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**Sovereign Ratings and National Culture**

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***WORKING PAPER***

**No. 31/2016**

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### **Sovereign Ratings and National Culture**

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**Abstract:** Whether sovereign governments default in part depends upon their willingness to pay and this in turn may depend on national culture. National culture may also affect capacity to pay and the assessment by rating analysts of sovereign risk. We therefore argue that culture affects ratings and empirically test the effects of culture on levels and changes in sovereign ratings. Levels and changes in sovereign ratings have traditionally been modelled in terms of macro-economic variables, rating outlook and rating history. The addition of culture variables to such models significantly improves the models' fit to the data.

**Keywords:** Sovereign debt; sovereign rating; national culture; rating history; rating outlook

**JEL Classifications:** G24

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# Sovereign Ratings and National Culture

## 1. Introduction

The globalisation of debt markets and increased international diversification by institutional investors has made sovereign ratings more important. A change in rating can lead to the re-balancing of international portfolios and have a substantial impact on a country's cost of financing (Bissoondoyal-Bheenick, 2005). Sovereign ratings also affect the ratings and yields of debt issued by corporate borrowers domiciled in the sovereign state (Cantor and Packard, 1996). Consequently, levels and changes in sovereign ratings are a matter of significant interest.

Governments can choose either to honour debt agreements or to default. Consequently, sovereign risk reflects not just capacity to pay, but also willingness to pay (Eaton, Gersovitz and Stiglitz, 1986; Clark and Zenaidi, 1999). As S&P RatingsDirect (2013, p. 9) state: "Thus willingness to default is an important consideration when analysing a sovereign's creditworthiness, partly because creditors have only limited legal redress. As a result, a sovereign can and sometimes does, default on its obligations even when it possesses the capacity to pay timely debt service." Giving attention to willingness to pay in sovereign ratings directly articulates with traditional credit analysis, where the first of the 5Cs of credit analysis is character.

We argue that national character as reflected in culture can affect both willingness and capacity to pay. National culture may also affect the ease with which negotiations to avoid a default can be successfully concluded. We use culture, rather than character, because attempts to define and measure national character can generally be traced back to culture. Indeed some researchers, such as Nakata and Sivakumar (1996) and Hofstede, Hofstede and Minkov (2010), treat national character and national culture as synonymous.

There is increasing recognition of the role that culture plays in financial decision making. In recent years there have been a substantial number of papers on this topic and we give some examples in the next section. It also seems likely that national culture affects a government's decisions. This is because the decision makers are influenced by their own cultural experience and culture will also affect whether government decisions are palatable to the population. For example, most observers would agree that the Greek debt crisis and the Greek government's decisions were influenced by the nature of Greek culture. The case has also been made that discussions about avoiding a default were made more difficult by cultural differences between the Greeks and the Germans, Guiso, Herrera and Morelli (2016).

While there seems little doubt that culture played a role in the Greek debt crisis it is not so clear how that role could be quantified. In this paper we undertake a quantitative analysis of the effect of culture on sovereign debt ratings. We empirically examine whether national culture affects a nation's rating grade and also whether national culture affects the probability and timing of changes in that rating. There has been substantial prior work on modelling rating grades and rating migrations, see for example Cantor and Packard (1996), Alsakka and ap Gwilym (2009), Hill, Brooks and Faff (2010) and Afonso, Gomes and Rother (2011).

However, such work has not examined the role of culture, but rather has focused on the impact of economic variables and aspects of rating history and rating outlook. We extend this research by considering the effect of cultural variables after controlling for variables that have been found significant in prior literature. As far as we can ascertain, there is no published work that uses national culture in modelling sovereign ratings. Our contribution therefore is in introducing culture as a determinant of ratings and providing quantitative modelling of the effect.

Our study analyses Standard and Poor's (S&P) sovereign ratings over the period February 1995 - October 2011. We use ordered probit to model rating levels and survival analysis to

model rating changes. The models are expressed as a function of culture, controlling for the effect of macro-economic variables, past rating history and rating outlook.

We find that culture significantly adds to the explanatory power of models of rating levels and rating changes. Cultural variables that contribute to a higher rating are a high level of individualism, a long term orientation and acceptance of an unequal distribution of power. Cultures where there is avoidance of uncertainty, or more masculine cultures are less likely to have high ratings. Acceptance of an unequal distribution of power reduces the risk of a rating downgrade, while a long term orientation increases rating volatility, with greater risk of upgrades and downgrades.

The remainder of this paper is structured as follows. Section 2 discusses links between national culture and financial decision making and suggests how national culture may affect ratings. This is followed by a discussion of the dimensions along which national culture is measured. Section 3 presents the method of analysis and the data. Section 4 presents the empirical results and Section 5 summarises the key findings of the study.

## **2. Culture and sovereign ratings**

### *2.1. Culture and financial decision making*

It has been argued (Stulz and Williamson, 2003) that culture influences financial decision-making in three ways. First, culture affects values, this affects attitudes and then behaviours. Politicians have to translate the values and attitudes dominant in a country into political priorities and it is politically unpalatable to pursue strategies contrary to deeply rooted cultural norms in the country. Second, culture may either augment or weaken the intent of the law. Stulz and Williamson find that culture predicts a country's degree of investor protection

better than a country's legal system. Third, culture affects how resources are allocated in a country.

There is ample research that suggests national culture leads to differences in financial decision making at both macro and micro levels. For example, national culture has been used to explain cross-country differences in the choice of financial systems (Kwok and Tadesse, 2006; Aggarwal and Goodell, 2009), investors rights (Licht, Goldschmidt and Schwartz, 2005), corporate risk taking (Li, Griffin, Yue and Zhao, 2013) and bank risk taking (Ashraf, Zheng, Arshad, 2016). Cultural variables have also been used to explain foreign/ home bias and international asset allocation (Anderson, Fedenia, Hirschey and Skiba, 2011; Beugelsdijk and Frijns, 2010), trading momentum (Chui, Titman and Wei, 2010) and investors' stock trading decisions (Grinblatt and Keloharju, 2001).

The Greek sovereign debt crisis is one striking example where culture played a major role. This crisis was not only affected by Greek culture, but also German culture. According to Guiso, Herrera and Morelli (2016) culture can explain Germany's angry reaction towards Greece for hiding substantial fiscal deficits. Germany's subsequent decision to deny timely help and postpone the adoption of rescue measures contributed to a substantial deterioration in Greece's credit quality, a sharp increase in the risk premium on Greek debt and a propagation of the crisis to Portugal, Italy, Ireland and Spain.

The Greek debt crisis is one example where national culture affected government decisions on financial matters, but it is not difficult to find others. Compare the response of the U.S. government to their banking crisis in 2007-2009 with the response of Japanese government to their banking crisis in the 1990s. The immediate response in the U.S.A, which has an individualistic and short term oriented culture, was to let Lehman Brothers and Bear Stearns fail. For Japan, which has a more collectivistic and longer term oriented culture than the U.S.A., letting banks or companies fail was abhorrent. The Japanese government set up

mechanisms to support the banks and through loan guarantees encouraged lending to keep troubled firms going.

Given that culture affects governments' decisions and also helps explain cross-country differences in financial decision making, culture is a potential variable for use in the analysis of sovereign ratings. We examine the effect of the five variables that measure national culture after controlling for variables that the prior literature has identified as affecting sovereign ratings. Previous studies modelling the level of sovereign ratings have utilised economic and financial variables, whether there has been a prior default and to a lesser extent, political and institutional factors, see for example, Cantor and Packard (1996), Afonso (2003), Bissoondoyal-Bheenick (2005), Afonso, Gomes and Rother (2011). Studies of rating changes (migrations) have primarily focused on macro-economic variables, rating history including momentum and rating outlook/watch variables, Alsakka and ap Gwilym (2009) and Hill, Brooks and Faff (2010).

## *2.2. Ratings and culture*

The credit rating market is dominated by two major firms, Standard and Poor's (S&P) and Moody's Investors Service (Moody's). In this paper we focus on ratings supplied by S&P because, to quote Correa, Lee, Saprizza, and Suarez (2014, p. 98) "We use changes in sovereign credit ratings from S&P, as they appear to be relatively more frequent, tend not to be anticipated by the market and tend to precede the changes of other rating agencies..." Alsakka and ap Gwilym (2010) also find that S&P tends to be the most independent of the various agencies, although they also report that Moody's tend to lead in upgrades.

Ratings are determined by the analysts of rating agencies and therefore culture has to feed into the rating process that analysts follow if it is to affect ratings. Culture may affect the rating through three channels, by directly influencing the analyst's assessment of sovereign risk, by

indirectly influencing the analyst's assessment through the impact of culture on a sovereign's economic performance, and if culture affects ratings then it also affects rating history and this in turn influences the current rating. S&P RatingsDirect (2013) emphasises that sovereign ratings depend upon both willingness and capacity to pay, and describe the main factors in their rating process as follows (pp. 3-4):

- “Institutional and governance effectiveness and security risks, reflected in the institutional and governance effectiveness score.
- Economic structure and growth prospects, reflected in the economic score.
- External liquidity and international investment position, reflected in the external score.
- Fiscal performance and flexibility, as well as debt burden, reflected in the fiscal score.
- Monetary flexibility, reflected in the monetary score.”

Both quantitative and qualitative aspects of the factors listed above are used to derive a rating score. In S&P's discussion of how the score is derived there is direct reference to the sovereign's debt payment culture, but this is the only direct reference to culture. With respect to the sovereign's debt payment culture the focus is on payment outcomes.

Although S&P RatingsDirect (2013) make relatively little direct use of the term culture, there is frequent reference to rating criteria related to culture, such as: cohesive civil society, robustness of political institutions, stability of civil institutions, high social inclusion, degree of social order, effectiveness of policy making, transparency and accountability of institutions, data and process, unbiased enforcement of contracts and the rule of law, open debate on policy decisions, market oriented economies, level of corruption, tax compliance and so forth. It can be argued that some of these criteria are political rather than cultural. However, it is the different mind sets created by culture that lead to different political systems, Hofstede *et. al.* (2010, p. 125). Criteria related to culture are particularly common in S&P's discussion about the score for the institutional and governance effectiveness factor, but

they can also be found in relation to the discussion of scores for other factors mentioned above.

Economic performance, which is critical to sovereign ratings, is also related to culture. The score for S&P's economic factor is dependent on quantitative data about the performance of the economy, with particular emphasis on GDP per capita and growth prospects. The evidence of Hofstede *et. al.* (2010, p. 38) is that GNI per capita correlates positively with the extent of individualism in a culture. Hofstede *et.al.* (2010, pp. 263-265) also argue that growth rates correlate positively with the extent of long term orientation in a culture.<sup>1</sup> Thus, the cultural variables of individualism and long term orientation relate to the economic variables upon which S&P's economic performance score strongly depends. The national saving rate is also positively correlated with the extent of long term orientation in a culture, Hofstede *et. al.* (2010, p. 38). Thus, culture can have an indirect effect on rating through its impact on measures of economic performance such as GDP.

The relationships between culture and economic variables can be complex and contingent on other factors. For example, Hofstede *et.al.* (2010) suggest that the economic success of East Asia is based on their long-term orientation, but that it also took the availability of western technology and integration into world markets to achieve high growth. In considering the effect of culture on ratings it is important to control for economic variables. For example, both Greece and the U.S.A. have masculine cultures but, even assuming they were closely aligned on the other cultural dimensions, we would not expect them to have the same rating. Differences in their economic performance would affect both the level of their ratings and the likelihood of changes in that rating.

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<sup>1</sup> Post 1995 this result only applied to poor countries. There was a negative correlation for wealthy countries.

While cultural variables may help explain the level of ratings, it is unlikely to be *changes* in national culture that explain rating changes. According to Hofstede (2001), national cultures are extremely stable over time. The forces that cause cultures to shift tend to be global or continent-wide. In the long run, “cultures shift, but they shift in formation so that the differences between them remain intact” (Hofstede, 2001, p. 255). While changes in culture are slow, we argue that some cultures may lead to more rating changes. For example, in cultures where political violence is more likely, analysts may be more prone to change ratings as political tensions rise and fall. In other cases culture may result in a directional predisposition for rating changes. For example, a culture which predisposes to better economic performance could make upgrades more likely and downgrades less likely.

It is fortunate that culture is slow to change because measurements are available infrequently. In our empirical work we utilise both numerical measures of culture and dummy variables for country’s score relative to the median score.<sup>2</sup> Given Hofstede’s (2001) observation that cultures shift, but the differences between them remain intact, the use of the dummy variables should help preserve the relativities between national cultures even if there have been changes in scores over the period of our study.

### *2.3. Dimensions of culture*

This paper employs indices for five national culture dimensions which are extensively discussed in Hofstede *et. al.* (2010), these indices are:

1. Power distance
2. Collectivism versus individualism

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<sup>2</sup> We also use dummy variables based on means rather than medians and it makes relatively little difference to the models of rating levels or rating changes.

3. Femininity versus masculinity
4. Uncertainty avoidance
5. Long-term versus short-term orientation

The first four of the culture dimensions have been validated and widely employed since Hofstede's (1980) first book on culture. The fifth dimension, originally labelled the Confucian dynamic and later relabelled long-term versus short term orientation, was introduced following a survey of Chinese values, Chinese Culture Connection (1987).

Below we briefly explain the nature of each of these dimensions. These dimensions of culture have a pervasive impact on personal values, ideas, attitudes, behaviour and gender roles, the family, religion, education, the workplace, innovation, politics, institutions and the state. Thus there are many ways that culture may impact on capacity and willingness to pay.

#### *2.3.1. Power distance index (PDI)*

The power distance index measures "...the extent to which the less powerful members of institutions and organisations within a country expect and accept that power is distributed unequally." (Hofstede *et. al.*, 2010, p. 61). Scores are high for Latin, Asian and African countries and smaller for Anglo and Germanic countries.

In large power distance cultures "organisations centralise power as much as possible in a few hands" (Hofstede *et. al.*, 2010, p. 73). People in these cultures accept a hierarchical order in which everybody has a place and which needs no further justification. In contrast, in societies with a culture of low power distance people strive to equalise the distribution of power and demand justification for inequalities of power. Decisions are often made based on consensus and information is shared equally.

High power distance countries, relative to low power distance countries, are more likely to have military dictatorships, or one party systems of government. There tends to be less policy

debate and less political discussion. Political violence and change by revolution is more likely. Where more than one political party is allowed, the parties tend to be either strongly on the right, or strongly on the left (Hofstede *et. al.*, 2010, pp. 77-79).

Countries which score high on power distance seem likely to have lower sovereign ratings due to less robustness of political institutions, less transparency and accountability and greater risk of political violence.

### 2.3.2. *Individualism versus collectivism (IDV)*

A society's position on the individualism versus collectivism dimension is determined by whether people's self-image is defined in terms of "I" or "we." In individualistic cultures people tend to pursue independence while in collectivistic cultures there is an emphasis on being part of a cohesive group that looks after its members in exchange for loyalty to the group. Individualism prevails in developed and Western countries, while collectivism prevails in less developed and Eastern countries.

In countries with collectivist cultures governments, or collective interests, tend to dominate the economy and "... laws and rights may differ from one category of people to another – if not in theory, then in the way laws are administered – and this is not seen as wrong" (Hofstede *et. al.*, 2010, p. 126). Thus unbiased enforcement of contracts and the rule of law is less likely in collectivist countries. In cultures high on individualism investor legal rights are stronger (Litch, Goldschmidt, and Schwartz, 2005) and tax evasion is lower (Tsakumis, Curatola and Porcano, 2007). Wealth also is higher in nations with individualist cultures. Individualism is also associated with competitiveness and encourages a generally adversarial approach to conflict (Trubinsky, Ting-Toomey and Lin, 1991).

Higher scores on individualism, with higher levels of wealth, open debate on policy, better tax compliance and unbiased enforcement of contracts seems likely to result in higher sovereign

ratings. The positive association between individualism and higher levels of GNI (Hofstede *et. al.*, 2010, p. 38) also suggests higher ratings for nations scoring high on individualism.

### 2.3.3. Masculinity versus femininity (MAS)

Countries with a masculine orientation favour a performance society valuing assertiveness, material accomplishment, ambition, competition and success (Hofstede *et. al.*, 2010). In contrast, countries with feminine orientation favour a welfare society valuing cooperation, modesty, caring for the weak and quality of life. They “emphasize human needs, care and interdependence, even at the expense of accomplishment and performance” (Weaver, 2001, p. 9). Masculinity is high in Japan, in some European countries like Germany, Austria and Switzerland and moderately high in Anglo countries. It is low in Nordic countries and the Netherlands, and moderately low in some Latin American, Asian countries, France, Spain and Thailand.

Countries with a masculine culture put economic growth ahead of the environment and vice versa for feminine cultures. Politics tends to be more adversarial in masculine cultures and in feminine cultures coalition governments are more likely. Masculine countries tend to resolve conflicts by fighting or by a show of strength. Feminine countries, on the other hand, try to resolve conflicts by compromise and negotiation (Hofstede *et. al.*, 2010, pp. 170-175).

The effect of masculinity and femininity on ratings is not entirely clear. Masculine cultures have more focus on material achievement and economic growth. However a more aggressive masculine approach may also lead to acceptance of more indebtedness. On the other hand, feminine cultures may also accept higher indebtedness to support a more welfare oriented society but the positive benefit of this is high social inclusion and they are more likely to negotiate to avoid conflicts over debt service.

#### 2.3.4. Uncertainty avoidance index (UAI)

The uncertainty avoidance index measures the extent to which a culture is uncomfortable with uncertainty and ambiguity. Uncertainty avoidance scores are higher in Latin countries, in Japan and in German speaking countries, lower in Anglo, Nordic and Chinese culture countries.

Uncertainty avoiding cultures (high UAI) do not mind running familiar risks, such as driving faster, but they fear ambiguous situations and unfamiliar risks. “People in such cultures look for structure in their organisations, institutions and relationships that make events clearly interpretable and predictable. Paradoxically they are often prepared to engage in risky behaviour in order to reduce ambiguities, such as starting a fight with a potential opponent rather than sitting back and waiting” (Hofstede *et. al.*, 2010, pp. 197-198).

A market-based financial system is preferred in low UAI countries, since higher risks also open up opportunities for higher returns (Kwok and Tadesse, 2006). Countries with a high UAI are more likely to have a bank-based rather than market-based financial system (Kwok and Tadesse, 2006; Aggarwal and Goodell, 2009).

Uncertainty avoiding cultures tend to have more formal laws and informal rules, which give an emotional sense of security, although the laws may be ineffective. Hofstede *et. al.* (2010, pp. 216-217) give the examples that the time it takes to collect a bounced check and the time to evict a tenant for non-payment of rent tends to be longer in cultures with a high UAI.

People from high UAI cultures are also slower in paying their bills (De Mooij, 2004, p. 154).

Tax evasion is also associated with high UAI, Tsakumis, Curatola and Porcano (2007) and outside observers perceive more corruption in high UAI countries, Hofstede *et. al.* (2010, p. 223). These attributes are consistent with a poor payment culture.

A high UAI is associated with intolerant political ideologies and aggressive nationalism. (Hofstede *et. al.*, 2010, pp. 229-231). High UAI countries are “more likely to harbour extremist minorities within their political landscape and they are also more likely to ban political groups whose ideas are considered dangerous. Banned groups may continue an underground existence or may even resort to terrorism” (Hofstede *et. al.*, 2010, p. 221).

High UAI countries, with less market oriented economies, poor payment culture, more tax evasion, more corruption and the risk of extremist political groups seem likely to have lower sovereign rankings.

### 2.3.5. Long term versus short term orientation (LTO)

Long- term oriented cultures (high LTO) are oriented towards the future. They will forgo current benefit for benefit in the future and value perseverance and thrift. (Hofstede *et. al.*, 2010, p. 239). People in short-term oriented cultures are more concerned with the present and perhaps the past, they have a higher propensity to spend and are focussed on immediate results. Long-term orientation scores are highest in East Asia, moderate in Eastern and Western Europe and low in the Anglo world, the Muslim world, Latin America and Africa. Countries with a high LTO value tend to see good and bad not as fixed attributes, but rather dependent on circumstances and they place importance on networks of relationships. Such countries score higher in Bribe Payers Index than countries with a low LTO value (Hofstede *et. al.*, 2010, p. 246).

The long-term orientation may have both positive and negative impacts on ratings. Long term orientation correlates positively with growth and savings rates (Hofstede *et. al.*, 2010, pp. 38, 263-265), both of which favour higher ratings, but more bribes and corruption would favour lower ratings.

### 3. Models, variables and data

#### 3.1. Rating levels

In modelling the level of sovereign ratings we use ordered probit, which has been popular as a method for modelling sovereign ratings following Hu, Kieswl and Perraudin (2002). Use of the probit model assumes that the rating process is governed by an unobserved latent variable  $y_i^*$  for each rating observation  $i$ , such that:

$$y_i^* = \beta X + \varepsilon_i \quad (1)$$

Where,  $\beta$  represents a vector of coefficients to be estimated,  $X$  is a vector of independent variables (as defined in Panel A, Table 2) and the error term  $\varepsilon_i$  is assumed to follow a normal distribution. The observable rating states,  $y_i$ , are related to the latent variable by a series of limits  $z_n$  (to be estimated) such that:

$$y_i = \begin{cases} 1 & \text{if } y_i^* \leq z_0 \\ n & \text{if } z_{n-1} < y_i^* \leq z_n \\ n+1 & \text{if } z_n < y_i^* \end{cases} \quad (2)$$

For the ordered probit analysis, following Hill, Brooks and Faff (2010), we recode the S&P's alphabetic ratings into eight numerical rating states  $y_i$ , as in Table 1. Table 1 also gives the distribution of observations across the eight rating grades.

TABLE 1 ABOUT HERE

The independent variables for the probit analysis are given in Panel A of Table 2. The table provides the variable label, a description of the variable and references to examples of the relevant literature. The first group of variables are the dimensions of culture as discussed above and the references relate to the dimensions of culture and to papers in finance and business that have included these culture dimensions. In the empirical work we use both numeric scores for the culture variables and also dummy variables. Two sets of dummy

variables are created, one set using a cut-off point based on the median and the other using a cut-off point based on the mean. For the culture dimensions of power distance, individualism, masculinity and long term orientation, scores greater than or equal to the median (mean) take a value of one and otherwise zero. For the uncertainty avoidance dimension scores less than or equal to the median (mean) take a value of one and otherwise zero.

The rest of the variables in Table 2 Panel A are control variables represented by the country's history of prior default and macroeconomic and financial variables. All these variables have been used in the prior literature in modelling sovereign ratings and the references relate to this literature. Hill, Brooks and Faff (2010), suggest the need to account for non-linearities by including squared terms for the GDP growth and government surplus/GDP variables and find them to be significant. Accordingly we also include these squared variables in our analysis.

TABLE 2 ABOUT HERE

### *3.2. Rating changes*

When analyzing rating changes the question of interest is: What is the probability and timing of rating changes? Addressing such questions is the province of survival analysis. The objective in survival analysis is to estimate the probability of survival beyond time  $T$ , where  $T$  can be any time horizon of interest. The premier technique in survival analysis is Cox's hazard model<sup>3</sup> (Cox, 1972). We use Cox's model rather than ordered probit as Cox's model is particularly convenient for handling time varying variables and allows special techniques for handling repeated events (multiple rating migrations) as we discuss below. This latter is important as a majority of the sovereigns in the study experienced more than one migration. Cox's model has been used both for predicting sovereign rating migrations as in Hill, Brooks

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<sup>3</sup> The survival probability can be estimated from the hazard.

and Faff (2010) and for analysing corporate rating migrations as in Dang and Partington (2014).<sup>4</sup> Since we are interested in analysing rating changes at the level of rating notches we use 21 numerical codes to indicate the ratings as in Table 1. The distribution of observations across the 21 rating notches is also given in Table 1.

Sovereign states can experience multiple rating changes. In the presence of multiple rating changes special techniques are required, Hosmer, Lemeshow, and May (2008). It is necessary to both control for heterogeneity in the underlying hazard of a rating change and to ensure that a country is not considered at risk of a later rating change, say the third change, before the earlier changes, say the first and second, have occurred. This is important to the current study as during the study period about 62 percent of the sample had experienced between three and seven prior migrations and 24 percent of the sample had eight migrations. Following Dang and Partington (2014) we use stratification so that rating changes that have the same number of prior changes are included in the same strata. This allows the underlying hazard of a rating change to vary according to the number of prior changes, while the effect of the explanatory variables is assumed to be the same across strata.

The hazard of a rating change for a country in stratum  $s$  is given by the product of the underlying (baseline) hazard and the effect of the risk factors (covariates). This can be written as:

$$h_s(t, X_t) = h_{s,0}(t) \exp(\beta X_t) \quad (3)$$

Where  $h_s(t, X_t)$  is the hazard of a rating change for an observation in strata  $s$  at time  $t$ , with a

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<sup>4</sup> For a discussion of the advantages of hazard models, see for example Allison (1995). Hill, Brooks and Faff (2010) suggest ordered probit rather than hazard modelling for predicting rating changes, but in the current paper the purpose is not prediction.

given set of values for the covariates ( $X_t$ ),  $h_{s,0}(t)$  is the baseline hazard for stratum  $s$  at time  $t$ ,  $\beta$  is a vector of coefficients to be estimated and  $X_t$  is a vector of covariates as defined in Panel B, Table 2. The full rating migration model is estimated by multiplying together the individual likelihood functions for all the strata.

The covariates that we use are of two types, static (time-fixed) and time-varying. The static variables take the values observed at the start of the rating for a country and are not changed over the duration of the rating. Thus the static variables only change when the rating changes. The time-varying variables (*age since first rated*, *dummy negative outlook*, *dummy positive outlook*) are updated over the duration of the rating as a migration event of interest occurs in the sample or as the outlook changes. We repeated all of our analysis taking the measurement of the static variables at the latest possible observation date prior to the rating change. This was done because the magnitude of the static variables might change over the duration of the rating, leading to changes in the estimated model. However, it turns out that there was only a small impact both in terms of which variables were statistically significant and in the magnitude of the coefficients.<sup>5</sup> The duration of ratings in many cases was quite small, see Figure 1. Consequently, there was limited time for substantive changes in the magnitude of the static variables.

The covariates for the Cox model are given in Panel B of Table 2. The first group of variables are again the dimensions of culture. The second group of variables control for the current rating, for rating history and for the rating outlook. All these variables have been previously used in either, or both, of predicting corporate rating changes and sovereign rating changes

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<sup>5</sup> With respect to the culture variables, which are the focus of the study, the only substantive change was that individualism became significant, but only in the model using numeric scores for culture. A higher score on individualism reduced the probability of a downgrade.

(see references in Table 2). The third group of control variables represents macroeconomic and financial conditions. A majority of these variables are changes in the macroeconomic variables, as used in the probit analysis and have been previously used either to predict rating levels or changes. We include a debt crisis variable as Ferri, Lui and Stiglitz (1999) suggest that sovereign rating changes are pro-cyclical, although Mora (2006) disputes this view. Roychoudhury and Lawson (2010) find that economic freedom contributes to higher ratings, we take a slightly different tack and include a control for the impact of political freedom on rating changes.

We estimate separate models for rating upgrades and downgrades. This is because both theoretical consideration and prior empirical evidence suggest that upgrades and downgrades are governed by different models, Hill, Brooks and Faff (2010) and Dang and Partington (2014). The upgrades and downgrades are treated as competing risks. That is, if a country is currently rated, say BB, then an upgrade removes the country from the risk of a downgrade from the BB rating. Under the competing risks approach an upgrade is treated as censored when estimating the downgrade model and vice versa.

### 3.3. Data

We use S&P's long-term foreign currency sovereign ratings from February 1995 to October 2011 as listed in Cavanaugh, Phua and Young (2011).<sup>6</sup> For the probit analysis ratings are identified by year in order to match them to most of annual economic data. *GDP growth* and *inflation* are constructed as the geometric average of the previous three-year annual rates. The standard deviation of the world stock market index (*Std dev of world stock market index*) is calculated using daily data over a six-month rolling window prior to the rating observation

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<sup>6</sup> Rating years prior to 1995 could not be included due to missing data for control variables.

under study. *Dummy OECD member* and *dummy prior default* are updated at the commencement of each rating observation. Other economic data used in the probit model is taken from the year prior to the start of a rating.<sup>7</sup>

A rating observation either starts at beginning of the year, or when there is a new rating assigned during the year. A rating observation either finishes at the end of the year, or when the transition to a new rating occurs during the year. For example, if a rating started in Sep 2005 and ended in May 2007 then that rating would contribute the following rating observations: Sep 2005-Dec 2005, Jan-Dec 2006, Jan-May 2007.

Two samples of ratings are utilised in the probit analysis and are determined by the availability of data for the control variables. Sample A is the smaller sample and contains 835 rating states from 52 countries. For sample A the requirement of data availability for the government's budget surplus or deficit caused a substantial reduction in sample size. Relaxing the requirement for the government budget data resulted in sample B which contained 1048 rating states from 54 countries.

For the Cox model we observe ratings at the level of individual notches and measure the duration of the rating in each notch observed for each country, whether the rating is subsequently upgraded or downgraded and the sequence number in the transition sequence for each country. Requiring data for the control variables, including rating history and outlook restricted the sample size to 223 usable rating durations from 39 countries. There were 95 upgrades, 97 downgrades and 31 censored cases.

The details of the data sources for the independent variables in the probit analysis and the Cox analysis are given in Table 2. The measurements of the culture variables across countries were

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<sup>7</sup> The top and bottom one percent of the distributions of the economic variables were winsorised.

obtained from a website maintained by Hofstede<sup>8</sup> which provides the measurements from Hofstede *et. al.* (2010) in spreadsheet format. Table 3 gives the descriptive statistics for the numeric scores on the five dimensions of culture and shows the distribution of culture dummy variables, across the different samples used in the study. The table shows that there is a substantial range of variation in the scores for each of the culture measures and that their distributions look similar for sample A and sample B.

TABLE 3 ABOUT HERE

## 4. Results

### 4.1. Rating levels

As we discussed earlier culture may affect the current ratings by three channels, direct influence on analysts' judgements and via the impact on economic variables and rating history. Prior research has demonstrated that variables for economic performance and rating history can be used to partially explain ratings. However, it is uncertain to what extent the use of these variables as controls mimics the process by which analysts use such data to form ratings. Thus, we do not claim that our results isolate the direct influence of ratings. What the results show is the incremental contribution of culture to explaining ratings, after controlling for the effect of variables known to have explanatory power for ratings.

The results of the ordered probit analysis are given in Table 4 and the significant coefficients are in bold. For each of the two samples three sets of results are given, first using numeric scores for the dimensions of culture, second using dummy variables where the dummies are set according to the country's score on the culture dimension relative to the median and third

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<sup>8</sup> See <http://www.geerthofstede.nl/dimension-data-matrix>

using dummies where the cut-off point is based on the sample means. With the exception of the dummy for weak uncertainty avoidance, scores greater than or equal to the median (mean) are coded one and zero otherwise. For uncertainty avoidance it is scores less than or equal to the median (mean) that are coded one.

The likelihood ratio Chi squares in Table 4 are for tests of models including the culture variables against a model containing all the control variables, but excluding the culture variables. The result in all cases is that inclusion of the culture variables significantly improves the fit of the model. With the exception of the uncertainty avoidance index in sample A, all of the numerical culture variables are significant using the Wald test. A higher power distance index increases the chance of being in a higher rating grade, as does a higher score on individualism. The former result was unexpected and the latter result was as expected. There was some a priori uncertainty about the impact of masculinity and also long term orientation. As it turns out a high score on masculinity increases the chance of being in a lower rating grade, while a high score on long term orientation increases the chance of being in a higher rating grade. As expected a high score on the uncertainty avoidance index increases the chance of being in a lower rating grade, but the effect is only significant in sample B.

For the culture dummy variables, the signs of the coefficients are all consistent with the results using numeric scores,<sup>9</sup> but masculinity is not significant in sample B. Considering the results across all six models in Table 4 the evidence of culture effects is strongest for power

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<sup>9</sup> Because of the coding of the UAI dummy it is expected to have the reverse sign to the coefficient for the numeric UAI variable. A weak uncertainty avoidance country has a low numeric score and is assigned a value of one for the weak uncertainty avoidance dummy.

distance and individualism, less strong for long term orientation and the uncertainty avoidance index and weakest for masculinity.

The positive effect of power distance is contrary to expectations and hence is puzzling. The more so as high power distance countries are more common in Latin, Asian and African countries, regions where the ratings are often poor. Perhaps the explanation is that the negative effects expected from a high power distance turn up in poor economic performance and in default history. What is left over after controlling for these variables is a positive effect.

All the control variables are significant with the exceptions of the OECD member dummy, the square of GDP growth and, for sample A, freedom. For the consistently significant control variables the signs of the coefficients are in accordance with prior research.

TABLE 4 ABOUT HERE

#### *4.2. Rating changes*

The distribution of survival times (durations) for rating changes are given in Figure 1. The mean durations are 1.469 years for downgrades and 1.995 years for upgrades. It is evident from Figure 1 that rating durations tend to be longer for upgrades, but a majority of ratings tend to be quite short. Most downgrades have durations of 6 months or less and most upgrades have durations of 1.5 years or less.

FIGURE 1 ABOUT HERE

The results for the estimation of Cox's model are given in Table 5. Separate models are estimated for downgrades and upgrades. Using the numeric measurement of culture variables and the two alternative dummy variable measurements for culture, three models are estimated for downgrades and three models for upgrades. The likelihood ratio chi squares in Table 5 test rating migration models including the culture variables against the model excluding the

culture variables but including the control variables. In all cases inclusion of the culture variables significantly improves the fit of the model. However, the evidence in favour of including the culture variables is weaker for the upgrade models when dummy variables are used to represent culture.

With one exception, the upgrade models all have the same results for the significant variables and their signs. The exception is in the control variables. The dummy for having previously been a fallen angel is significant only in the model using dummy variables for culture with the median as the cut-off point. Also with one exception, the downgrade models all have the same results in terms of the significant coefficients and their signs. The exception is that long term vs short term orientation is not significant for the model estimated using the numeric measurement of culture.

For the culture variables the results show that the higher the power distance the lower the probability of a downgrade. The hazard ratios in the dummy variable models suggest a reduction in risk of a downgrade by up to 74 percent.<sup>10</sup> A long term orientation increases the probability of a downgrade and the dummy variable models suggest this risk is increased by up to 99 percent.

For the upgrade models the only significant culture variable is long term orientation and this increases the probability of an upgrade. The dummy variable models indicate that the risk of an upgrade increases by up to 117 percent. The results therefore indicate that a long term orientation substantially increases both the probability of an upgrade and a downgrade. In other words a long term orientation predisposes to rating volatility. However, it is worthwhile

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<sup>10</sup> Subtracting one from hazard ratio gives the change in relative risk for a one unit change in the relevant independent variable. Thus a hazard ratio of 3 represents a twofold, or 200 percent increase in risk, while a hazard ratio of 0.2 represents an 80 percent reduction in risk.

noting that the evidence of a significant effect for long term orientation in the downgrade models is weaker than the evidence of a significant effect in the upgrade models.

The results in Table 5 also confirm the results from the prior literature that outlook and rating momentum are important variables in explaining sovereign rating changes, Alsakka and ap Gwilym (2009) and Hill Brooks and Faff (2010). Across the dummy variable models a negative outlook increases the risk of a downgrade by up to 169 percent. A positive outlook increases the chance of an upgrade by up to 300 percent and reduces the chance of a downgrade by up to 72 percent. With respect to momentum, in the dummy variable models a downgrade at lag one increase the chance of a further downgrade by up to 163 percent, while reducing the chance of an upgrade by up to 64 percent. A large effect is also evident for the debt crisis variable. During debt crises the risk of a downgrade increases by 200 percent or more, which is consistent with procyclical ratings (Ferri, Lui and Stiglitz, 1999).

TABLE 5 ABOUT HERE

## **5. Conclusion**

We argue that national culture may affect both the level of a sovereign rating and the risk that it will change. To empirically test these propositions we utilized Hofstede's five dimensions of national culture in models of both sovereign rating levels and changes. In undertaking the modeling we include control variables identified as relevant to ratings in the prior literature. The controls are important to the interpretation of the results. This is because national culture may affect both past economic performance and previous rating history, both of which directly affect ratings. Because we control for these variables, the results of culture that we report reflect the additional explanatory power of culture after controlling for economic performance and rating history.

We use ordered probit to model the levels in ratings and a Cox regression model (hazard model with time-varying covariates) to model the changes in ratings. The results show that culture does indeed help explain both levels of sovereign ratings and changes in those ratings. Including culture variables in the models results in a significant improvement in explanatory power relative to models excluding culture.

For sovereign rating levels there was evidence of statistical significance for all five of the culture dimensions, but significance varied depending on whether the culture dimensions were measured as numeric scores or dummy variables. The evidence of significance was strongest for the effect of the power distance index and individualism versus collectivism, less strong for long term orientation and the uncertainty avoidance index and weakest for femininity versus masculinity. Countries with a higher power distance, a higher level of individualism and a long term orientation are more likely to be in higher rating grades. Countries with a high level of uncertainty avoidance and that are more masculine are more likely to be in lower rating grades.

With regard to rating changes only two dimensions of culture are significant. Countries with a high power distance index have a reduced probability of a downgrade and countries with a long term orientation have a higher probability of the rating changing, either up or down. Both dimensions of culture have a very substantial impact on the risk of a rating migration, Culture is a fundamental determinant of the way governments and societies behave, therefore it is not surprising to find that culture affects sovereign ratings. The conclusion from this study is that knowing the nature of a country's culture can help explain the sovereign rating grade it receives. In turn knowing the effect of culture on ratings may be helpful in predicting rating levels and rating changes.

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**Table 1 Distribution and coding of ratings**

| S&P Rating         | Probit<br>Regression<br>Coding | Sample A with<br>835 ratings for<br>probit model | Sample B with<br>1048 ratings for<br>probit model | Cox<br>Regression<br>Coding | Sample C with<br>223 rating<br>changes for<br>Cox model |
|--------------------|--------------------------------|--------------------------------------------------|---------------------------------------------------|-----------------------------|---------------------------------------------------------|
| AAA                | 8                              | 181                                              | 206                                               | 21                          | 3                                                       |
| AA+                | 7                              | 60                                               | 70                                                | 20                          | 7                                                       |
| AA                 | 7                              | 37                                               | 47                                                | 19                          | 7                                                       |
| AA-                | 7                              | 26                                               | 34                                                | 18                          | 10                                                      |
| A+                 | 6                              | 21                                               | 26                                                | 17                          | 5                                                       |
| A                  | 6                              | 63                                               | 67                                                | 16                          | 11                                                      |
| A-                 | 6                              | 72                                               | 79                                                | 15                          | 14                                                      |
| BBB+               | 5                              | 51                                               | 60                                                | 14                          | 18                                                      |
| BBB                | 5                              | 52                                               | 72                                                | 13                          | 21                                                      |
| BBB-               | 5                              | 52                                               | 82                                                | 12                          | 18                                                      |
| BB+                | 4                              | 53                                               | 68                                                | 11                          | 16                                                      |
| BB                 | 4                              | 45                                               | 64                                                | 10                          | 16                                                      |
| BB-                | 4                              | 37                                               | 56                                                | 9                           | 16                                                      |
| B+                 | 3                              | 29                                               | 40                                                | 8                           | 14                                                      |
| B                  | 3                              | 17                                               | 26                                                | 7                           | 15                                                      |
| B-                 | 3                              | 18                                               | 25                                                | 6                           | 13                                                      |
| CCC+               | 2                              | 10                                               | 11                                                | 5                           | 7                                                       |
| CCC                | 2                              | 6                                                | 7                                                 | 4                           | 6                                                       |
| CCC-               | 2                              | 1                                                | 3                                                 | 3                           | 2                                                       |
| CC                 | 1                              | 4                                                | 5                                                 | 2                           | 4                                                       |
| C                  | 1                              | 0                                                | 0                                                 | 1                           | 0                                                       |
| Total observations |                                | 835                                              | 1048                                              |                             | 223                                                     |

This table shows the distribution of observations over rating grades and the conversion of S&P's alphabetic grades to numerical scores for the probit regression and for the Cox regression.

**Table 2 Definition of variables used in the analysis**

| Variable                                                                                                                                                     | Definition                                                                                                                                                                                                                                                                                 | References                                                                                                                                                                                                                                                               |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Panel A: Variables for the ordered probit analysis of rating levels</b>                                                                                   |                                                                                                                                                                                                                                                                                            |                                                                                                                                                                                                                                                                          |
| <b>National culture dimensions</b> Source: <a href="http://www.geerthofstede.nl/dimension-data-matrix">http://www.geerthofstede.nl/dimension-data-matrix</a> |                                                                                                                                                                                                                                                                                            |                                                                                                                                                                                                                                                                          |
| Power distance index                                                                                                                                         | In high power distance countries less powerful members of a society accept and expect that power is distributed unequally.                                                                                                                                                                 | Litch <i>et. al.</i> (2005), Hofstede <i>et. al.</i> (2010), Ashraf <i>et. Al.</i> (2016)                                                                                                                                                                                |
| Individualism vs collectivism                                                                                                                                | A country's position on this dimension is reflected in whether people's self-image is defined in terms of "I" or "we."                                                                                                                                                                     | Trubinsky <i>et. al.</i> (1991), Litch <i>et. al.</i> (2005), Tsakumis <i>et. al.</i> (2007), Beugelsdijk and Frijns (2010), Chui <i>et. al.</i> (2010), Hofstede <i>et. al.</i> (2010), Li <i>et. al.</i> (2013), Ashraf <i>et. al.</i> (2016)                          |
| Masculinity vs. femininity                                                                                                                                   | Countries with a masculine orientation favour a performance society valuing assertiveness, material accomplishment, ambition, competition and success. Countries with feminine orientation favour a welfare society valuing cooperation, modesty, caring for the weak and quality of life. | Litch <i>et. al.</i> (2005), Hofstede <i>et. al.</i> (2010), Anderson <i>et. al.</i> (2011)                                                                                                                                                                              |
| Uncertainty avoidance index                                                                                                                                  | The uncertainty avoidance index expresses the degree to which the members of a society feel uncomfortable with uncertainty and ambiguity.                                                                                                                                                  | Licht <i>et. al.</i> (2005), Kwok and Tadesse (2006), Tsakumis <i>et. al.</i> (2007), Aggarwal and Goodell (2009), Beugelsdijk and Frijns (2010), Hofstede <i>et. al.</i> (2010), Anderson <i>et. al.</i> (2011), Li <i>et. al.</i> (2013), Ashraf <i>et. al.</i> (2016) |
| Long term vs short term orientation                                                                                                                          | Long-term oriented cultures are oriented towards the future. They will forgo current benefit for benefit in the future and value perseverance and thrift.                                                                                                                                  | Hofstede <i>et. al.</i> (2010), Anderson <i>et. al.</i> (2011)                                                                                                                                                                                                           |
| <b>Default history</b> Source: S&P Global Ratings' Credit Research (2013)                                                                                    |                                                                                                                                                                                                                                                                                            |                                                                                                                                                                                                                                                                          |
| Dummy prior default                                                                                                                                          | The dummy takes the value of one if a country had a foreign currency-denominated debt default prior to the rating state under study, and zero otherwise                                                                                                                                    | Cantor and Packard (1996), Hu, Kiesel, Perraudin (2002), Afonso (2003), Mora (2006), Hill, Brooks and Faff (2010)                                                                                                                                                        |
| <b>Macroeconomic and financial variables</b> Source: World Bank databases unless otherwise stated                                                            |                                                                                                                                                                                                                                                                                            |                                                                                                                                                                                                                                                                          |
| Dummy OECD member                                                                                                                                            | This variable takes a value of one if the country is a member of the OECD at the start of the rating observation under study, and zero otherwise.                                                                                                                                          | Ferri, Lui and Stiglitz (1999), Mora (2006)                                                                                                                                                                                                                              |
| GDP growth                                                                                                                                                   | The geometric average of the previous three-year annual growth rate in GDP                                                                                                                                                                                                                 | Cantor and Packard (1996), Ferri, Lui and Stiglitz (1999), Mora (2006), Hill, Brooks and Faff (2010)                                                                                                                                                                     |
| GDP per capita                                                                                                                                               | GDP in constant (US\$ 2005) prices divided by mid-year population                                                                                                                                                                                                                          | Cantor and Packard (1996), Ferri, Lui and Stiglitz (1999), Afonso (2003), Mora (2006), Hill, Brooks and Faff (2010)                                                                                                                                                      |
| Inflation                                                                                                                                                    | The geometric average of the previous three-year inflation as measured by the consumer price index.                                                                                                                                                                                        | Cantor and Packard (1996), Ferri, Lui and Stiglitz (1999), Mora (2006), Hill, Brooks and Faff (2010)                                                                                                                                                                     |
| Government surplus or deficit/GDP                                                                                                                            | The government surplus or deficit divided by GDP defined as above.                                                                                                                                                                                                                         | Cantor and Packard (1996), Ferri, Lui and Stiglitz (1999), Mora (2006), Hill, Brooks and Faff (2010)                                                                                                                                                                     |

|                                           |                                                                                                                                                                                                |                                                                                                      |
|-------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------|
| Current account surplus or deficit to GDP | The current account surplus or deficit divided by GDP defined as above.                                                                                                                        | Cantor and Packard (1996), Ferri, Lui and Stiglitz (1999), Mora (2006), Hill, Brooks and Faff (2010) |
| International debt                        | The international debt outstanding as a share of GDP.                                                                                                                                          | Cantor and Packard (1996), Ferri, Lui and Stiglitz (1999), Mora (2006), Hill, Brooks and Faff (2010) |
| Std dev of world stock market index       | The annualised standard deviation of the Datastream world stock market index, which is calculated using daily data over a six-month rolling window prior to the rating observation under study | Hill, Brooks and Faff (2010)                                                                         |
| Square of government surplus or deficit   | Squared value of the government surplus or deficit as defined above.                                                                                                                           | Hill, Brooks and Faff (2010)                                                                         |
| Square of GDP growth                      | Squared value of the GDP growth as defined above.                                                                                                                                              | Hill, Brooks and Faff (2010)                                                                         |

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**Political rights and civil liberties** Source: Freedom House (2011)

A country is scored for each of 10 political rights indicators and 15 civil liberties indicators. The average of the score gives the freedom rating: Free (1.0 to 2.5), Partly Free (3.0 to 5.0), or Not Free (5.5 to 7.0).

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|               |                                                                                                                                         |
|---------------|-----------------------------------------------------------------------------------------------------------------------------------------|
| Dummy freedom | The dummy takes the value of one if a country is assigned a “Free” status for political rights and civil liberties, and zero otherwise. |
|---------------|-----------------------------------------------------------------------------------------------------------------------------------------|

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**Panel B: Variables for the Cox regression analysis of rating changes**

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**National culture variables:** As defined above, Power distance index, Individualism vs collectivism, Masculinity vs. femininity, Uncertainty avoidance index, Long term vs short term orientation

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**S&P’s rating data:** Source: Cavanaugh, Phua and Young (2011) unless otherwise stated

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|                          |                                                                                                                                                                |                                                                                                                      |
|--------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------|
| Current rating grade     | The starting rating grade for the rating transition being observed.                                                                                            | Alsakka and ap Gwilym (2009), Dang and Partington (2014)                                                             |
| Dummy unsolicited rating | The dummy takes the value of one if the rating S&P assigns to a country is unsolicited, and zero otherwise                                                     | Poon (2003)                                                                                                          |
| Dummy lag one downgrade  | The dummy takes the value of one if the lag one rating ends with a downgrade, and zero otherwise                                                               | Alsakka and ap Gwilym (2009), Alsakka and Ap Gwilym (2010), Hill, Brooks and Faff (2010), Dang and Partington (2014) |
| Dummy prior fallen angel | This variable takes the value of one if a country experienced being a fallen angel (a downgrade from an investment-grade rating to a speculative-grade rating) | Vazza, Aurora and Schneck (2005), Guettler and Wahrenburg (2007), Dang and Partington (2014)                         |
| Age since first rated    | This time-varying variable measures the duration since a country was first rated                                                                               | Altman (1998), Dang and Partington (2014)                                                                            |
| Lag one duration (years) | The duration of the rating state immediately preceding the current rating state                                                                                | Alsakka and ap Gwilym (2009), Bannier and Hirsch (2010), Dang and Partington (2014)                                  |
| Dummy prior default      | This dummy takes the value of one if a country had a foreign currency-denominated debt default prior to the rating state under study, and zero otherwise       | Cantor and Packard (1996), Hu, Kiesel, Perraudin (2002), Afonso (2003), Mora (2006), Hill, Brooks and Faff (2010)    |

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Source: S&P Global Ratings' Credit Research (2013)

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**S&P's outlook** Source: Cavanaugh, Phua and Young (2011)

S&P issues a rating outlook to indicate its view regarding the potential direction of a long-term credit rating over the intermediate term (six months to two years) (S&P RatingsDirect, 2009). Outlooks can be positive (rating may be raised), negative (rating may be lowered), stable (rating unlikely to change), or developing (rating may be raised or lowered).

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|                        |                                                                                                                            |                                                                                                                           |
|------------------------|----------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------|
| Dummy negative outlook | This time-varying variable takes the value of one if a country was assigned a negative outlook by S&P, and zero otherwise. | Vazza, Leung, Alsati and Katz (2005), Hill <i>et. al.</i> (2010), Bannier and Hirsch (2010), Alsakka and ap Gwilym (2012) |
| Dummy positive outlook | This time-varying variable takes the value of one if a country was assigned a positive outlook by S&P, and zero otherwise. | Vazza, Leung, Alsati and Katz (2005), Hill <i>et. al.</i> (2010), Bannier and Hirsch (2010), Alsakka and ap Gwilym (2012) |

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**Macroeconomic and financial conditions** Source: World Bank databases unless otherwise stated

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|                                |                                                                                                                                                                                                                                       |                                                    |
|--------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------|
| Dummy debt crisis              | This variable takes a value of one if a rating commences during a period of debt crisis as listed in Manasse, Roubini, Schimmelpfennig (2003), Laeven and Valencia (2008), or De Paoli, Hoggarth, Saporta (2009), and zero otherwise. | Ferri, Lui and Stiglitz (1999), Mora (2006)        |
| Dummy OECD member              | This variable takes a value of one if the country is a member of the OECD at the start of the current rating and zero otherwise.                                                                                                      | See references for macro-economic variables above. |
| Change in GDP per capita       | The change in real GDP per capita over the year prior to the start of the rating.                                                                                                                                                     | See references for macro-economic variables above. |
| Change in real GDP growth rate | The change in the real GDP growth rate over the year prior to the start of the rating.                                                                                                                                                | See references for macro-economic variables above. |
| Change in inflation            | The change in the inflation rate over the year prior to the start of the rating.                                                                                                                                                      | See references for macro-economic variables above. |
| Change in international debt   | The change in international indebtedness over the year prior to the start of the rating.                                                                                                                                              | See references for macro-economic variables above. |

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**Political rights and civil liberties** Source: Freedom House (2011)

A country is scored for each of 10 political rights indicators and 15 civil liberties indicators. The average of the score gives the freedom rating: Free (1.0 to 2.5), Partly Free (3.0 to 5.0), or Not Free (5.5 to 7.0).

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|               |                                                                                                |
|---------------|------------------------------------------------------------------------------------------------|
| Dummy freedom | The dummy takes the value of one if a country is assigned a "Free" status, and zero otherwise. |
|---------------|------------------------------------------------------------------------------------------------|

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This table defines the variables used in the probit regression and the Cox regression. The table gives the data sources, variable names, the definition of the variable and references to examples of the literature that has used the variables

**Table 3 Descriptive statistics for national culture*****Panel A: Descriptive statistics of culture dimensions for sample A for probit model (n = 835)***

|                                     | Mean  | Median | Std<br>Dev | Min   | Max | n for<br>Dummy<br>Median split |     | n for<br>Dummy<br>Mean split |     |
|-------------------------------------|-------|--------|------------|-------|-----|--------------------------------|-----|------------------------------|-----|
|                                     |       |        |            |       |     | D=1                            | D=0 | D=1                          | D=0 |
| Power distance index                | 55.91 | 60     | 21.09      | 11    | 104 | 422                            | 413 | 460                          | 375 |
| Individualism vs collectivism       | 47.28 | 46     | 23.85      | 13    | 91  | 427                            | 408 | 403                          | 432 |
| Masculinity vs. femininity          | 48.18 | 49     | 20.43      | 5     | 110 | 423                            | 412 | 423                          | 412 |
| Uncertainty avoidance index         | 68.75 | 70     | 22.68      | 8     | 112 | 430                            | 405 | 386                          | 449 |
| Long term vs short term orientation | 51.01 | 49.87  | 22.20      | 12.59 | 100 | 421                            | 414 | 393                          | 442 |

***Panel B: Descriptive statistics of culture dimensions for sample B for probit model (n= 1048)***

|                                     | Mean  | Median | Std<br>Dev | Min   | Max | n for<br>Dummy<br>Median split |     | n for<br>Dummy<br>Mean split |     |
|-------------------------------------|-------|--------|------------|-------|-----|--------------------------------|-----|------------------------------|-----|
|                                     |       |        |            |       |     | D=1                            | D=0 | D=1                          | D=0 |
| Power distance index                | 57.34 | 60     | 21.66      | 11    | 104 | 556                            | 492 | 556                          | 492 |
| Individualism vs collectivism       | 46.39 | 46     | 23.49      | 12    | 91  | 529                            | 519 | 472                          | 576 |
| Masculinity vs. femininity          | 49.97 | 50     | 21.2       | 5     | 110 | 528                            | 520 | 528                          | 520 |
| Uncertainty avoidance index         | 68.42 | 70     | 22.65      | 8     | 112 | 537                            | 511 | 492                          | 556 |
| Long term vs short term orientation | 50.2  | 47.61  | 23.03      | 12.59 | 100 | 518                            | 530 | 472                          | 576 |

***Panel C: Descriptive statistics of culture dimensions for sample C for Cox's hazard model (n = 223)***

|                                     | Mean  | Median | Std<br>Dev | Min  | Max   | n for Dummy<br>Median split |     | n for Dummy<br>Mean split |     |
|-------------------------------------|-------|--------|------------|------|-------|-----------------------------|-----|---------------------------|-----|
|                                     |       |        |            |      |       | D=1                         | D=0 | D=1                       | D=0 |
| Power distance index                | 65.67 | 64     | 17.8       | 28   | 104   | 118                         | 105 | 109                       | 114 |
| Individualism vs collectivism       | 37.12 | 35     | 18.69      | 13   | 91    | 121                         | 102 | 88                        | 135 |
| Masculinity vs. femininity          | 48.1  | 46     | 16.7       | 9    | 95    | 123                         | 100 | 104                       | 119 |
| Uncertainty avoidance index         | 74.68 | 82     | 22.33      | 30   | 112   | 121                         | 102 | 94                        | 129 |
| Long term vs short term orientation | 48.56 | 45.59  | 21.59      | 3.53 | 87.91 | 119                         | 104 | 106                       | 117 |

This table shows the descriptive statistics for scores on the dimensions of culture and the number of observations in each dummy variable classification. The definitions of the culture variables are as in Table 2. In all cases, except the dummy for weak uncertainty avoidance, Dummy = 1 represents observations with scores greater than or equal to the median (mean). In the case of the uncertainty avoidance index Dummy = 1 represents observations with scores less than or equal to the median (mean).

**Table 4 Probit model for rating levels**

|                                               | Sample A (with Govt surplus data) n=835 |                        |                      | Sample B (without Govt surplus data) n=1048 |                        |                      |
|-----------------------------------------------|-----------------------------------------|------------------------|----------------------|---------------------------------------------|------------------------|----------------------|
| Variables                                     | Numeric culture score                   | Culture dummy (median) | Culture dummy (mean) | Numeric culture score                       | Culture dummy (median) | Culture dummy (mean) |
| <b>Culture</b>                                |                                         |                        |                      |                                             |                        |                      |
| Power distance index (PDI)                    | <b>0.0147***</b>                        |                        |                      | <b>0.01230***</b>                           |                        |                      |
| Individualism vs collectivism (IDV)           | <b>0.0138***</b>                        |                        |                      | <b>0.00537**</b>                            |                        |                      |
| Masculinity vs femininity (MAS)               | <b>-0.00492*</b>                        |                        |                      | <b>-0.00614**</b>                           |                        |                      |
| Uncertainty avoidance index (UAI)             | -0.00201                                |                        |                      | <b>-0.00695***</b>                          |                        |                      |
| Long term (LT) vs short term (ST) orientation | <b>0.00458**</b>                        |                        |                      | <b>0.00298*</b>                             |                        |                      |
| Dummy large power distance                    |                                         | <b>0.3921***</b>       | <b>0.8252***</b>     |                                             | <b>0.4568***</b>       | <b>0.4733***</b>     |
| Dummy individualism                           |                                         | <b>0.6633***</b>       | <b>1.1647***</b>     |                                             | <b>0.3156**</b>        | <b>0.6401***</b>     |
| Dummy masculine                               |                                         | <b>-0.2694**</b>       | -0.1409              |                                             | -0.0798                | 0.0042               |
| Dummy weak UAI                                |                                         | <b>0.2836***</b>       | <b>0.2136**</b>      |                                             | <b>0.4402***</b>       | <b>0.2806**</b>      |
| Dummy long term orientation                   |                                         | <b>0.167*</b>          | 0.1172               |                                             | <b>0.2883***</b>       | <b>0.2141***</b>     |
| <b>Controls</b>                               |                                         |                        |                      |                                             |                        |                      |
| Dummy prior default                           | <b>-1.2849***</b>                       | <b>-1.3083***</b>      | <b>-1.1384***</b>    | <b>-1.1843***</b>                           | <b>-1.2401***</b>      | <b>-1.1476***</b>    |
| Dummy OECD member                             | -0.0179                                 | 0.1304                 | -0.1743              | -0.0738                                     | -0.0222                | -0.1858              |
| GDP per capita                                | <b>0.0002***</b>                        | <b>0.00017***</b>      | <b>0.0002***</b>     | <b>0.0002***</b>                            | <b>0.00018***</b>      | <b>0.0002***</b>     |
| GDP growth                                    | <b>0.1125***</b>                        | <b>0.1153***</b>       | <b>0.1152***</b>     | <b>0.1224***</b>                            | <b>0.1249***</b>       | <b>0.126***</b>      |
| Square of GDP growth                          | -0.0026                                 | -0.0042                | -0.0029              | 0.0023                                      | 0.00167                | 0.0010               |
| Inflation                                     | <b>-0.0019***</b>                       | <b>-0.0014***</b>      | <b>-0.0017***</b>    | <b>-0.0021***</b>                           | <b>-0.0018***</b>      | <b>-0.0020***</b>    |
| Current account surplus/GDP                   | <b>0.0223***</b>                        | <b>0.0258***</b>       | <b>0.0250***</b>     | <b>0.0197**</b>                             | <b>0.0277***</b>       | <b>0.0271***</b>     |
| International debt                            | <b>-0.0069***</b>                       | <b>-0.0059***</b>      | <b>-0.0083***</b>    | <b>-0.0122***</b>                           | <b>-0.0111***</b>      | <b>-0.0116***</b>    |
| Govt surplus/GDP                              | <b>0.0353*</b>                          | <b>0.0362*</b>         | 0.0236               |                                             |                        |                      |
| Square of Govt surplus /GDP                   | <b>-0.0089***</b>                       | <b>-0.0086***</b>      | <b>-0.0086***</b>    |                                             |                        |                      |
| Std dev of world stock market index           | <b>-0.2498***</b>                       | <b>-0.2448**</b>       | <b>-0.2531***</b>    | <b>-0.2105**</b>                            | <b>-0.1972**</b>       | <b>-0.1888**</b>     |
| Dummy freedom                                 | -0.0336                                 | -0.0176                | 0.0127               | <b>-0.078***</b>                            | <b>-0.0753***</b>      | <b>-0.0462**</b>     |
| Likelihood ratio $\chi^2$ adding culture      | 54.7***                                 | 44.067***              | 97.31***             | 52.83***                                    | 54.984***              | 71.67***             |
| Cox Snell R <sup>2</sup>                      | 0.8309                                  | 0.8287                 | 0.8393               | 0.8154                                      | 0.8158                 | 0.8187               |

This table presents the results from estimating a probit model for rating levels. Descriptions of the independent variables are given in Table 2 Panel A. The independent variables for culture are coded as numeric variables and also dummy variables as described in Table 3. Significant coefficients are shown in bold, with \*\*\*, \*\* and \* representing significance at the 0.01, 0.05 and 0.10 levels respectively, using the Wald test. The likelihood ratio is based on a comparison of models with culture variables added versus a model containing all the variables except the culture variables.

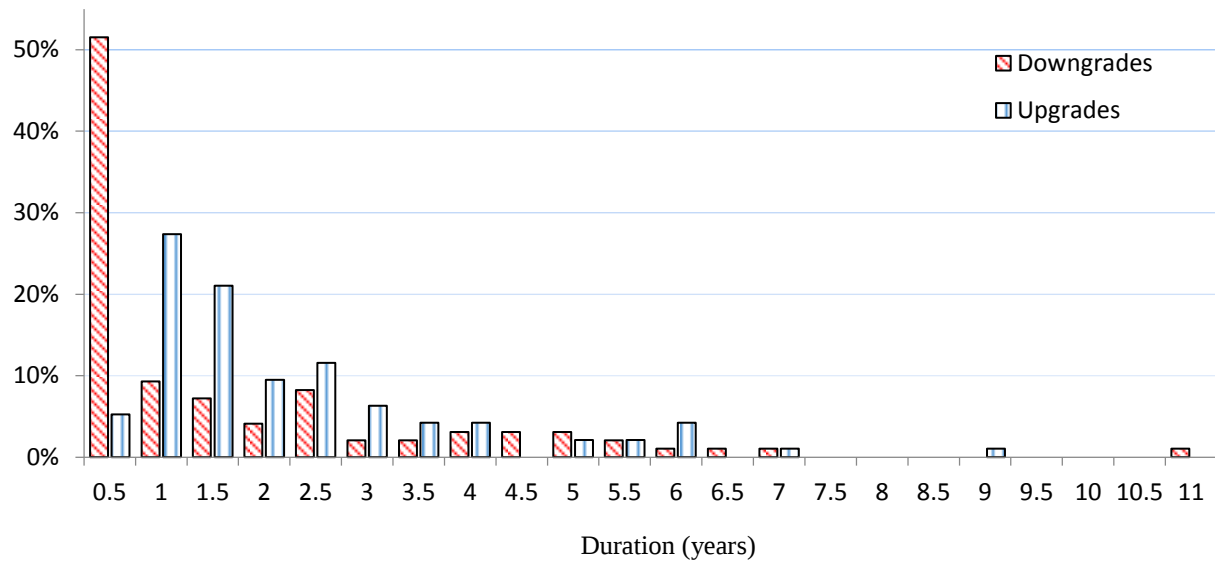
**Table 5 Cox regression model for rating changes**

| Variables                                     | Numeric culture score |              |                    |              | Culture dummy (median) |              |                    |              | Culture dummy (mean) |              |                    |              |
|-----------------------------------------------|-----------------------|--------------|--------------------|--------------|------------------------|--------------|--------------------|--------------|----------------------|--------------|--------------------|--------------|
|                                               | Downgrade             |              | Upgrade            |              | Downgrade              |              | Upgrade            |              | Downgrade            |              | Upgrade            |              |
|                                               | Coefficient           | Hazard ratio | Coefficient        | Hazard ratio | Coefficient            | Hazard ratio | Coefficient        | Hazard ratio | Coefficient          | Hazard ratio | Coefficient        | Hazard ratio |
| <b>National culture dimensions</b>            |                       |              |                    |              |                        |              |                    |              |                      |              |                    |              |
| Power distance index (PDI)                    | <b>-0.05216***</b>    | 0.949        | 0.00446            | 1.004        |                        |              |                    |              |                      |              |                    |              |
| Individualism vs collectivism (IDV)           | -0.01654              | 0.984        | 0.000383           | 1.000        |                        |              |                    |              |                      |              |                    |              |
| Masculinity vs femininity (MAS)               | 0.00111               | 1.001        | -0.0107            | 0.989        |                        |              |                    |              |                      |              |                    |              |
| Uncertainty avoidance index (UAI)             | 0.01177               | 1.012        | 0.00263            | 1.003        |                        |              |                    |              |                      |              |                    |              |
| Long term (LT) vs short term (ST) orientation | 0.00665               | 1.007        | <b>0.02769***</b>  | 1.028        |                        |              |                    |              |                      |              |                    |              |
| Dummy large power distance index              |                       |              |                    |              | <b>-1.30737***</b>     | 0.271        | 0.2407             | 1.272        | <b>-1.36325***</b>   | 0.256        | 0.12393            | 1.132        |
| Dummy individualism                           |                       |              |                    |              | -0.15079               | 0.86         | 0.20534            | 1.228        | -0.08149             | 0.922        | 0.1773             | 1.194        |
| Dummy masculine                               |                       |              |                    |              | 0.29125                | 1.338        | -0.04975           | 0.951        | 0.10529              | 1.111        | -0.25929           | 0.772        |
| Dummy weak UAI                                |                       |              |                    |              | -0.49702               | 0.608        | -0.38845           | 0.678        | -0.47097             | 0.624        | -0.226             | 0.798        |
| Dummy long term orientation                   |                       |              |                    |              | <b>0.6885**</b>        | 1.991        | <b>0.77559***</b>  | 2.172        | <b>0.61927*</b>      | 1.858        | <b>0.72591***</b>  | 2.067        |
| <b>S&amp;P's rating data</b>                  |                       |              |                    |              |                        |              |                    |              |                      |              |                    |              |
| Current rating grade                          | -0.0369               | 0.964        | <b>-0.30452***</b> | 0.737        | -0.04592               | 0.955        | <b>-0.23604***</b> | 0.79         | -0.05385             | 0.948        | <b>-0.24094***</b> | 0.786        |
| Dummy unsolicited rating                      | 0.75755               | 2.133        | -0.00523           | 0.995        | 0.41259                | 1.511        | -0.33999           | 0.712        | 0.37368              | 1.453        | -0.22337           | 0.8          |
| Dummy lag one downgrade                       | <b>1.27504***</b>     | 3.579        | <b>-1.69411***</b> | 0.184        | <b>0.9691**</b>        | 2.636        | <b>-1.42366***</b> | 0.241        | <b>0.9195**</b>      | 2.508        | <b>-1.34345***</b> | 0.261        |
| Dummy prior fallen angel event(s)             | 0.4472                | 1.564        | -0.63803           | 0.528        | 0.61931                | 1.858        | <b>-0.69916*</b>   | 0.497        | 0.61336              | 1.847        | -0.50277           | 0.605        |
| Age since first rated (time-varying)          | -0.00845              | 0.992        | 0.04164            | 1.043        | 0.0006392              | 1.001        | 0.05705            | 1.059        | 0.00644              | 1.006        | 0.04332            | 1.044        |
| Lag one rating duration                       | 0.04317               | 1.044        | -0.07152           | 0.931        | 0.02954                | 1.03         | -0.10666           | 0.899        | 0.02632              | 1.027        | -0.09566           | 0.909        |
| Dummy negative outlook (time-varying)         | <b>0.90565***</b>     | 2.474        | -0.07243           | 0.93         | <b>0.98956***</b>      | 2.69         | -0.00276           | 0.997        | <b>0.93905***</b>    | 2.558        | -0.01108           | 0.989        |
| Dummy positive outlook (time-varying)         | <b>-1.54465**</b>     | 0.213        | <b>1.3511***</b>   | 3.862        | <b>-1.28068*</b>       | 0.278        | <b>1.40691***</b>  | 4.083        | <b>-1.28451*</b>     | 0.277        | <b>1.39469***</b>  | 4.034        |

| Variables                                      | Numeric culture score |              |                   |              | Culture dummy (median) |              |                  |              | Culture dummy (mean) |              |                  |              |
|------------------------------------------------|-----------------------|--------------|-------------------|--------------|------------------------|--------------|------------------|--------------|----------------------|--------------|------------------|--------------|
|                                                | Downgrade             |              | Upgrade           |              | Downgrade              |              | Upgrade          |              | Downgrade            |              | Upgrade          |              |
|                                                | Coefficient           | Hazard ratio | Coefficient       | Hazard ratio | Coefficient            | Hazard ratio | Coefficient      | Hazard ratio | Coefficient          | Hazard ratio | Coefficient      | Hazard ratio |
| <b>Macro-economic and financial conditions</b> |                       |              |                   |              |                        |              |                  |              |                      |              |                  |              |
| Dummy prior default                            | <b>-1.3285***</b>     | 0.265        | 0.07575           | 1.079        | <b>-1.31035**</b>      | 0.27         | 0.4354           | 1.546        | <b>-1.41818***</b>   | 0.242        | 0.18465          | 1.203        |
| Dummy debt crisis                              | <b>1.29706***</b>     | 3.659        | -0.6831           | 0.505        | <b>1.10844**</b>       | 3.03         | -0.53124         | 0.588        | <b>1.16616**</b>     | 3.21         | -0.58452         | 0.557        |
| Dummy OECD member                              | <b>-1.15755***</b>    | 0.314        | 0.3501            | 1.419        | <b>-1.28066***</b>     | 0.278        | -0.23494         | 0.791        | <b>-1.05036**</b>    | 0.35         | 0.19309          | 1.213        |
| Change in GDP per capita at year $t$           | 0.01941               | 1.02         | 0.0004444         | 1            | -0.02163               | 0.979        | 0.01136          | 1.011        | -0.01141             | 0.989        | 0.02727          | 1.028        |
| Change in real GDP growth rate at year $t$     | 0.03121               | 1.032        | <b>-0.07777**</b> | 0.925        | 0.04564                | 1.047        | <b>-0.06711*</b> | 0.935        | 0.03732              | 1.038        | <b>-0.07153*</b> | 0.931        |
| Change in inflation at year $t$                | -0.00328              | 0.997        | 0.00204           | 1.002        | 0.00409                | 1.004        | 0.00295          | 1.003        | 0.00176              | 1.002        | 0.00138          | 1.001        |
| Change in international debt at year $t$       | <b>0.01079***</b>     | 1.011        | 0.00366           | 1.004        | <b>0.00636**</b>       | 1.006        | 0.00477          | 1.005        | <b>0.00598**</b>     | 1.006        | 0.0052           | 1.005        |
| <b>Political</b>                               |                       |              |                   |              |                        |              |                  |              |                      |              |                  |              |
| Dummy freedom                                  | <b>0.11685**</b>      | 1.124        | -0.06676          | 0.935        | <b>0.09793*</b>        | 1.103        | -0.04772         | 0.953        | <b>0.1276**</b>      | 1.136        | -0.02948         | 0.971        |
| Likelihood ratio $\chi^2$ adding culture       | 23.8388***            |              | 16.7876***        |              | 19.0876***             |              | 9.954*           |              | 17.7979***           |              | 9.2831*          |              |
| Cox Snell R <sup>2</sup>                       | 0.4645                |              | 0.3621            |              | 0.4530                 |              | 0.3422           |              | 0.4498               |              | 0.3402           |              |

This table presents the results from estimating a Cox regression model for rating changes, with separate models for upgrades and downgrades. Descriptions of the independent variables are given in Table 2 Panel B. The independent variables for culture are coded as numeric variables and also dummy variables as described in Table 3. Significant coefficients are shown in bold, with \*\*\*, \*\* and \* representing significance at the 0.01, 0.05 and 0.10 levels respectively using the Wald test. Subtracting 1 from the hazard ratio gives the percentage change in the hazard for a one unit change in the independent variable. The likelihood ratio is based on a comparison of models with culture variables added versus a model containing all the variables except the culture variables.

**Figure 1 Distribution of ratings by duration**



This figure shows the distribution of ratings for upgrades and downgrades by the duration (survival time) of the ratings. Duration is the length of time a country stays in a rating grade measured from the time it enters the rating grade subsequent to the commencement of the study until the time it either migrates to another rating grade or becomes censored. A country may contribute multiple observations of rating changes to the study. The sample used to estimate the Cox hazard model includes 223 ratings of which 97 are downgrades and 95 are upgrades.