be a dramatic difference between countries with high and with low Moody ratings. For those with high Moody rating scores, the mean inflation rate is 3.49%, for countries with low ratings a considerably higher 33.63%. However, where we remove the hyperinflationary observations (12 observations out of our total data set of 1342 observations), notice that the distinction is considerably less dramatic: highly rated countries report an average inflation of 3.29%, countries with low ratings 11.15%. Admittedly, lowly Moody rated countries on average still have inflation four times as high as the highly rated countries - but 12% inflation is hardly indicative of crisis-level inflation, yet Moody ratings continue to reflect considerable risk. Once again, therefore, the dramatic differences in Moody ratings between countries, and the associated lending costs this translates into for countries, does not appear to have strong association with the objective underlying policy performance of countries.

	With Hyperinflation		Without Hyperinflation	
	Below Mean Moody	Above Mean Moody	Below Mean Moody	Above Mean Moody
Inflation	33.63	3.49	11.15	3.29

Table 5: Inflation Performance of Countries with High and Low Moody Ratings

Now consider the effect of conditioning this evidence on the responsiveness of Moody ratings to changes in policy.

In Table 6, we again report the mean growth rate in our sample for all data points for which the country Moody rating lay above, and below the sample mean value of the Moody rating, but we also differentiate between data points associated with high and low responsiveness of the Moody rating to changes in the

growth performance of countries. Note that the evidence now conforms precisely with the predictions of our model. Countries for which the responsiveness of Moody ratings is high (above sample mean), invariably record higher growth performance than countries with a Moody rating responsiveness that is below average. Indeed, the highest growth performance in sample is now recorded for cases that have *both* an above average Moody rating, *and* an above average responsiveness of the Moody rating to policy changes. Conversely, the lowest growth performance occurs for countries which have high Moody ratings, but where the Moody rating does not respond strongly to policy changes.

		With Hyperinflation		Without Hyperinflation	
	Responsiveness of Moody to Policy Change:	Below Mean Moody	Above Mean Moody	Below Mean Moody	Above Mean Moody
Growth	Above Mean	3.89	4.13	3.89	4.14
	Below Mean	3.33	2.74	3.42	2.74
		Removing Growth Outliers		Removing Growth Outliers	
Growth	Above Mean	3.89	4.13	3.58	4.13
	Below Mean	3.33	2.69	2.68	2.69

Table 6: Growth Performance of Countries with High and Low Moody Ratings

Table 7 repeats the exercise for inflation. Again we report the mean inflation rate for all data points for which the country Moody rating lies above and below the sample mean, but differentiate between data points associated with low and high responsiveness of the Moody rating to changes in the inflation rate of countries. Again the evidence conforms with the predictions of our model. Countries for which the responsiveness of Moody ratings is high (above sample mean), invariably record lower inflation performance than countries with a Moody rating responsiveness that is below average. For the data that includes the hyperinflationary evidence, the lowest inflation rates occur in countries that have *both* an above average Moody rating, *and* an above average responsiveness of the Moody rating to policy changes - once the hyperinflation is removed, there is not much difference between countries with high and low Moody ratings, provided only that the responsiveness of Moody ratings with respect to policy changes is above average. Conversely, the highest inflation performance occurs for countries which have low Moody ratings, but where the Moody rating does not respond strongly to policy changes (in inflation).

It is worth noting that in the case of the growth policy outcome, the poorest policy performance occurs in countries that have a high Moody rating, but where there is a low responsiveness of the rating to changes

	Responsiveness of Moody to Policy Change:	With Hyperinflation		Without Hyperinflation	
		Below Mean Moody	Above Mean Moody	Below Mean Moody	Above Mean Moody
Inflation	Above Mean	13.14	3.88	3.05	3.89
	Below Mean	68.60	3.05	13.17	7.98

Table 7: Inflation Performance of Countries with High and Low Moody Ratings

in policy. In the case of inflation, while the pattern is not quite as stark, nonetheless countries with high Moody ratings but low rating responsiveness, have a worse inflationary track record than countries with a low Moody rating, but with a high rating responsiveness. These patterns are precisely those predicted by the model. And they make good intuitive sense. If policy makers of a country with a high Moody rating know that there is a low probability of a change in the rating even under poor policy performance, there is no longer a strong incentive for policy makers to behave well.

4.3 An Econometric View

Symmetrical evidence can be generated econometrically.

Our baseline estimation is given by:

$$P_{i,t} = \alpha_0 + \alpha_M \left(\frac{dM_{i,t}}{dP_{i,t}} \right) + \gamma_i + \delta_t + \varepsilon_{i,t} \tag{16}$$

where $M_{i,t}$ denotes the Moody rating $P_{i,t}$ denotes the policy measure of interest (either growth, or the inflation rate) of country i, in period t. $(dM_{i,t}/dP_{i,t})$ denotes the correlation measure of the responsiveness of the rating to changes in policy. $\varepsilon_{i,t}$ denotes the error term, γ_i, δ_t country and time effects respectively. For the sake of robustness, we also estimate:

$$P_{i,t} = \alpha_0 + \alpha_M \left(\frac{dM_{i,t}}{dP_{i,t}} \right) + \alpha_R M_{i,t} + \alpha_D D_{it} + \gamma_i + \delta_t + \varepsilon_{i,t} \tag{17}$$

where $M_{i,t}$, denotes the level of a country's rating by Moody, and D_{it} controls for shocks arising from unusual growth episodes. For estimation purposes, we excluded the two countries in our sample with dramatic hyperinflationary episodes (Brazil, Bulgaria), since the magnitude of the outliers they introduce overrides all other data associations. For this reason, the need to control for hyperinflation in estimation is eliminated.

	Growth					
	(1)	(2)	(3)	(4)	(5)	(6)
$\frac{dM_{i,t}}{dP_{i,t}}$	61.71*** (6.59)	58.66*** (6.48)	60.71*** (6.57)	54.67*** (5.86)	49.27*** (5.76)	51.21*** (5.74)
$M_{i,t}$		0.15** (0.07)	0.16** (0.07)		0.25*** (0.07)	0.26*** (0.07)
D_{it}			11.41** (5.19)			11.33*** (4.35)
$Country$	Yes	Yes	Yes	Yes	Yes	Yes
$Time$	No	No	No	Yes	Yes	Yes
n	1313	1313	1313	1313	1313	1313
$adj - R^2$	0.12	0.13	0.18	0.34	0.35	0.40
* denotes sig at the 10% level; ** denotes sig at the 5% level; *** denotes sig at the 10% level; round parentheses report standard errors; square parentheses denote significance levels						

Table 8: Estimation Results for Growth

The expectation under our model is that for growth, $\alpha_M > 0$, while for inflation $\alpha_M < 0$.

We deal with the endogeneity of $(dM_{i,t}/dP_{i,t})$ by instrumentation.[20] For growth we employ instruments suggested by the recent growth literature, that points to the importance of geography[21] and institutions.[22] As measures of geography we employ latitude and longitude (denoted *lat* and *lon*); for institutions measures of legal origin (for English, Socialist, French and German legal origin, denoted L_Eng, L_Soc, L_Fr, L_Ger respectively)[23] and the measure of democratization from POLITY-IV (denoted $Polity2$).[24] For inflation we employ the interest rate ($IntRat$), and the consumption and export intensity of GDP (consumption and exports as a percentage of GDP, denoted C_GDP, X_GDP respectively). The interest rate serves an indicator of monetary policy, consumption as percentage of GDP as an indicator of aggregate demand, and exports as a percent of GDP as an indicator of external shocks to the economy.

Results for growth are reported in Table 8. Columns (1) through (6) the results from using the instrumented variable (first stage regression results are reported in Column (1) of Table 10). We find that greater responsiveness of ratings to changes in the policy outcome measure given by growth, is always associated with statistically significantly better growth outcomes, regardless of whether the level of the Moody rating, or exceptional growth episodes are controlled for.

Estimation results thus confirm the predictions of the model.

[20] An alternative might have been provided by GMM estimators which employ higher order lags of levels and/or differences of regressors in the panel as instruments to test for the robustness of the simple correlation. The relatively short time dimension in a number of our country data points precludes this option.

[21] See Bloom and Sachs (1998) and Gallup et al (1999).

[22] See the discussion in Acemoglu et al (2005) for instance.

[23] See La Porta et al (1998, 1999) for these measures. Our excluded category is Scandinavian legal origin.

[24] From the INSCR (2009) data set.

	$Inflation$			
	(1)	(2)	(3)	(4)
$\frac{dM_{i,t}}{dP_{i,t}}$	-147.95^{***}	-145.67^{***}	-161.25^{***}	-158.89^{***}
	(23.78)	(24.42)	(28.25)	(29.15)
$M_{i,t}$		-0.31		-0.40
		(0.29)		(0.30)
$Country$	Yes	Yes	Yes	Yes
$Time$	No	No	Yes	Yes
n	1279	1279	1279	1279
$adj - R^2$	0.39	0.39	0.41	0.41
* denotes sig at the 10% level; ** denotes sig at the 5% level; *** denotes sig at the 10% level; round parentheses report standard errors; square parentheses denote significance levels				

Table 9: Estimation Results Inflation

Inflation results are reported in Table 9. Columns (1) through (4) reports the results from using the instrumented variable (first stage regression results are reported in Column (1) of Table 11). Symmetrically to the growth specification, greater responsiveness of ratings to policy changes is associated with lower inflation, in all instances statistically significantly, irrespective of whether the level of ratings is controlled for.

Legitimacy of the instrumentation strategy is examined under the estimation methodology proposed by Altonji et al (2002). The approach is briefly described in Appendix 3. The approach allows for the possibility that the instruments are not entirely independent of the outcome variable of interest (here the growth rate, and the inflation rate), corrects all variables in order to render them orthogonal to the instruments, and tests for stability and significance of association between the orthogonal transforms.

Results are reported in Table 10 for growth, and Table 11 for inflation respectively. Columns (1) and (2) report the Altonji et al first stage regressions, columns (3) and (4) the tests for the significance of the association between the orthogonal transforms of the variables.

Notable is that the impact of the responsiveness of the rating agency to changes in policy orientation remains statistically significant, and of the correct sign, even after we have accounted for the possibility that our policy measure (growth, inflation) is possibly not entirely independent of the variables employed in our instrumentation strategy.

The implication is thus not only that at least part of the relationship between the responsiveness of the rating agency to changes in policy and the policy outcome variables (growth, Inflation) is generated by the responsiveness of the rating agency to changes in policy, but that this finding appears robust to controlling

	$\frac{dM_{i,t}}{dP_{i,t}}^*$	$Growth^*$		$Growth - Growth*$	
	(1)	(2)		(3)	(4)
lat	-0.001 (0.001)	-0.002 (0.01)	$\frac{dM_{i,t}}{dP_{i,t}} - \frac{dM_{i,t}}{dP_{i,t}}^*$	43.52^{***} (16.88)	45.96^{***} (15.41)
lon	0.001^* (0.001)	-0.004 (0.003)	I_GDP	0.31^{***} (0.10)	0.28^{***} (0.09)
L_Eng	-0.05 (0.07)	1.03^{**} (0.45)			
L_Soc	0.05 (0.06)	0.23 (0.47)			
L_Fr	-0.003 (0.07)	0.24 (0.47)			
L_Ger	-0.02 (0.07)	-0.60 (0.39)			
$Polity2$	-0.01 (0.01)	-0.12^{***} (0.04)			
I_GDP	0.01^* (0.003)	0.28^{***} (0.82)			
$Const.$	0.09 (0.11)	()			
$Country$				Yes	Yes
$Time$				No	Yes
n	1253	1313		1253	1253
R^2	0.24	0.22		0.02	0.27
* denotes sig at the 10% level; ** denotes sig at the 5% level; *** denotes sig at the 10% level; round parentheses report standard errors; square parentheses denote significance levels					

Table 10: Test of Instrumentation Strategy Growth

	$\frac{dM_{i,t}}{dP_{i,t}}^*$	$Inflation^*$		$Inflation - Inflation^*$	
	(1)	(2)		(3)	(4)
$IntRat$	-0.01^{***} (0.001)	0.97^{***} (0.09)	$\frac{dM_{i,t}}{dP_{i,t}} - \frac{dM_{i,t}}{dP_{i,t}}^*$	-166.33^{***} (1.61)	-167.05^{***} (1.44)
X_GDP	0.0003 (0.001)	-0.005 (0.02)			
C_GDP	0.002 (0.004)	-0.13 (0.10)			
$Constant$	-0.18 (0.29)	8.39 (8.30)			
$Country$				Yes	Yes
$Time$				No	Yes
n	1220	1220		1220	1220
R^2	0.07	0.56		0.99	0.99
* denotes sig at the 10% level; ** denotes sig at the 5% level; *** denotes sig at the 10% level; round parentheses report standard errors; square parentheses denote significance levels					

Table 11: Test of Instrumentation Strategy Inflation

for the possibility that the policy outcome variables may be impacted by our chosen instruments also.

The econometric evidence therefore corroborates precisely the distribution of countries across the quality of policy outcomes that the model predicts, and which was identified in the descriptive evidence of the preceding sub-section.

5 Conclusion and Evaluation

This paper has as its starting point the fact that the association between the quality of policy outcomes reported by countries and the ratings outcomes published by credit rating agencies is weak at best, and entirely absent at worst.

Strong market incentives preclude the likelihood that this absence of an association is simply a reflection of market failure, or of information asymmetries.

Instead, we present a model in which policy makers respond endogenously to ratings, and in which the rating agency changes ratings in response to policy changes. We show that for rational, social welfare maximizing policy makers, the quality of policy outcomes comes to be conditional on the probability of receiving a high or low rating outcome, as well as the responsiveness of ratings agencies to changes in policy.

It is important to note that the consequence is that poor policy can occur under high ratings (where the rating agency shows slow response to policy changes, policy makers have constrained incentives to maintain good policy), but that good policy can also occur under poor ratings (where ratings agencies show high responsiveness to improvements in policy, policy makers have an incentive to respond by better policy choices).

We examine panel evidence for 60 countries for which there are 5 or more Moody rating data points, over the 1980-2013 time period. Our evidence confirms the prediction of the model: better policy is observable where Moody's is more responsive to changes in policy.

Two policy implications are immediate.

Greater and more frequent changes in ratings in response to the underlying policy environment, are likely to improve the disciplining effect of the ratings agency on policy makers to improve the quality of their policy choices.

For country policy makers, the objective has to be good policy when rating agencies are responsive, and an incentive to ensure the lowest possible information asymmetries with respect to the ratings agencies, so as to ensure that ratings fully reflect the quality of policy.

6 Appendix 1

Rating:	Coding:	Rating:	Coding:	Rating:	Coding:
C	1	B1	8	A3	15
Ca	2	Ba3	9	A2	16
Caa3	3	Ba2	10	A1	17
Caa2	4	Ba1	11	Aa3	18
Caa1	5	Baa3	12	Aa2	19
B3	6	Baa2	13	Aa1	20
B2	7	Baa1	14	Aaa	21

Table 12: Coding of Moody Ratings

7 Appendix 2

Australia	Colombia	Greece	Latvia	Pakistan	Spain
Austria	Croatia	Hungary	Lithuania	Peru	Sweden
Belgium	Czech	Iceland	Luxembourg	Poland	Switzerland
Bolivia	Denmark	India	Malaysia	Portugal	Thailand
Botswana	Ecuador	Indonesia	Mexico	Romania	Turkey
Brazil	Egypt	Ireland	Morocco	Russia	United Kingdom
Bulgaria	Estonia	Israel	Netherlands	Singapore	United States
Canada	Finland	Italy	New Zealand	Slovakia	Ukraine
Chile	France	Japan	Norway	Slovenia	Uruguay
China	Germany	Korea	Paraguay	South Africa	Venezuela

Table 13: Countries Included in Study

8 Appendix 3

Object of the identification test is to use the relationship between an endogenous variable and observables to make inferences about the relationship between the variable and unobservables.

Consider an outcome variable of interest, Y, which is a function of the latent variable, Y^*, such that:

$$\begin{aligned} Y^* &= P\beta + W'\Gamma \\ &= P\beta + X'\Gamma_X + \xi \end{aligned}$$

where P denotes the endogenous variable, β is the causal effect of P on Y^*, W is the full set of observed and unobserved variables that determine Y^*, Γ is the causal effect of W on Y^*. X is a vector of observable variables, Γ_X the associated causal effect, while ξ is an index of unobserved variables. Since $cov(X, \xi) = 0$, is unlikely in general, consider:

$$Y^* = P\beta + X'\gamma + \varepsilon$$

such that γ, ε, are defined such that $cov(\varepsilon, X) = 0$, so that γ captures both Γ_X and the relationship between X and ξ. If P^* is the latent variable that determines P, specify:

$$E(P^* \mid X'\gamma, \varepsilon) = \eta_0 + \eta_{X'\gamma} X'\gamma + \eta_\varepsilon \varepsilon$$

Now the standard assumption in estimation is that $\eta_\varepsilon = 0$. An alternative would be to require that $\eta_{X'\gamma} = \eta_\varepsilon$, a formalization of the idea that selection on observables is the same as selection on the unobservables. While strong, the assumption is no stronger than the standard least squares assumption.($\eta_\varepsilon = 0$).

Conditions for $\eta_{X'\gamma} = \eta_\varepsilon$ are that the X are randomly chosen from the W, that the number of elements in X, W, are large and that none dominates the distribution of P or Y, and crucially that:

$$\begin{aligned} E(Y^* - P\beta) &= P^*\beta \\ E[(Y^* - P\beta) \perp X] &= (P^*\beta) \perp X \end{aligned}$$

are equivalent. Given the strength of the assumption, Altonji et al (2002) point out that estimation under the $\eta_{X'\gamma} = \eta_\varepsilon$ condition provides lower bound estimates of β, while estimation under the assumption of $\eta_\varepsilon = 0$ (exogeneity) provides an upper bound estimate.

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