Governance Risk and the Cross-Section of Stock Returns:

Do Business Cycles Help to Solve the Puzzle?

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ABSTRACT

This paper investigates the asset-pricing implications of corporate governance decisions. Since Gompers, Ishii and Metrick (2003), the question of whether governance indices are priced into stocks has been debated. From an asset pricing perspective, it remains a puzzle that firms with low indices or good governance also deliver higher risk premiums. We propose a framework with governance risk and business cycles to explain this puzzle and to provide theoretical and empirical evidence of a connection between corporate governance decisions and asset-pricing theory. Our finding is made possible by introducing business cycles and Epstein-Zin type of investors into corporate finance models with agency conflicts.

JEL Codes: G30, G12, G32, G14
Keywords: Governance risk, equity pricing, business cycles

1 Introduction

Understanding the asset-pricing implications of corporate governance has been a challenge for at least the last two decades. As evidenced by the literature, the balance of power between insiders and outside investors should play a significant role in shedding light on this challenge (e.g., Jensen and Meckling, 1976; LaPorta et al., 2000a, 2002; Morellec (2004); Lambrecht and Myers, 2008).[1] Corporate finance models with agency costs operate in a riskless environment and so do not make predictions on the risk premium, whereas the ones that do make predictions do so empirically without a model. Moreover, these empirical studies mostly document a weak relationship between governance quality and equity prices. This paper provides a theoretical solution to this issue by introducing business-cycle risk and Epstein-Zin investors into corporate finance models with agency conflicts. Unlike the literature, we use the term governance risk, measured by the (lagged) instruments of governance indices instead of agency costs, proxied by the actual governance indices in the literature.[2] On the empirical side, this paper eliminates the endogeneity problems embedded into governance indices through the use of the instruments of these indices instead. We also show that firms that have higher governance risk in bad vs. good economy periods for the economy have higher equity premiums.

To fill the theoretical gap, we built a dynamic consumption-based corporate finance model

[1]Here, "insiders" refers to managers. It can be assumed that controlling shareholders have also more influence on managers than minority shareholders. However, the firm's decisions are solely in the hands of managers. We choose to use the two terms interchangeably. There is a blurry line between the two in the context of the paper, namely whether there is a majority shareholder. If there is, the majority shareholder can force managers to adjust the objective function of the firm. In this case, "insiders" will be managers plus the majority shareholder. If not, insiders are the managers. This paper assumes the latter. The reason is as follows. Firms in the indices are drawn from the S&P 500, the lists of the largest corporations, firms with large institutional ownership, and some smaller firms (Gompers, Ishii and Metrick, 2003). Although one needs to appreciate the proportion of firms with a majority shareholder if there are any, this proportion is likely to be insignificant in regard to the sample of firms. This is also in line with LaPorta et al. (2000b), who document that in large US firms the decisions are taken by managers because ownership is dispersed.

[2]Governance risk is distinct from managerial risk as defined by Pan, Wang and Weisbach (2018), "the uncertainty about a management team's impact on firm value, which comes from both the policies the team is likely to bring to their firms and their ability to implement them personally." Governance risk refers a firm's past governance decisions, where governance decisions are captured by governance indices E- and G-indices. The rationale is that the impacts of these strategic decisions can take years before being reflected into stock valuations. Consequently, governance risk is an exogenous variable when the time decisions are taken. It is a source risk because the higher the instruments the greater the costs are *likely* to be from the investor's perspective. Note that the costs induced by governance risk are likely to be higher than the agency costs, which only captures private benefits. However, we assume both are equivalent in magnitude.

with both business cycles and governance risk, in which state-dependent optimal financing, default, and refinancing decisions are endogenously determined. Macroeconomic conditions, which are governed by aggregate consumption, change over the business cycle and affect firms' profitability. The agent has an Epstein-Zin preference and so dislikes a positive correlation between consumption and cash-flow shocks (consumption-CAPM risk), as well as the uncertainty linked to shifts in economic conditions (business-cycle risk). Consequently, buying stocks yields a compensation for these two sources of risk. We focus on the total risk premium, although the business cycle risk drives most of the equity risk premium, as shown in Dorion, Ekponon and Jeanneret (2020). Similar to corporate finance models with agency conflicts, we find that higher governance risk leads insiders to use debt more conservatively. By plugging in an asset pricing framework to these aforementioned models, we show that less debt subsequently produces low equity premium, thus providing a theoretical explanation to Gompers, Ishii and Metrick (2003) and others' findings. We also contribute to creating more links between agency conflicts and equity prices. Because governance risk is time-varying, in bad times, firms with greater governance risk see their equity valuation fluctuate more over the business cycle. On average, these firms then pay a higher compensation for business-cycle risk, and thus have higher risk premiums.

Using G- and E-indices level as proxy for agency costs and their instruments as capturing governance risk, we provide support for our theoretical framework. As in the literature, we start with the governance indices and find a weak relation between the indices and equity prices. Next, using the indices instruments, we uncover two new sources of cross-sectional differences in equity returns among U.S. firms. The first is the instrument level at the time the firm went public and the second is the variation in the instrument's level in bad versus good economic periods. We find that firms with higher governance risk levels at IPO time have lower average equity premiums because insiders optimally choose a lower debt level, and hence pay a lower compensation for equity risk during the subsequent years because capital structure decisions are stable across time. Importantly, firms with greater governance risk in bad as opposed to good times deliver higher average equity returns due to more volatile stock prices at the business-cycle frequency. In a recent study, Gagnon and Jeanneret (2022) document in an international setting that better governance quality is associated with lower equity volatility. These findings indicate that governance risk has the potential to explain some cross-sectional differences in equity returns.[3]

To generate a leverage ratio close to the market average of 25% for the representative firm, governance risk must be calibrated at 2.15% of the profits, given our calibration. Initial governance risk from 0.05% to 2.50% produce equity premia that decrease from 10.25% to 3.53%. Hence, our framework offers a theoretical model that allows to reproduce the key empirical findings of the seminal work by Gompers, Ishii and Metrick (2003) and by subsequent contributions. These unprecedented results are theorized here for the first time, especially as most scholars acknowledge that the literature has not yet developed a solid interpretation of Gompers, Ishii and Metrick (2003)'s findings. In this paper, we find that the cross-sectional differences in returns are caused by self-interested insiders who adopt suboptimal capital structure choices. Next, we derive the following novel prediction: if the instruments measure risk, their impact must be stronger in bad economic periods. Henceforth, firms with higher governance risk in recession should have higher equity returns. Changes in governance risk in bad versus good times from -30% to 30% result in average governance risk of -6.85% to 11.15%, respectively.[4] Using these values, the model predicts that the equity premium spreads from 0.13% to 9.00%. The economic justification for this prediction is as follows. In a model with business cycles but no agency conflicts, investors are compensated for business-cycle risk on top of the consumption-CAPM risk premium. With business cycles and agency conflicts, firms that have higher governance risk in bad times face a greater decline in their stock price in bad compared to good times, magnifying stock-price fluctuations at the business cycle frequency. Hence, greater governance risk in recession increases the business-cycle risk premium.

To calculate governance risk, we rely on corporate governance G- and E-indices instruments

[3] Rather than showing governance risk is a risk factor for stocks, we aim to build a still weak link between corporate finance and asset pricing. This paper does not look into the predictive power of governance either and its relevance in the factor zoo discussion.

[4] Because the benchmark value for governance risk is 2.15% of net income in initial financing time. Average governance risk is computed as value-weighted, by the probability density of each state, of state-dependent values. The average goes from -6.85% (= 2.15% x 0.70 + (-27.85%) x 0.30) to 11.15% (= 2.15% x 0.70 + 32.15% x 0.30). One may think of negative governance risk as a wage or executives privileges cuts for example.

by Karpoff, Schonlau and Wehrly (2017).[5,6] A higher instrument value translates into greater governance risk (e.g., Masulis, Wang and Xie, 2007 and Giroud and Mueller, 2011). We follow the literature and start our analysis with raw corporate governance G- and E-indices, which are not our measure for governance risk. Over the period from 1990 to 2006 (2 economic cycles), we examined cross-sectional regressions of firms' average excess returns on their average index levels, average changes in their index levels in bad versus good times, and square of the average changes in their index levels in bad versus good times. Regressions are controlled for the Fama-French five-factor, plus momentum. For the G-index, we found a negative relationship (p-value $< 5\%$) between returns and the average index value, in line with the consensus, and a positive relationship (not significant) between returns and changes in index value in bad vs. good times. The results are the same yet better with the E-index (p-value $< 5\%$). Hence, we not only replicate previous findings but also find support for our prediction regarding the connection between returns and the changes in the indices value in bad vs. good times. Next, we compute firms' average returns with respect to the average changes in their index levels in bad versus good times and show a V-shaped relationship between their two quantities. This occurs because reducing insiders' flexibility (lower index value) in bad times curbs the firm's productivity, thus generating higher equity returns.

We now turn to our measure of governance risk instead of the raw indices. As *Asset pricing implication 1* refers to governance risk at IPO time, raw indices are replaced by their 5-year lagged IPO cohort-based instruments. For *Asset pricing implication* 2, we use the 5-year lagged geography-based instruments. The rationale is that the GEO (geography)-based instrument controls for endogeneity, as in the case of altered performances of firms with lower G-index in bad times. In comparison, IPO cohort-based instrument provides a cleaner measure of a firm's governance risk at the time the company shapes its capital structure. Moreover, as pointed out by Johnson, Karpoff and Yi (2015), the use of provisions by firms that went public

[5]The geography-based instrumental variable is based on the takeover defenses deployed in previous years at geographically proximate firms that are not in the same industry as the focus firm. The IPO-based instrument is constructed on the takeover defenses deployed in previous years by firms that went public within one year of the focus firm, but are not in the same industry and using data from five years before the year of analysis.

[6]Karpoff et al. (2017) among others have questioned the ability of governance indices to capture the likelihood of a firm takeover deterrence and to represent reliable measures of governance quality. A higher (lower) index level should lead to a lower (higher) takeover likelihood (deterrence) of a firm. In the context of this paper, a low takeover likelihood means more power to insiders and higher governance risk to outside investors.

at the same time is stable over time. As an example, 90% of the E-index IPO firms never remove any provision during the following 15 years (See also Daines and Klausner (2001) and Hannes (2006)). Thus, the average IPO cohort-based instrument still closely matches its initial level. With these instruments, results are in line with the two predictions for both the G- and E-indices. The average level of the IPO cohort-based instrument has a negative and both economically and statistically significant relationship with excess returns, confirming *Asset pricing implication 1*. Specifically, a decrease in IPO cohort-based instrument by one unit leads to a higher annualized level in equity returns of 1.71% for the G-index and 5.31% for the E-index, producing spreads of 7.85% and 6.15% in equity risk premium for the G- and E-index, respectively. In addition, the average change in the GEO-based instrument in bad versus good times shows a positive and both economically and statistically significant relationship with excess returns, in line with *Asset pricing implication* 2. One more unit in the index level in bad versus good times on average translates into a higher level in excess equity returns of 2.61% for the G-index and 3.85% for the E-index per year, leading to spreads of 18.85% (5.22% from 5 to 95th percentile) and 5.46% for the G- and E-index per year, respectively. These results establish strong evidence to support the model predictions.

Asset pricing implication 1 clarifies the findings of Gompers, Ishii and Metrick (2003), Cremers and Nair (2005), and Bebchuk, Cohen and Ferrell (2009), among others. A remarkable observation that can be drawn from these empirical results is that the two instruments contain complementary information, both incorporated into the raw index. Henceforth, there is information at the IPO time in the indices that seems uncorrelated to their variability over the business cycle. Out-of-sample tests confirm these predictions. First, we derived a raw E-index following Bebchuk, Cohen and Ferrell (2009)'s approach and used it to reproduce the same tests as in the main empirical analysis.[7] Indices and returns are from the period from 2007 to 2018 covering the 2008-09 financial crisis. This substantiates another main contribution of this paper, firms with higher indices in bad times experienced a steeper drop in their stock price in the cross-section during this crisis, whereas their growth was faster during the

[7] As pointed out by Li and Li (2016), some provisions of the G-index are no longer available since 2007. Furthermore, the results are not as good as one may expect since our measure of governance risk are the indices instruments, not the raw indices data.

strong expansion period of 2014. Second, we exploited the instruments' data from 2007 and 2008 and corroborated the model's predictions over the period from 1995 to 2015 (2 economic cycles).

The main contributions of this paper are to 1) identify (new) corporate governance risk measures for equity pricing, 2) provide a theoretical explanation to Gompers, Ishii and Metrick (2003)'s findings, and 3) show that investors ask for more compensation for stocks with greater governance risk in bad times.

2 Literature review

Conflicts between insiders and outside investors have been studied extensively in several theoretical and empirical papers in the economics and finance literature. These conflicts are costly for corporations. Insiders can use the protection provided by firms' governance policies for personal gains (Lambrecht and Myers 2008). They may sell the firm's outputs or assets for under the fair value or divert the firm's profitable growth options for to their own businesses, recruit unqualified relatives for high-level positions, or overpay executives (Jensen and Meckling 1976, and LaPorta et al. 2000a, 2002).[8] These phenomena pose severe problems for firms with more volatile cash flows (DeMarzo and Sannikov 2006) or when insiders are entrenched and protect their positions (Jensen and Ruback 1983 and Shleifer and Vishny 1989). This friction has several documented implications for firm's assets, optimal decisions and capital structure. Entrenched insiders tend to underinvest (Lambrecht and Myers 2012, 2017) and choose a lower leverage (Leland 1998, Morellec 2004, and Morellec, Nikolov and Schurhoff 2012). These latter findings are captured in our framework. In response to insiders' decision to borrow less, shareholders may force them to increase leverage because interest payments reduce the firm's free cash flow, thus limiting the amount available for cash diversion by insiders (See Jensen 1986, Stulz 1990, Zwiebel 1996, and Morellec 2004). Therefore, debt can be used as a tool with which to discipline insiders. On the other side, insiders can resist hostile takeovers or lead shareholders to push for the adoption of more provisions that would be beneficial to them. These frictions may lead to loss of operational efficiencies for the firm

[8] See also Baumol (1959), Marris (1964), and Williamson (1964).

and in particular affect equity prices and volatility (See LaPorta et al., 2000a, 2002, Gompers, Ishii and Metrick 2003, Albuquerque and Wang 2008, Bebchuk et al. 2009, and Gagnon and Jeanneret 2022).

This paper relates to different strands of the literature. First, it contributes to the literature that studies the impacts of agency conflicts on firms' financing decisions[9] and the role of investor protection in corporate performance[10]. Most papers focus on the average value of the raw governance indices and its implications for firm valuation and find conflicting results. This paper relies on the indices instruments derived by Karpoff, Schonlau and Wehrly (2017) and proposes two new measures of governance risk. These authors study the relationship between adjusted costs and the likelihood of firms' takeover. Second, the paper follows the dynamic trade-off models of Fischer, Heinkel and Zechner (1989), Goldstein, Ju and Leland (2001), Ju et al. (2005), Strebulaev (2007), and Morellec, Nikolov and Schurhoff (2012). Third, it also relates to the literature examining the influence of macroeconomic factors on equity premium, capital structure and, in particular, consumption-based models with a representative Epstein-Zin-Weil agent as in Bansal and Yaron (2004), Bhamra, Kuehn and Strebulaev (2010a; 2010b), Chen (2010) and Tedongap (2015). Our model is the first to conceptualize an economy with governance risk and business cycles jointly. Lastly, it does similar analysis to that in Philippon (2006) who has studied the consequences of good/bad governance over the business cycles. in a production-based economy. Philippon (2006) shows how time-varying governance conflicts affect aggregate variables volatility, and "provides empirical evidence that badly governed firms respond more to aggregate shocks than do well-governed firms". Another similar work by Dah (2016) analyzes how the relationship between governance and firm value differ during recession periods. Yet, these two papers still posit that governance quality is constant over time, making this paper the first to study the consequences of time-varying corporate governance quality. In this paper, we show that the initial level and time-varying nature of agency conflicts in conjunction with the dynamics of the economy could help explain some cross-sectional patterns in equity returns. Unlike the literature, our measure of the consequences of agency conflicts

[9]See Jensen (1986), Stulz (1990), Hart and Moore (1995), Zwiebel (1996), Morellec (2004), Barclay, Morellec and Smith (2006), Lambrecht and Myers (2008, 2012, 2017), and Morellec, Nikolov and Schurhoff (2012).

[10]LaPorta et al. (2002) and Cremers and Ferrell (2014)

is governance risk (G- and E-index instruments) instead of agency costs (G- and E-index).

The article proceeds as follows. Section 3 presents the model. Section 4 illustrates the asset pricing implications of the cross-sectional variations in governance risk on equity returns. Section 5 discusses empirical evidence. Section 6 concludes.

3 The model setup

The economy consists of a representative firm run by insiders. There is a representative investor (shareholder and bondholder) who provides capital to the firm by buying equity and bond. Investors have Epstein-Zin preferences, that is they can observe the current state of the economy and know the expected probability of each state. Macroeconomic conditions are governed by two states - expansion, $s_t = E$ and recession, $s_t = R$, which affect consumption's dynamic and firm profits. Governance risk comes from the firm's past governance decisions. Hence, insiders have no control over the firm's contemporaneous governance risk. This ensures past governance decisions are known at the time the firm shapes its capital structure. Furthermore, investors also adjust the firm's governance risk whenever the economy changes states as they dislike firms with higher governance risk in bad times.

To model asset dynamics, we follow Fischer, Heinkel and Zechner (1989), Leland (1994), Goldstein, Ju and Leland (2001), Hackbarth, Miao and Morellec (2006), and more specifically Bhamra, Kuehn and Strebulaev(2010a; 2010b). The firm initially finances itself at $s_0 = \{R, E\}$. On one hand, it may default at $s_D = \{R, E\}$ when unable to service its debt. This is assumed to happen the first time cash flow falls to X_D from its initial level X_0 ($> X_D$) at the time of debt issuance or during the last refinancing. At default, a fraction of the firm's assets is lost due to liquidation costs which represent ξ of the firm's asset at default. On the other hand, the firm refinances when cash flow reaches X_U from its initial level X_0 ($< X_U$) at the time of debt issuance or during the last refinancing by scaling up its coupon by a fraction of X_U/X_0. Asset prices are also path dependent because default and refinancing boundaries depend on the initial financing state, $s_0 = \{R, E\}$, meaning that $X_U = X_{U,s_0 s_t}$. So, if the initial state was s_0, then there are two refinancing boundaries for $X_{U,s_0 s_t}$, which are $X_{U,s_0 E}$ and $X_{U,s_0 R}$, the former corresponding to expansion and the latter to recession periods. The same logic applies to X_D

as well. In the rest of this article, we use the notation X_{U,s_t} and X_{D,s_t} as it does not affect the results whether the initial state is in an expansion or a recession period. Conditional on inferred governance risk κ_{s_0}, insiders derive the firm's optimal policies $\left\{c_{s_0}, X_{U,s_t}, X_{D,s_t}\right\}$ by maximizing their own claim, with c_{s_0} being the debt coupon at the initial financing or refinancing state $s_0 = \{R, E\}$ and $\left\{X_{U,s_t}, X_{D,s_t}\right\}$ the optimal barriers.

We build on Morellec, Nikolov and Schurhoff (2012) to design the insiders' claim. Our approach differs in two significant ways. Agency costs is replaced by governance risk allowing us to avoid endogeneity because the latter is predetermined. Hence, we do not need to endogenize it when deriving the optimal decisions of the firm. Morellec, Nikolov and Schurhoff (2012) do endogenize agency costs too. Moreover, the optimal decisions are state-dependent. In our framework, the agent observe the firm's past governance policies when decisions are made and we characterize the overall loss due to agency conflicts as governance risk. Governance risk at the time the firm shapes it capital structure represents κ_{s_0} of the net profit. κ_{s_0} is an exogenous variable when optimal decisions are derived because past governance decisions are known. Investors are sensitive to the increase in governance risk in periods of heighten uncertainty for the economy. Henceforth, they dislike firms for which governance risk is higher during economic downturns and assess governance risk conditional on the state of the economy, κ_R in recession and κ_E in expansion when they price stocks.

3.1 Macroeconomic conditions and the firm's cash flow

This section describes the dynamics of the macroeconomic variables. Both consumption and cash flow dynamics have geometric Brownian motions, in which moments are characterized as follows. The conditional expected growth rate and volatility of consumption are denoted by θ_{s_t} and σ_{s_t}, respectively. Macroeconomic conditions govern the dynamic of consumption, making the expected first moment procyclical, while the second moment is countercyclical, i.e., $\theta_E > \theta_R$ and $\sigma_E < \sigma_R$, respectively.[11] The succession of the two states s_t is random. Hence, consumption dynamics C_t, evolves as follow:

[11]In practice, the state of the economy is extracted by detecting endogenous moments embedded into consumption growth data. A standard Markov-type regime switching model can be used to this end.

$$\frac{dC_t}{C_t} = \theta_{s_t} dt + \sigma_{s_t} dB_{c,t}, \quad s_t = \{R, E\}, \tag{1}$$

where the standard Brownian motion under the physical measure $B_{c,t}$ represents the continuous shocks to consumption.

The representative firm's cash flow growth has a conditional expected growth rate of μ_{s_t} and a total volatility of $\sqrt{(\sigma^{sp})^2 + (\sigma_{s_t}^{sy})^2}$, where σ^{sp} and $\sigma_{s_t}^{sy}$ represent, respectively, the idiosyncratic and systematic volatility of cash-flow growth. Similarly, due to cash flow exposure to macroeconomic conditions, μ_{s_t} is procyclical, meaning that $\mu_E > \mu_R$ and $\sigma_{s_t}^{sy}$ is countercyclical, so $\sigma_R^{sy} > \sigma_E^{sy}$. Hence, the representative firm has a stream of cash flow, denoted by X_t, given by the stochastic process:

$$\frac{dX_t}{X_t} = \mu_{s_t} dt + \sigma^{sp} dB_t^{sp} + \sigma_{s_t}^{sy} dB_t^{sy}, \quad s_t = \{R, E\}. \tag{2}$$

All firms are exposed to macro-level shocks (B_t^{sy}). As a consequence, the representative firm cash flow shocks are correlated to aggregate consumption or macroeconomic shocks ($B_{c,t}$). Let ρ be the coefficient of correlation between aggregate cash flow, B_t^{sy}, and consumption shocks, $B_{c,t}$.

3.2 Asset valuation and optimal decisions (by insiders)

3.2.1 Asset valuation

This section derives assets value. The present or time-t value, also characterized by state s_t, of the representative firm net profit, I, over one financing period and conditional on the initial financing or the last refinancing state, is defined by

$$I_{s_0 s_t} = (1-\eta)\, E_t \left[\int_t^{\tau} \frac{\pi_u}{\pi_t} \left(X_u - c_{s_0} \right) du \mid s_t \right], \quad s_0, s_t = \{R, E\} \tag{3}$$

where π is the discount factor described in Section B of the Appendix,[12] X_t is the firm's earnings before interests and taxes at time t, $\tau = min\,(\tau_D, \tau_U)$ where τ_U and τ_D are the next

[12] To have an intuition of the role of the discount factor π, see the following formula A.3 in the Appendix, $\frac{d\pi_t}{\pi_t} = -r_{s_t} dt - \Theta_{s_t}^B dB_{c,t} - \Theta_{s_t}^P dJ_{s_t,t}$, where r_{s_t} is the risk-free rate, $\Theta_{s_t}^B = \gamma \sigma_{s_t}$ is the consumption-CAPM risk's price, $\Theta_{s_t}^P = 1 - \Delta_{s_t}$ is the business cycle risk's price, $\Delta_{s_t} = \left. \frac{\pi_j}{\pi_{s_t}} \right|$, $s_t \neq j$ quantifies the change in the discount factor whenever the state of the economy switches, $dJ_{s_t,t} = 1$ when the state of the economy switches and 0

refinancing and default times, respectively, and η the tax rate. Let's define $\Phi_{s_0 s_t}$ (see Section B of the Appendix) as the firm's scaling factor that allows to obtain stock value, $S_{s_0 s_t}$, from its value over one financing cycle ($I_{s_0 s_t}$). Thus,

$$S_{s_0 s_t} = \left(1 - \kappa_{s_0}\right) \Phi_{s_0 s_t} I_{s_0 s_t}, \tag{4}$$

where κ_{s_0} represent the financing state governance risk.

Debt value, $B_{s_0 s_t}$, is the sum of the debt value during one cycle $b_{s_0 s_t}$ and the present value of new debt issued when the firm restructures. Its value during one cycle $b_{s_0 s_t}$ is the discounted coupon stream c_{s_0} before default plus the present value of the recovered firm asset at default $(1 - \xi) A_{\tau_D}$, where ξ is the liquidation costs and A_{τ_D} is the firm's asset value at default. The debt value of the representative firm during one cycle $b_{s_0 s_t}$ is equal to

$$b_{s_0 s_t} = E_t \left[\int_t^{\tau} c_{s_0} \frac{\pi_u}{\pi_t} du \mid s_t \right] + E_t \left[\frac{\pi_{\tau_D}}{\pi_t} (1 - \xi) A_{\tau_D} \mid s_t \right], \quad s_0, s_t = \{R, E\} \tag{5}$$

where $\tau = min\left(\tau_D, \tau_U\right)$ represents the first time the firm decides either to restructure its debt or to default and $A_{\tau_D} = (1 - \eta) \frac{X_D}{r_{a,s_t}}$ is the firm's asset value at default. The first term represents the present value of the coupon stream before default or refinancing. If the firm decides to default, bondholders receive liquidated asset value at default. When the firm restructures, it repels the previous debt, $b_{s_0 s_t}$, and issues a new larger debt. The value of newly issued debt over all future refinancing periods is $B_{s_0 s_U} = \Phi_{s_0 s_U} b_{s_0 s_U}$, with $\Phi_{s_0 s_U} > 1$.
Hence, the firm's bond value, $B_{s_0 s_t}$, is

$$B_{s_0 s_t} = b_{s_0 s_t} + E_t \left[\Phi_{s_0 s_U} b_{s_0 s_U} \right], \quad s_0, s_t, s_U = \{R, E\} \tag{6}$$

$$= b_{s_0 s_t} + \sum_{s_U} \Phi_{s_0 s_t} b_{s_0 s_t} \widetilde{q}_{U s_t s_U} \tag{7}$$

3.2.2 Optimal firm's decisions

Insiders benefit from the allocation of control rights over the fraction ν of the firm's equity. As in Zwiebel (1996), Morellec (2004), and Lambrecht and Myers (2008, 2017), we deduce

otherwise. In the case when there is no consumption risk, $\sigma_{s_t} = 0 \Rightarrow \Theta^B_{s_t} = 0$ and no business cycle risk $s_t = j \Rightarrow \Delta_{s_t} = 1 \Rightarrow \Theta^P_{s_t} = 0$, $\frac{d\pi_t}{\pi_t} = -r_{s_t} dt \Rightarrow \pi_t = e^{-rt + cst}$, hence yielding the classical continuously discount factor formula $\frac{\pi_u}{\pi_t} = e^{-r(u-t)}$ for a risk neutral agent. Hence, an Epstein-Zin agent receives a risk premium for both C-CAPM and business cycle risks.

that they have control over this fraction of the firm value. Additionally, insiders have decision rights over the firm's initial capital structure and refinancing timing. Governance risk are likely to be higher than agency costs, which only captures private benefits. For simplicity, we assume that both are equivalent in magnitude. Hence, self-interested insiders maximize, $V_{s_0 s_t}$, such that

$$V_{s_0 s_t} = \underbrace{\nu_{s_0} F_{s_0 s_t}}_{Insiders'\ stake} + \underbrace{\kappa_{s_0} \Phi_{s_0 s_t} I_{s_0 s_t}}_{Private\ benefits}, \quad s_t = \{R, E\}. \tag{8}$$

The first term of equation 8 represents insiders' stake and the second the costs from agency conflicts. Given the initial state of the economy when debt is issued s_0, insiders choose the coupon value and state-dependent refinancing policy that maximize $V_{s_0 s_t}$:

$$\left\{c_{s_0}, X_{U,s_t}\right\} = argmax\left(V_{s_0 s_t}\big|_{X=X_0}\right), \quad s_t = \{R, E\}.$$

The firm's claimants (insiders and investors) agree on the default policy. Hence, optimal default boundaries, X_{D,s_t}, must maximize equity valuation at default. Hence, X_{D,s_t} satisfy (since $I_{s_0 s_t}\big|_{X_t = X_{D,s_t}} = 0$):

$$\left.\frac{\partial S_{s_0 s_t}}{\partial X_t}\right|_{X_t = X_{D,s_t}} = \Phi_{s_0 s_t} \left.\frac{\partial I_{s_0 s_t}}{\partial X_t}\right|_{X_t = X_{D,s_t}} = 0, \qquad s_D = \{R, E\} \tag{9}$$

A firm's cash flow is exposed to both the CCAPM and business cycle risks as presented in Section 3.1. Following Bhamra, Kuehn and Strebulaev (2010b), the equity risk premium, $RP^0_{s_0 s_t}$ is given by:

$$RP^0_{s_0 s_t} = \rho \Theta^B_{s_t} \sigma^{0,B}_{s_t} + \lambda_{s_t} \Theta^P_{s_t} \sigma^{0,P}_{s_t}, \quad s_t = \{R, E\} \tag{10}$$

where $\sigma^{0,B}_{s_t} = \frac{X_t}{S_{s_0 s_t}} \frac{\partial S_{s_0 s_t}}{\partial X_t} \sigma^{sy}_{x,s_t}$ is the stock returns volatility coming from consumption shocks, $S_{s_0 s_t}$ represents the stock value, $\sigma^{0,P}_{s_t} = \frac{S_{s_0 j}}{S_{s_0 s_t}} - 1$, $s_t \neq j = \{R, E\}$ represents the stock price changes over the business cycle. $\sigma^{0,B}_{s_t}$ and $\sigma^{0,P}_{s_t}$ are also labelled quantity of risk. $\Theta^B_{s_t}$ and $\Theta^P_{s_t}$ represent the prices of risk due to CCAPM and business cycle risks respectively, as described in Section A.

Asset pricing implication 1. *Firms with higher governance risk at the time of initial financing choose lower coupon level and default barriers, and therefore have a lower equity premium. Let us assume that Firms 1 and 2 are identical except for their initial governance risk,* κ_{s_0} *and both firms' IPOs occurred at* s_0*, the financing state. If Firm 1 has s higher governance risk than Firm 2, that is,* $\kappa^1_{s_0} > \kappa^2_{s_0}$*, then* $RP^{0,1}_{s_0 s_t} < RP^{0,2}_{s_0 s_t}$ *for* $s_t = \{R, E\}$*.*

Asset pricing implication 1 states that firms with greater governance risk, during initial financing, optimally choose to use less debt and therefore have a lower default risk and equity premium. Assume Firm 1, with initial governance risk $\kappa^1_{s_0}$, has optimal coupon and default barriers $c^1_{s_0}$ and X^1_{D,s_t}. The model's simulations show that if Firm 1 has a higher initial governance risk than Firm 2, $\kappa^1_{s_0} > \kappa^2_{s_0}$, its optimal coupon is such that $c^1_{s_0} < c^2_{s_0}$. This result is line with Morellec (2004) and Morellec et al. (2012), among others. We go further and derive the asset pricing implications of this prediction because our agent is averse to macroeconomic risks. The smooth-pasting conditions given by equation 9 ensures a positive relationship between a firm optimal coupon and its default barriers. Therefore, $X^2_{D,s_t} > X^1_{D,s_t}$. Hence, Firm 1 optimally chooses lower coupon and default boundary. Firm 1, in turn, has lower Arrow-Debreu default securities (See Sections B and C of the Appendix) due to higher distance to default, leading to higher equity valuation and lower risk premium.[13] So, differences in initial governance risk κ_{s_0} among firms lead to cross-sectional patterns in equity premium. As such, our paper provides a first theoretical explanation of the main empirical findings of the seminal work of Gompers, Ishii and Metrick (2003). Figure 1 illustrates these predictions.

Figure 1 [about here]

3.3 Equity pricing (by investors)

Investors characterize the uncertainty bring about by governance provisions adopted in the past as a governance risk. Hence, they are sensitive to the intensity of this risk over time and in particular dislike firms with higher governance risk in periods of recession. So, they

[13]This predicts a positive relation between default risk and the equity premium. This prediction excludes distressed firms. See Garlappi and Yan (2011), Campbell, Hilscher and Szilagyi (2008) and Aretz, Florackis and Kostakis (2017) among others for empirical evidence concerning distress risk and equity returns.

demand a higher compensation from firms with higher governance risk in bad economic periods. Investors infer the firm's optimal policies (coupon. default and refinancing barriers) from asset prices, particularly during initial financing. They then adjust stock prices when the state of the economy changes. Investors price equity using equation 4, that is by taking as given optimal policies, but adjusting governance risk dynamics. Hence, equity market value, $P_{s_0 s_t}$, is determined as follows:

$$P_{s_0 s_t} = \left(1 - \kappa_{s_t}\right) \Phi_{s_0 s_t} I_{s_0 s_t}, \quad s_t = \{R, E\} \tag{11}$$

where κ_{s_t} is the state-dependent governance risk.

Equation 11 shows higher governance risk in bad vs. good times widen stock price fluctuations at the business cycle frequency. If two firms are identical in every way except for their governance policy, these firms will exhibit differences in their stock volatility over the business cycle. This is in line with Philippon (2006) who provides evidence, using a production-based economy, that well governed firms respond less to aggregate shocks over the business cycle. This paper is the first to derive these predictions using a consumption-based model when governance risk varies. We argue that variations (not the level) in governance risk at the business cycle frequency induce cross-sectional differences in equity risk premium. Following equation 10, equity risk premium, $RP_{s_0 s_t}$, for the current state $s_t = \{R, E\}$ is given by:

$$RP_{s_0 s_t} = \rho \Theta^B_{s_t} \sigma^B_{s_t} + \lambda_{s_t} \Theta^P_{s_t} \sigma^P_{s_t}, \quad s_t = \{R, E\} \tag{12}$$

where $\sigma^B_{s_t} = \frac{X_t}{P_{s_0 s_t}} \frac{\partial P_{s_0 s_t}}{\partial X_t} \sigma^{sy}_{x, s_t}$ is the systematic volatility of stock returns due to consumption shocks, $P_{s_0 s_t}$ represents the stock value and $\sigma^P_{s_t} = \frac{P_{s_0 j}}{P_{s_0 s_t}} - 1$, $s_t \neq j = \{R, E\}$ represents the volatility of stock returns (or stock price) caused by changes in economic conditions. $\Theta^B_{s_t}$ and $\Theta^P_{s_t}$ represent the prices of risk due to consumption shocks and changes in the economic conditions respectively, as described in Section A.

Asset pricing implication **2.** *Let us assume that Firms 1 and 2 are identical except for their governance risk.* s_0 *is the financing state and is not necessarily the same for both* *firms. If Firm 1 has a greater change in governance risk in bad versus good times, that is* $Diff^1 = \kappa_R^1 - \kappa_E^1 > Diff^2 = \kappa_R^2 - \kappa_E^2$*, then* $RP^1_{s_0 s_t} > RP^2_{s_0 s_t}$ *for* $s_t = \{R, E\}$.

Asset pricing implication 2 states that firms with greater governance risk in bad compared versus good times have higher risk premia. As clarified in Section B.3 of the Appendix, the component of the risk premium that comes from the second source of risk (i.e. business cycle risk) drives the increase in the total risk premium. This prediction underlines how heterogeneity among firms regarding changes in governance risk can explain cross-sectional differences in their risk premia. The right Panel of figure 1 illustrated it. The economic intuition is as follows. In expansion, firms have a given level of governance risk measured by past exogenous proxy of their governance index. During the following recession period, investors estimate firms' governance risk and these with higher governance risk experience a greater drop in their stock valuation because investors price these stocks with higher governance risk. Then, over the following expansion period, these firms will need to outperform the others to survive, which is why they end up having higher average returns over complete economic cycles. Thus, conditional on survival, higher governance risk in bad times, produces higher average equity premia *over the business cycle*. So, the model prices cross-sectional variations in risk premia originating from the combined effects of the changes in economic conditions and governance risk.

Figure 2 [about here]

To calibrate the model, baseline governance risk of the representative firm are obtained by setting leverage to its observed level (about 25%). We use the market leverage ratio, $L_{s_0 s_t}$, defined as:

$$L_{s_0 s_t} = \frac{(1-\delta)\, B_{s_0 s_t}}{F_{s_0 s_t}}, \tag{13}$$

where δ are debt issuance costs, $P_{s_0 s_t}$ is the equity market value, $B_{s_0 s_t}$ is the market value of debt, and , and $F_{s_0 s_t} = P_{s_0 s_t} + (1-\delta)\, B_{s_0 s_t}$ the firm's value. In our framework, the optimal coupon value (leverage) plays a role in the cross-section of equity premium at the initial financing time as emphasized in *Asset pricing implication 1.*

4 Asset pricing implications

This section presents the calibration approach, gives more details about the rationale between the variations in agency conflict, and shows the main predictions of the effects of these variations on stock returns.

4.1 Calibration

A calibration is set up via the parameter values for firm characteristics, macroeconomic conditions, and governance risk following similar contingent claims models. Table 1 summarizes the parameter values.

Table 1 [about here]

The state of the economy can be either expansion (E) or recession (R). The conditional moments of consumption growth are $\theta_R = 0.00\%$ in recession and $\theta_E = 3.00\%$ in expansion, while its volatility is $\sigma_R = 1.50\%$ in recession and $\sigma_E = 1.00\%$ in expansion. The probabilities of being in an expansion and in recession are assumed to be respectively $f_E = 70\%$ and $f_R = 30\%$. The speed of actual news arrival is assumed to be $p = 0.80$. Consumption data is sum of non-durable goods and services from the Real Personal Consumption Expenditures. Our estimation, from 1952 to 2019 and shown in Figure 5, gives $f_E = 70.7\%$, $f_R = 29.3\%$. $p = 0.8155$, $\theta_R = 0.27\%$, $\theta_E = 2.64\%$, $\sigma_R = 1.63\%$ and $\sigma_E = 1.40\%$. Using data from 1947 to 2005, Bhamra, Kuehn and Strebulaev (2010b) have found that conditional moments of consumption growth are $\theta_R = 1.41\%$ in recession and $\theta_E = 4.20\%$ in expansion and its conditional volatility are $\sigma_R = 1.14\%$ and $\sigma_E = 0.94\%$. The probabilities of being in an expansion and in recession are $f_E = 64.5\%$ and $f_R = 35.5\%$. The speed of actual news arrival is assumed to be $p = 0.7646$. Dorion, Ekponon and Jeanneret (2020)'s estimates for the period from 1952 to 2018 are $\theta_R = -0.71\%$, $\theta_E = 2.75\%$, $\sigma = 1.2\%$, $f_E = 76.21\%$, $f_R = 23.79\%$ and $p = 1.01$.

The cash flow's conditional growth rate is equal to $\mu_R = -6.00\%$ in recession and $\mu_E = 8.00\%$ in expansion while the systematic volatility of aggregate cash flow is $\sigma_R^{sy} = 14.00\%$ in recession and $\sigma_E^{sy} = 7.00\%$ in expansion. The constant specific volatility of the representative firm is $\sigma^{sp} = 22.00\%$. Bhamra, Kuehn and Strebulaev (2010b)'s estimates are $\mu_R = -4.01\%$, $\mu_E = 7.82\%$, $\sigma_R^{sy} = 13.34\%$, $\sigma_E^{sy} = 8.34\%$, and use $\sigma^{sp} = 22.58\%$, while Dorion, Ekponon and Jeanneret (2020) have obtained $\mu_R = -20.73\%$, $\mu_E = 8.31\%$, $\sigma^{sy} = 15.63\%$, and use $\sigma^{sp} = 20.00\%$.

The asset recovery rate in liquidation is assumed to be constant and set to $\xi = 50\%$. Chen (2010) estimates a mean recovery rate of 41.8%, whereas Longstaff, Mithal and Neis (2005) use a recovery rate of 50%, and Duffee (1999) calculated a 44% rate using Moody's data. The corporate tax rate is set at $\eta = 20\%$, the issuance cost at $\delta = 1.5\%$, and managerial ownership is set at $\nu = 5.50\%$.

Regarding the representative agent's preferences, this paper considers a coefficient of risk aversion of $\gamma = 10$, a coefficient of elasticity intertemporal substitution (EIS) of $\psi = 1.5$, and an annual time discount rate equal of $\beta = 5\%$.

4.2 Time-varying nature of agency conflicts

First, firms can decide to change their governance policies at times in an effort to mitigate the consequences of bad economic conditions, give more power to executives in periods of high uncertainty and ease their capacity to protect the firm from hostile takeovers. In turn, insiders may extract more private benefits when granted more power. Agency problems may also worsen in some cases, as described by Jin and Myers (2006)[14], due to insiders information advantage over outside shareholders. Agency conflicts could reach acute levels in bad times. There may appear cases where insiders dislike fluctuations[15] in net income and will seek to keep a higher proportion of free cash flow during the very period when shareholders are concerned about the firm's survival and have more incentive to monitor very closely not only the firm's performances but, more importantly, dividend payments. DeMarzo and Sannikov (2006) and Giannetti and Koskinen (2010), among others, show that insiders in particular those with

[14] See also Dah (2016) who argues that recession provides insiders with a good opportunity for camouflaging their behavior and extracting more private benefits and, then, blaming poor performances on bad economic conditions.

[15] For example, insiders may fail to smooth a firm's income. See Acharya and Lambrecht (2015) for a theory about income smoothing.

empire-building motive, have more incentive to expropriate when the firm's expected returns are more volatile.

Second, there is the obvious situations where insiders would simply decide to reduce their appetite in bad times to avoid default because free cash flow has significantly shrunk. They could want to avoid putting themselves at risk of being fired. Insiders might also lower their private benefit due to more stricter monitoring by others claimants in economic downturns. Westermann (2018) documents a procyclical agency costs (1.9% of the firm value in booms and 1.4% in recessions) because managerial underleverage is stronger in recessions.

Hence, governance risk appear to vary over time, but differently across firms. Some firms have governance risk in bad times, others in good times, and for the rest, it is stable. Henceforth, we do not take a stand regarding the nature of governance risk and we show that differences in governance risk dynamics explain variations in equity risk premium across firms.

4.3 Governance risk and leverage ratio (inertia)

For the asset-pricing implications to hold, there needs to be have a negative correlation between governance risk and leverage ratio at the initial financing time. Welch (2004) shows that equity returns and leverage ratios dynamics are interlinked, and that stock returns can explain about 40% of debt ratio dynamics. Hence, firms do not adjust their capital structure frequently to reduce the effect of stock price movements on their leverage ratios.

Among others, Friend and Lang (1988), Mehran (1992), Novaes and Zingales (1995), Berger, Ofek and Yermak (1997), and Kayhan (2008) have shown a negative relationship between agency costs and debt ratios. They demonstrate that because high-entrenched managers are exposed to an increase in stock prices in relation to the market timing effect, they have a tendency to cut down on debt ratios. Wen, Rwegasira and Bilderbeek (2002) and Ganiyu and Abiodun (2012) confirm that there is a negative influence of managerial entrenchment on the leverage ratio for listed firms in Nigeria and in China. The document that the entrenched CEOs and executives prefer low leverage to reduce the performance pressures accompanying high debt.

4.4 Theoretical predictions

The main predictions of the model are as follows. Regarding *Asset pricing implication 1*, we derive asset pricing implications for governance risk ranging from 0.05 to 2.50%. Higher costs lead to lower equity premium, which goes from 10.25 to 3.53, leading to a spread of 6.72%. The left Panel of Figure 1 display the evolution of the equity risk premium (and optimal coupon) for firms with different levels of governance risk. Over the same range of governance risk, leverage goes from 75.44% to 12.61%. A leverage of 24.60% is obtained for governance risk of 2.15%, our baseline average governance risk. Strebulaev and Whited (2012) document that in a dynamic model with endogenous default, the optimal leverage as implied by reasonable parameters is too high to explain actual cross-sectional leverage patterns (70% as opposed to the observed average leverage ratio of 25%). Using a structural econometric estimation, Morellec, Nikolov and Schurhoff (2012) show that on average an agency costs of 1.50% equity valuation are enough to explain the documented leverage puzzle. They also report significant variations in average agency costs across firms and show that the magnitude of these costs, coming from the data, correlate with many commonly used corporate governance measures. The predictions for the cases when $\kappa_{s_0} = 0.05$, $\kappa_{s_0} = 2.15$, and $\kappa_{s_0} = 2.50\%$ are displayed in Table 2.

Table 2 [about here]

With respect to *Asset pricing implication 2*, the right Panel of Figure 1 displays the cross-sectional variations in equity risk premium for different levels of the average change in governance risk, confirming that differences in the governance risk $Diff = \kappa_R - \kappa_E$ induce a monotonic increase in the equity risk premium and that firms with higher $Diff$s should have higher risk premiums. The average leverage moves at a slow pace, whereas the equity risk premium's variation is significant. Right Panels in Figure 1 show the results for the case for which the difference in governance risk $Diff = \kappa_R - \kappa_E$ increases from -30 to 30%, resulting in average governance risk from -6.85% to 11.15%. This corresponds to cross-sectional differences in equity premium from 0.13% to 9.00% respectively. The average leverage is about 26%.

Table 3 [about here]

Table 3 presents the predictions for different values of $Diff = \kappa_R - \kappa_E$, with governance risk in expansion periods set to $\kappa_{s_0} = 2.15\%$. The results are obtained for $Diff = -30.00$, 0.00, and 30.00%. The equity premium is predicted to be respectively 0.127, 3.803, and 9.004%. Hence, the spread is 8.877% overall. More importantly, this pricing exercise is performed in a realistic economic environment, with leverage between 23 and 27%.

5 Empirical evidence

How are the predictions presented in Section 4.4 reflected in the data? This section seeks to provide empirical proof for *Asset pricing implication 1 and* 2, thereby formulate the following hypotheses.

5.1 Using raw (contemporaneous) indices data

This section seeks to provide empirical proof to *Asset pricing implications 1* and *2*. We start with the actual indices and use the novel econometric specification below:

$$RP^i = a + bDiff^i + c\overline{Index^i} + d\left(Diff^i\right)^2 + \sum_{j=1}^{6} e_j \beta^{i,j} + \epsilon^i, \tag{14}$$

where RP^i is the firm i's average stock excess return, $i \in [1, N]$ with N being the number of firms, $Diff^i = Ind^i_R - Ind^i_E$ is the difference between the average G- or E-index in bad times Ind^i_R and in expansion periods Ind^i_E. $\overline{Index^i}$ is the average index level and $Factors^i$ represents the beta's of pricing factors. $Factors^i$ are common asset pricing factors. These factors (6) are from the Fama-French five-factor, i.e. market excess returns (MKT), size (SMB), book-to-market (HML), profitability (RMW), investment (CMA), and the Carhart's model momentum (MOM). Each firm i's exposure to the factor j, $\beta^{i,j}$ with $j \in [1, 6]$, is obtained by performing time-series regressions $ExcessReturns^i_t = \alpha^{i,j} + \beta^{i,j} Factors^j_t + e^i_t$. Factors' data are taken from Kenneth French's website.

We explore the equation 14 with raw indices data, IPO cohort- and GEO-based instrumental variables. The last two represent our measures for governance risk. The literature studies relationships between governance indices and stock returns using average raw indices data only. Most papers' findings can be interpreted as leading to $b^{RAW} = 0$ and $c^{RAW} < 0$. We go further in this analysis and should find that $c^{IPO} < 0$ and that $b^{GEO} > 0$.

5.2 Using raw (contemporaneous) indices data

HYPOTHESIS I: *Average agency costs (governance indices)* $\overline{\boldsymbol{Index}}$ *have a weakly negative correlation in the cross-section with average stock returns.*

HYPOTHESIS II: *Change in agency costs (governance indices),* $\boldsymbol{Diff} = \boldsymbol{Ind}_R - \boldsymbol{Ind}_E$*, can not explain (or is weakly positively correlated to average stock returns) variations in equity returns among firms. In other terms, firms with greater governance indices in bad times do not have significantly higher equity returns.*

We use two measures of corporate governance, namely, the G-index developed by Gompers, Ishii and Metrick (2003) and E-index proposed by Bebchuk, Cohen and Ferrell (2009). G-index data are taken from Andrew Metrick's website and the E-index data are obtained from Lucian Bebchuk's website.[16] These two datasets are merged with stock returns, and Fama-French five factors plus momentum. Stock returns data are from CRSP. Fama-French 5-factors, Carhart's momentum factor data, and the risk-free rate are from Kenneth French's website. Stock returns and market pricing factors cover the period from 1989 to 2006 which correspond to the two corporate governance index data availability. During this time period there were two recessions, in 1990 and 2001. The number of firms with at least one index data in recession and expansion is 2106 (1916) for the G-index (E-index). The indices are constructed on a set of governance rules, also called provisions, that firms adopt to protect themselves against takeovers. Thus, more provisions means that insiders enjoy more power relative to outside investors which translates into more costs for the latter. Summary statistics are is Table 4.

[16]The provision-level data used in these indices are from the Investor Responsibility Research Center (IRRC) database, acquired by the Institutional Shareholder Services (ISS) in 2005, and RiskMetrics in 2007. After this date, only about half of the 24 components of the G-index are via RiskMetrics as well as the information collected. For consistency, we focus on the data available before and in 2006, specifically from 1990 to 2006. The G-index is a governance index constructed by Gompers, Ishii and Metrick (2003). Governance provisions (24) are classified into firm-level charter and by-law provisions and state-level anti-takeover laws that restrict shareholder rights. A high (low) G-index value is regarded as depicting weak shareholder control or strong managerial power (strong shareholder control or weak managerial power). These indices vary with economic conditions.

Table 4 [about here]

Following the National Bureau of Economic Research (NBER), there are two types of periods in the economy, expansion (E) and recession (R) periods. We first compute the average G- or E-index in bad times (Ind^i_R), in expansion periods (Ind^i_E), and the difference $Diff^i = Ind^i_R - Ind^i_E$ for each firm i. We define firms with counter-, a- and procyclical governance policies, as firms for which $Diff < 0$, $Diff = 0$, and $Diff > 0$, respectively. Second, we compute the equity average excess return for each firm in the sample. G- and E-indices are available for the following years: 1990, 1993, 1995, 1998, 2000, 2002, 2004, and 2006. The average value in bad times (Ind_R) is obtained with the index data from the years 1990, 2000 and 2002. For the expansion period, the average value is obtained from the other values available, that is 1993, 1995, 1998, 2004, and 2006. Hence, for a given firm, the maximum number of index data is $N_R = 3$ in recession and $N_R = 5$ in expansion. To have consistent estimates, firms which have less than five (5) index data are excluded. The rationale behind this choice is that this study aims to measure differences in stock returns coming from changes in governance practices at the business-cycle frequency. Hence, the analysis should be conducted on data from various stages of the economic cycles. So, it is crucial to keep firms for which data cover most periods throughout different steps in the cycles. Moreover, firms with six (6) indices data or more have at least one data in recession. The number of firms with at least one index data in recession and expansion is 726 (654) for the G-index (E-index). To check the robustness of this choice, the results are shown for the case when indices data are available in each of the two recessions; this is $N_R \geq 2$ and $N_E \geq 4$. This means that we do not necessarily need to hypothesize that firms stick to the same governance policy in the future.[17]

Tables 6 and 7 [about here]

In Table 6, columns 4 of the left Panel shows $b^{RAW} > 0$ and $c^{RAW} < 0$ for the E-index and column 4 of the right Panel shows $b^{RAW} = 0$ and $c^{RAW} < 0$ for the G-index $b^{RAW} = 0$ and

[17]It is common practice to complete the data points by using the same value of the index for the years up to the next date a value is available. This practice allows having a continuous series of data. However, the information contained in the variable $Diff$ is not qualitatively altered by this approach, because in most cases the same value will be repeated within each state.

$c^{RAW} < 0$. These results are significant at 5%. When considering each measure individually with no control, we obtain $b^{RAW} > 0$ and $c^{RAW} < 0$. Hence, these deliver a first empirical proof of the pricing of governance policy into stock prices. Still, two key points remain to be explained. Why does good governance lead to greater risk premium? What can explain the observation that greater flexibility for the management in bad times also produces higher risk for stocks? Columns 3 and 4 of Table 6 lay out some directions to answer these questions. As can be seen, the significance of the results clearly fades, but also reveal that $Diff$ is priced for the E-index and $\overline{Index}$ for both indices. Intrigued by the complete disappearance of the significance for the G-index, we classify firms with respect to their $Diff$ for the E- and G-indices in 5 groups. There are firms with $Diff < -1$, $Diff < -0.5$, $Diff = 0$, $Diff > 0.5$, and $Diff > 1$.

Figure 3 [about here]

Figure 3 shows a V-shape relationship between $Diff$ and average returns. Firms that restrict and these that increase insiders power in bad times ($Diff < -1$ and $Diff > 1$) have higher premia. However, the source of the higher average returns is not the same. For the firms that restrict insiders power in bad economic periods and reduce their productivity, this counterbalances the reduction in risk premium due to lower governance risk. This points to endogeneity problems incorporated in the raw data. Raw E-index, which measures shareholders (voting) rights, tends to be a cleaner measure for asset pricing implications from outsiders perspective. Henceforth, we will use indices instruments to capture the investors-centric measure of governance policies, our measure of governance risk.

5.3 Using (lagged) indices' instrumental variables

HYPOTHESIS III: *In the cross-section, firms with higher governance risk at initial financing time, proxied by the average indices IPO cohort-based instruments,* $\overline{\widehat{Index}}$, *have lower average equity returns.*

HYPOTHESIS IV: *In the cross-section, firms with greater* $\widehat{Diff} = \widehat{Ind_R} - \widehat{Ind_E}$ *of the indices GEO-based instruments have higher average equity returns. In other* *words, firms with greater governance risk in bad times have higher average equity returns.*

We now turn to our measure for governance risk, raw indices instrumental variables. First, raw governance indices are contaminated with potential endogeneity problems that may affect the relationship between the adoption of provisions and equity pricing, and to test for a possible causality. Some papers argue that conceptually governance indices are flawed and might not be adequate to measure a firm's takeover defense - a high governance index leads to a lower takeover probability. Certain aspects of these indices are reproved: the specific provisions each index includes or excludes, the equal weighting of all provisions that are included, data and measurement problems, takeover defenses that do not offer incremental takeover protection, and also the fact that there is no empirical justification to assume that takeover defenses capture takeover deterrence (Klausner (2013), Catan and Kahan (2016), Bates, Becher and Lemmon (2008), and Karpoff, Schonlau and Wehrly (2017)). In the context of this paper, the adoption of more takeover defenses attributes more power to insiders while the opposite gives more power to outside investors. Karpoff, Schonlau and Wehrly (2017) have developed some valid instrumented versions of the raw indices. They show that contrary to the raw indices, their geography- and IPO-based IVs are significantly and negatively related to acquisition likelihood. We examine the implications of changes in these IVs at the business cycle frequency for stock returns as for the raw indices. We use their two types of IVs and test the following new econometric specification

$$RP^i = a + b\widehat{Diff^i} + c\overline{\widehat{Index^i}} + d\left(\widehat{Diff^i}\right)^2 + \sum_{j=1}^{6} e_j \beta^{i,j} + \epsilon^i, \tag{15}$$

where $\widehat{Diff^i} = \widehat{Ind^i_R} - \widehat{Ind^i_E}$ is the difference between the average G- or E-index instruments in bad times $\widehat{Ind^i_R}$ and in expansion periods $\widehat{Ind^i_E}$, $\overline{\widehat{Index^i}}$ is the average indices instrument. The geography-based instrumental variable is based on the provisions deployed in the previous five years at geographically proximate firms that are not in the same industry as the focus firm. The IPO-based instrument uses the takeover defenses deployed in the previous five years by firms that went public within one year of the focus firm but that are not in the same industry. Both use rolling five-year lagged data and so cover the period from 1995 to 2008, instead of

1990 to 2008. Following the dates when G- and E-indices were made available to investors, recession periods are in 2000 and 2002, and expansion periods in 1995, 1998, 2004, and 2006.[18] Summary statistics are is Table 5.

Table 5 [about here]

The advantage of using the 5-year lagged instruments is twofold. First, it serves our objective to find governance risk measures. Hence, we must be able to confirm that $c^{IPO} < 0$ (HYPOTHESIS III) and $b^{GEO} > 0$ (HYPOTHESIS IV). Next, we could claim causality if the following conditions are satisfied: i) the correlation between the indices instrument and stock returns, ii) no causal effect of the indices IVs on equity returns, iii) existence of a the causal effect of the indices IVs on the raw indices, and iv) the indices IVs are assigned randomly to satisfy the exclusion requirement and iii). Based on Karpoff, Schonlau and Wehrly (2017)'s results, iii) and iv) are met. Next, about ii), there is no reason to expect the geographically- and IPO-based IVs to have a causal effect on the focus firm stock returns. Columns 4 of the two Panels in Tables 8 and 9 confirm HYPOTHESES III and IV for both the E- and G-index. The results are all highly statistically significant and the empirical estimates, sizable and consistent with the model predictions.

Tables 8 and 9 [about here]

For HYPOTHESIS III, the regression coefficient are -5.311 (p-value<0.001) for the E-index and -1.3709 (p-value<0.001) for the G-index. This means that, in the cross-section, one less unit during IPO time leads to an increase of 5.311% for the E-index and 1.709% for the G-index. For HYPOTHESIS IV, the regression coefficients are 3.847 (p-value=0.015) for the E-index and 2.612 (p-value<0.001) for the G-index. This means that one more unit in bad vs. good times translates into an increase in the equity returns of 3.847% for the E-index and 2.612% for the G-index.

[18] These results are obtained from a sample that contains firms with index data available for years during which the raw index data is released. This is to be consistent with the idea that investors observe them before making their investment decisions. Hence, recession and expansion dates follow these of the raw data and are available between 1995 and 2006.

5.4 Out-of-sample tests

Out-of-sample analyses are performed to test and possibly uncover more insights about the relationship between governance risk and equity pricing. First, we follow Bebchuk, Cohen and Ferrell (2009)'s approach and construct an equivalent to the entrenchment index for the period from 2007 to 2018. Data are available annually, meaning a maximum number of 12 data per firm. This period covers the great recession. So, it officially has one recession from 2008 to 2009 and one expansion from 2010 to 2018. The E-index is used for this exercise because some provisions of the G-index are no longer available since 2007 (Li and Li, 2016).[19] The same specification as in equation 14 is performed with the returns, indices, and factors from 2007 to 2018. The results are reported in Table 10. As shown in the first Panel of this table, there is a positive relationship between average indices and equity returns and a negative correlation between $Diff$ and equity returns, in apparent contradiction with the model's predictions.

Table 10 [about here]

To test the model consistently, it is crucial to have at least two or more economic cycles in the data. This may explain why the main data sample gives better results. It covers two expansions and two recessions, the early 1990's recession and the 2000 dot-com bubble. Both recessions were of equal intensity and as shown in Figure 5, the estimation of the state of the economy from consumption data perfectly coincide with the NBER recession dates. The quantity of business-cycle risk predicted to explain the results measures state-dependent changes in average equity price. Hence, the more expansion and recession periods the data has the more precise the estimates will likely be. The mechanism behind the negative correlation in the out-of-sample data is as follows. Firms with higher agency costs during the financial crisis have seen their stock price falling dramatically in the cross-section. During the next expansion period (from 2010 to 2018), these firms' growth was not strong enough to have a higher average growth rate. To prove this, the sample period the average coefficients over the period from 2007-18 are split into their contributions during the crisis and none crisis periods,

[19]This paper follows Bebchuk, Cohen and Ferrell (2009)'s approach to build the E-index data over the period 2007-2018. The procedure and data are available here.

as shown respectively in Panels 2 and 3 of Table 10. The $Diff$'s coefficients are -0.730 (p-value=0.043), 0.505 (p-value=0.650), and -2.570 (p-value=0.007), respectively for the periods 2007-2018, 2014 (the year with the strongest economic growth), and 2008-2009. This shows stronger declines in stock valuation for firms with higher $Diff$s during the great recession and the predicted sign of the coefficients of average index and $Diff$ in 2014, confirming the intuition of the model.[20] These results also mirror the weak relationship between raw indices data and stock returns.

Tables 11 and 12 [about here]

Second, the full model is tested by exploiting instruments data from 2007 and 2008. We design the following empirical exercises. We use all available instruments data, i.e., from 1995 to 2008 and perform the same analysis as in Section 5.3. The results are reported in Panels B.1 and B.2 of Table 12. In B.1, recession dates are 2000 and 2002 and in B.2, these dates are 2000, 2002, and 2008. Because the period from 1995 to 2008 does not cover full recession periods, we conduct the same analysis over the period from 1995 to 2015. These two dates are in the middle of expansion periods, allowing to obtain two complete cycles within this time period. In this latter case, all variables are from 1995 to 2015 except the instruments which data are from 1995 to 2008. See the results in Panels A.1 and A.2 of Table 12. In A.1, recession dates are 2000 and 2002 and in A.2, these dates are 2000, 2002, and 2008. Panel A.2 confirms Hypotheses III and IV. When we include instruments data from 2008 as a recession period and data over two complete recessions from 1995 and 2015, we obtain $c^{IPO} < 0$ (coefficient of $\overline{\widehat{index}}$ for IPO cohort-based instruments) and $b^{GEO} > 0$ (coefficient of $\widehat{Diff}$ for GEO-based instruments). The results are all significant with p-value<0.03 and, in particular, they are highly significant with the G-index instruments. On the economic significance side, we find that the spreads due to IPO cohort-based IV differences are (3.268 - 2.152)x3.27% = 3.65% for the E-index and (12.250 - 7.650)x1.69% = 7.78% for the G-index. The model predicts a spread of 6.72%. Next, the spreads due to GEO-based differences are (0.677 + 0.737)x4.66%

[20] During the subsequent recovery period, there was almost no cross-sectional variations across firms. The reason that can be that the recovery may have not been completed at the end of 2018. It is worth noticing that the NBER's Business Cycle Dating Committee also considers data on personal income, employment, or industrial production among others on top of personal consumption. Figure 5 shows the US economy growth was not strong enough before 2014, whereas the two previous recessions are correctly captured.

= 6.59% for the E-index and (2.050 + 1.200)x3.66% = 11.89%. See Table 11 for the summary statistics of the instruments. These figures are also in line with the model predictions, with an estimated spread of 8.87%.

5.5 Further empirical proofs

In this section, we provide additional empirical evidence using portfolio sorting. We sort our sample of stocks in three (3) portfolios as shown in Table 13 and, also in four (4), five (5), six (6), and eight (8) portfolios as shown in Table 14. Stocks' risk adjusted excess returns are sorted with respect to the $\widehat{Diff}$ (resp. $\widehat{\overline{Index}}$) of their E- and G-index geography-based (IPO-cohort based) instruments. Table 14 shows the risk adjusted excess returns for the two extreme portfolios and the difference in returns between them. The results are in line with the model predictions. The difference in risk adjusted excess returns of portfolios with high against low $\widehat{Diff}$ ranges from 2.35 to 4.29% for the G-index and from 1.39 to 1.98% for the E-index. The difference in risk adjusted excess returns of portfolios with high against low $\widehat{\overline{Index}}$ ranges from -2.52 to -2.10% for the G-index and from -3.37 to -1.91% for the E-index.

Tables 13 and 14 [about here]

5.6 Asset-pricing implications vs. endogenous factors

This paper studies the impact of agency conflicts from investors' perspective. However, the V-shape relationship between changes in the raw G-index and equity returns (see Figure 3), plus greater regressions coefficients with the instruments in absolute terms ($b^{GEO} > b^{RAW}$ and $|c^{IPO}| > |c^{RAW}|$) show that there should exist an offsetting effect coming from endogenous factors. Firms that have stronger takeover pressure approve more takeover defenses. From the last columns of Tables 6, 8, and 9, the E-index instrument's coefficient for $\widehat{Diff}$ is b^{GEO} = 3.847 against b^{RAW} = 2.629 for the raw data, $Diff$, both with a p-value of 0.014. This phenomenon is even stronger with the G-index for which the instrument's coefficient is b^{GEO} = 2.612 (p-value = 0.002) while it gives b^{RAW} = 0.754 for the raw data (p-value = 0.155). The same applies to the implications of the average raw indices level, $\overline{Index}$, and the proxy for the IPO time governance risk, $\widehat{\overline{Index}}$, on the equity returns. In the cross-section, the negative relationship between indices' level during initial financing and equity returns is reinforced with the instruments after controlling for the counterbalancing effect of endogenous factors. For the E-index (G-index), the coefficient of $\widehat{\overline{Index}}$ is $c^{IPO} = -5.311$ (-1.709) against $c^{RAW} = -0.615$ (-0.291) for the raw data, $\overline{Index}$, with a p-value lower than 0.001 (0.001) for the instruments and equal to 0.049 (0.041) the raw indices. We clarify these results in Figure 4.

Figure 4 [about here]

Panels A and B of Figure 4 illustrate the relationship between average index and equity risk premium. The dashed blue lines shows the negative but weak relationship between the raw indices and equity premium. For both E- and G-indices, the dashed blue lines' slope are smaller in absolute terms than the black lines, which represent the link between the average of the IPO cohort-based instruments and equity premium, $\left|c^{IPO}\right| > \left|c^{RAW}\right|$. The blue lines captures endogenous factors embedded into the raw data. As expected, this shows the negative impact of giving managers more flexibility (from investors prospective) - higher indices translates into higher equity premium. Henceforth, two opposite effects are at play. On one side, firms with G- and E-indices optimally choose a low coupon/leverage and so have a lower equity premium (Asset pricing implication 1). On the other, investors dislike firms with powerful insiders, i.e., firms with high indices (endogenous). The former effect dominates leading to a smaller negatively sloped relationship between the total effect (raw data) and equity premium.

Panels C and D of Figure 4 show how investors preference interacts with the managerial power for different values of $\boldsymbol{Diff}$. Firms which have higher governance risk (GEO-based instruments) in bad times are seen by investors as riskier, hence have higher equity premium. By contrast, firms that give more power to the managerial team in bad improve in productivity, reducing the increase in risk premium and counterbalancing the increase in risk premium coming from the fact that investors dislike firms with higher $\boldsymbol{Diff}$, i.e., governance risk in bad times. Overall, the investors preference effect still dominates, i.e. $b^{GEO} > b^{RAW}$, explaining the weak positive correlation between between the raw indices data and equity premium. By disentangling asset pricing implications from endogenous factors, we are able to derive governance risk impacts on equity returns and, importantly, its role in providing a new reason for cross-sectional differences in stock returns.

6 Concluding remarks

This paper proposes a corporate finance framework in an economy with business cycles AND governance risk. Having business cycles implies the following. Governance risk vary because investors dislike firms with higher governance risk in bad times. These fluctuations in governance risk also differ across firms. Fluctuations in economic conditions translate into higher stock price volatility at the business cycle frequency. To test the model, we assume that investors infer governance risk using lagged G- and E-indices of peers that are not in the same industry. Hence, governance risk is exogenous and predetermined measure.

Our model produces at the same time adequate leverage and equity premium, better than models with business cycle risks or agency conflicts alone. we theoretically derive and empirically test two new predictions. First, firms with higher governance risk at the IPO time choose a lower indebtedness level and, so, have lower average stock returns during the subsequent years. Second, firms with higher governance risk in bad versus good economic periods deliver greater equity risk premia. To achieve these results, we use the indices of IPO cohort- and geography-based instruments derived by Karpoff, Schonlau and Wehrly (2017) as governance risk and disentangle a firm's overall average indices in two dimensions to capture the IPO time governance risk and its change in bad versus good times. Hence, this study not only proposes a theoretical explanation of the empirical findings by Gompers, Ishii and Metrick (2003) but also provides a risk-based analysis of governance decisions to explain cross-sectional variations in equity returns. The ultimate objective is not to claim a new pricing factor but to provide more links between corporate governance and asset pricing. These findings should have important implications about the role of firms' governance policies and can be applied to any other country or asset classes like emerging sovereign bonds or equity markets.

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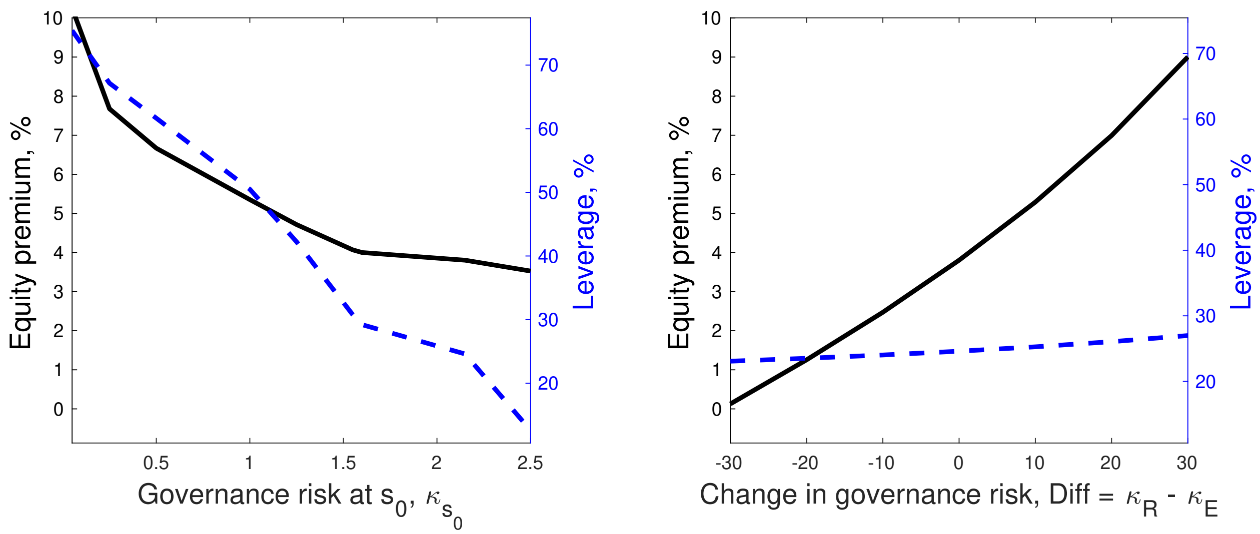

Figure 1: **Governance risk and equity risk premium (*Asset pricing implications 1* and *2*).** This graph shows how governance risk affect firms' equity risk premium and leverage. These predictions correspond to the case when the financing state's earning level is normalized at $X_0 = 1$. Without loss of generality, initial financing state is expansion, $S_0 = E$. The left Panel plots equity risk premium and optimum coupon level with respect to governance risk at the initial financing time, κ_{s_0}. Firms with higher governance risk at initial financing time optimal choose a lower coupon level and so have a lesser equity returns in the cross-section. The right Panel displays equity risk premium for different values of the change in governance risk over the business cycle, i.e. for different values of $Diff = \kappa_R - \kappa_E$. To keep a realistic economic environment, we assume that the initial governance risk is that of the case when leverage is 25%, κ_{s_0}= 2.15%. Each firm has two level of governance risk, one in each state of the economy. Because the variable of interest is $Diff$, we fix agency in expansion such that κ_E =κ_{s_0}= 2.15% and make the cost in recession vary. Unless otherwise specified, the parameters are the values of the baseline calculation shown in Table 1.

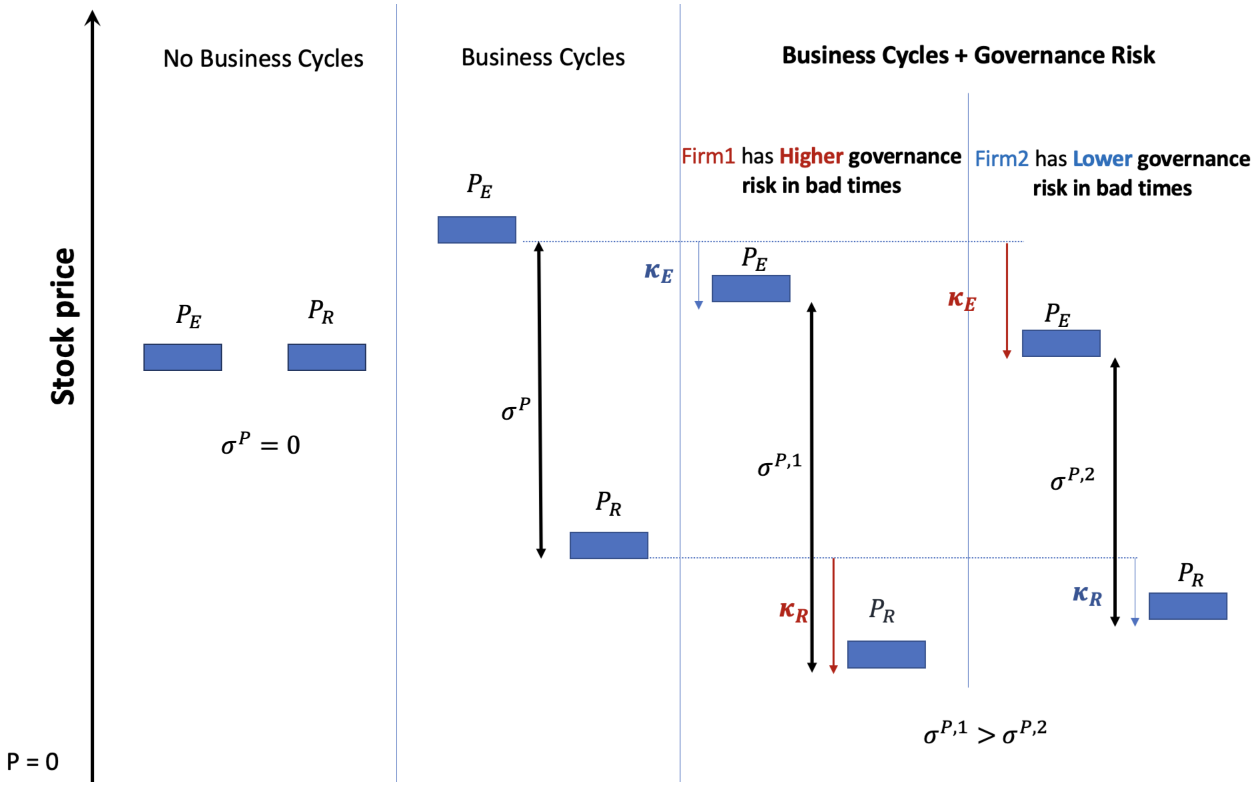

Figure 2: **Illustration of *Asset pricing implication 2*.** This graph illustrates the magnitude of the change in a stock price in good vs. bad times in various situations. This graphs ignore Consumption CAPM risk. On the left, we are in an economy with no business cycles, i.e. a one-state economy and so the stock valuation is the same in both states. Hence, $P_E = P_R$ and the quantity of business cycle risk $\sigma^P = 0$. In the middle, we have an economy with business cycles but no governance risk. Equity prices are higher in expansion periods so $P_E > P_R$ and the quantity of business cycle risk $\sigma^P > 0$. On the right, we have an economy with both business cycle and governance risk. There are two types of firms. Firm 1 has a higher governance risk in bad times (red arrow) whereas it is greater in expansion for firm 2. Hence, as shown firm 1 exhibits a higher quantity of risk, $\sigma^{P,1} > \sigma^{P,2}$ and so a higher equity risk premium.

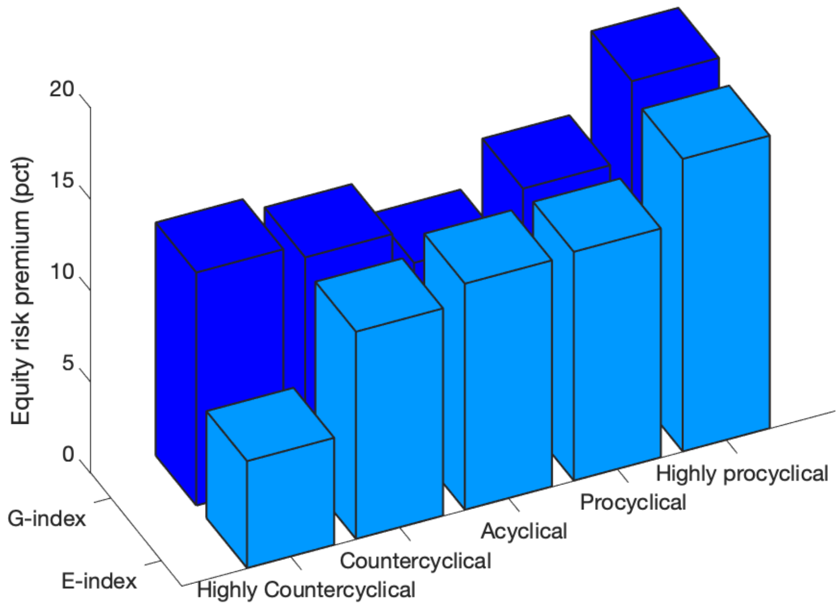

Figure 3: **Governance risk and equity returns using the raw G- and E-indices data.** The figure shows the average excess returns of firms with respect to their corporate governance policy. In blue (light blue) are the excess returns computed using the the raw G-index (E-index). The returns are annualized. Firms are sorted by their governance policy. Firms are grouped in five categories for each index, i.e., firms with $diff > 1$ for G-index and $diff > 0.5$ for E-index, these with $diff > 0$ for G-index and $diff > 0$ for E-index, these with $diff = 0$ for G-index and $diff = 0$ for E-index, these with $diff < 0$ for G-index and $diff < 0$ for E-index, and these with $diff < -1$ for G-index and $diff < -0.5$ for E-index. Firms with $diff > 0$ and $diff < 0$ for the raw G-index have both higher returns, leading to a V-shaped relationship between equity returns and governance policy. The sample consists of firms for which more than 5 index data over 8 in total are available.

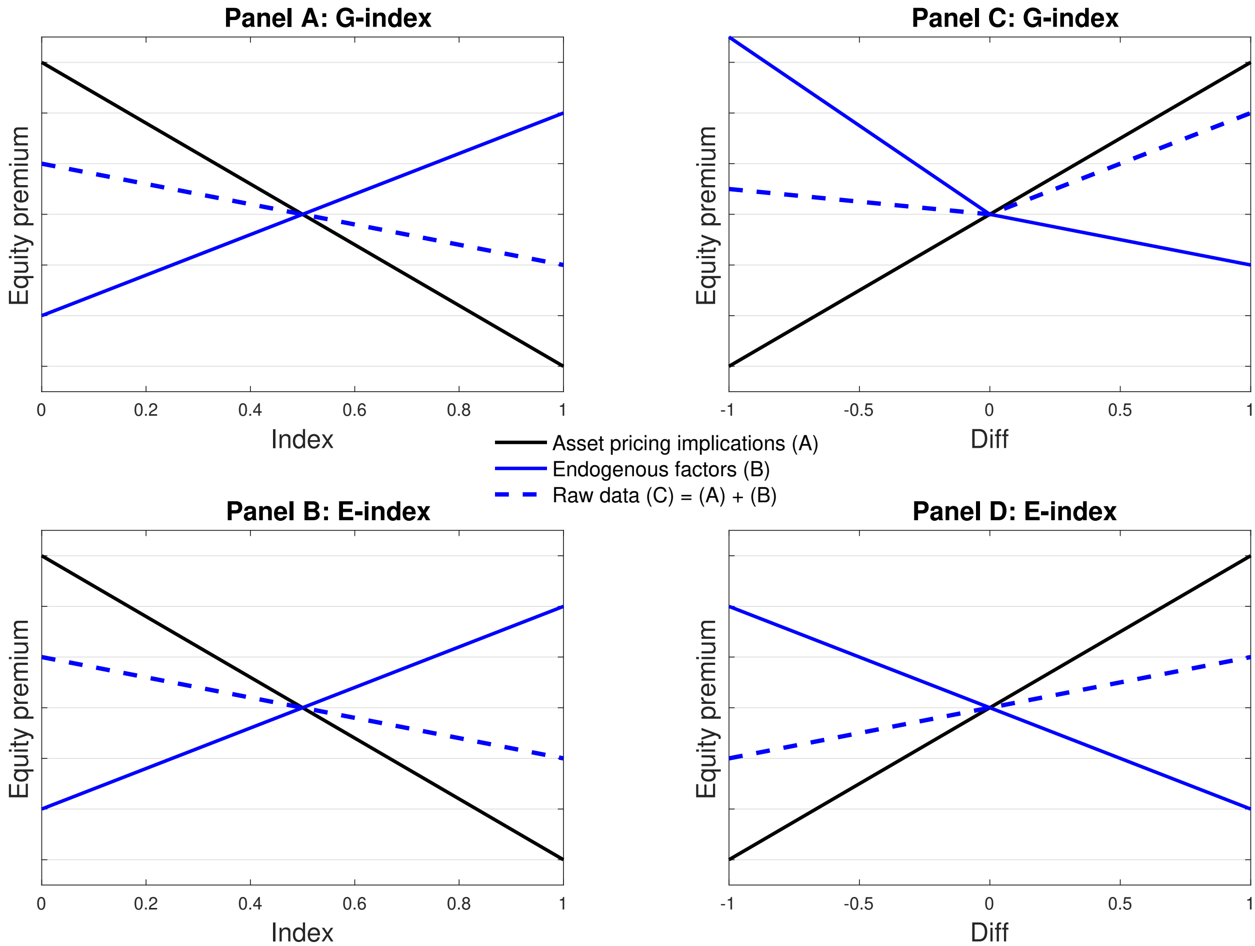

Figure 4: **Asset pricing implications versus endogenous factors embedded into raw governance index.** The figure shows the relationship between the raw indices (dashes lines) and equity premium. The decomposition of the raw indices between the *Asset pricing implication 1* (left Panels - black lines) and *2* (right Panels - black lines), and the impact of the endogenous factors (blue lines) on the equity risk premiums. The dashed blue lines represent the empirical findings display in the right Panel of Figure 3. Hence, Panels A and B illustrate the findings for the IPO time governance risk or average governance risk on equity risk premiums. Average index are normalized and range from 0 to 1. Panels C and D illustrate the findings for the changes in GEO-based instruments or governance risk on equity risk premium. Changes in governance risk over the business cycle are normalized and range from -1 to 1.

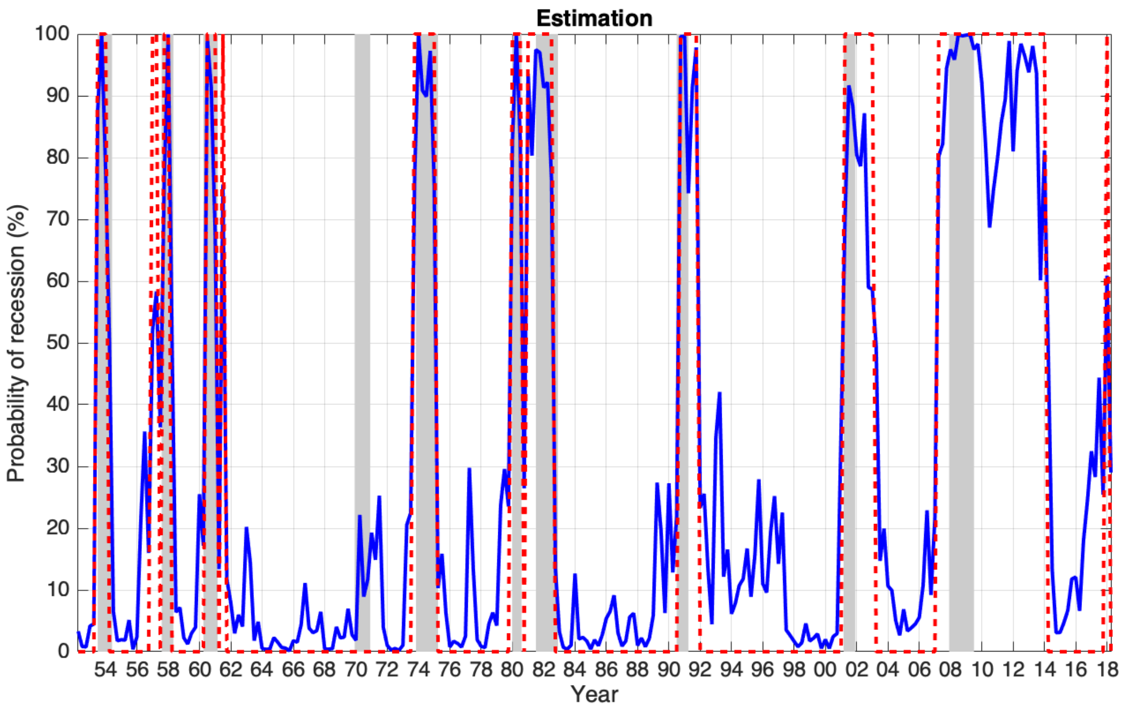

Figure 5: **Two-states estimation using US consumption growth data.** The approach follows Hamilton (1989). The grey areas are NBER recession dates. The blue curve shows the filtered probability of recession (FPR) obtained from the estimation. The red dotted line gives the prediction of the state of the economy. If FPR>0.5 the state is predicted to be recession (R) or expansion (E) otherwise. It shows a strong growth in 2014.

Table 1 : **Model calibration.** This table reports the values of the parameters used to calibrate the model. The values are annualized.

Variable	Notation	Value	
Panel A: Economic environment			
		Recession	Expansion
State of the economy	s_t	R	E
Consumption growth rate	θ_{s_t}	0.000	0.030
Consumption growth volatility	σ_{s_t}	0.015	0.010
State probability	f_{s_t}	0.300	0.700
Panel B: Agent preferences and decision			
Time preference	β	0.050	0.050
Risk aversion coefficient	γ	10.00	10.00
Elasticity of intertemporal substitution	ψ	1.500	1.500
Managerial ownership	ν	0.055	0.055
Panel C: Firm characteristics			
Cash flow growth rate	μ_{s_t}	-0.060	0.080
Systematic cash flow growth volatility	$\sigma^{sy}_{s_t}$	0.140	0.070
Idiosyncratic cash flow growth volatility	σ^{sp}	0.220	0.220
Correlation	ρ	0.200	0.200
Tax rate	η	0.200	0.200
Liquidation costs	ξ	0.500	0.500
Issuance cost	δ	0.015	0.015

Table 2 : **Governance risk and asset pricing.** This table reports the results for three cases: when governance risk are low ($\kappa_{s_0} = 0.05\%$), at the baseline case ($\kappa_{s_0} = 2.15\%$), and when they are high ($\kappa_{s_0} = 2.50\%$). These predictions correspond to the case when the financing state's earning level is normalized at $X_0 = 1$. Without loss of generality, the initial state s_0 is assumed to be an expansion period, $s_0 = E$. The first column contains the predictions for when the current state of the economy is recession, the second column contains the predictions for when the current state is expansion, and the third column displays unconditional values. All parameters are from the baseline calibration shown in Table 1.

Current state, s_t	Recession, R	Expansion, E	Unconditional
When $\kappa_{s_0} = 0.05\%$			
Equity risk premium, $RP_{s_0 s_t}$ (%)	19.687	6.2073	10.251
Leverage, $L_{s_0 s_t}$ (%)	82.775	72.291	75.4361
Default threshold, $X_{D,s_0 s_t}$	0.4317	0.3333	0.3628
Refinancing threshold, $X_{U,s_0 s_t}$	7.7298	4.6269	5.5578
Scaling factor, $\Phi_{s_0 s_t}$	1.4096	1.6158	1.5539
Coupon at s_0	0.9019	0.9019	0.9019
When $\kappa_{s_0} = 2.15\%$			
Equity risk premium, $RP_{s_0 s_t}$ (%)	5.994	2.8644	3.8034
Leverage, $L_{s_0 s_t}$ (%)	28.117	23.098	24.604
Default threshold, $X_{D,s_0 s_t}$	0.1195	0.1001	0.1059
Refinancing threshold, $X_{U,s_0 s_t}$	8.4019	6.3724	6.9813
Scaling factor, $\Phi_{s_0 s_t}$	1.3247	1.4737	1.4290
Coupon at s_0	0.2739	0.2739	0.2739
When $\kappa_{s_0} = 2.50\%$			
Equity risk premium, $RP_{s_0 s_t}$ (%)	5.4983	2.6809	3.5261
Leverage, $L_{s_0 s_t}$ (%)	14.645	11.730	12.605
Default threshold, $X_{D,s_0 s_t}$	0.0571	0.0486	0.0512
Refinancing threshold, $X_{U,s_0 s_t}$	6.6701	5.3897	5.7738
Scaling factor, $\Phi_{s_0 s_t}$	1.3788	1.5632	1.5079
Coupon at s_0	0.1333	0.1333	0.1333

Table 3 : **Main results for different values of $Diff = \kappa_R - \kappa_E$.** This table reports the predictions for different values of $Diff = \kappa_R - \kappa_E$, with governance risk in expansion periods set to $\kappa_E = 2.15\%$ as in the baseline case shown in Table 2. The results are obtained for: $Diff = -30.00\%$, $Diff = 0.00\%$ and, $Diff = 30.00\%$. The first column contains the predictions when the current state of the economy, s_t, is in recession, the second contains the predictions in expansion, and the third displays unconditional values. All parameters are from the baseline calibration shown in Table 1.

	Recession	Expansion	Unconditional
Optimal decisions			
Default threshold, $X_{D,s_0 s_t}$	0.1195	0.1001	0.1059
Refinancing threshold, $X_{U,s_0 s_t}$	8.4019	6.3724	6.9813
Scaling factor, $\Phi_{s_0 s_t}$	1.3247	1.4737	1.4290
Coupon at s_0	0.2739	0.2739	0.2739
When $Diff = -30.00\%$			
Equity risk premium, $RP_{s_0 s_t}$ (%)	0.2500	0.0740	0.1268
Leverage, $L_{s_0 s_t}$ (%)	23.040	23.098	23.080
When $Diff = 0.00\%$			
Equity risk premium, $RP_{s_0 s_t}$ (%)	5.994	2.8644	3.8034
Leverage, $L_{s_0 s_t}$ (%)	28.117	23.098	24.604
When $Diff = 30.00\%$			
Equity risk premium, $RP_{s_0 s_t}$ (%)	16.8189	5.6548	9.0040
Leverage, $L_{s_0 s_t}$ (%)	36.066	23.098	26.988

Table 4 : **Summary Statistics - Raw indices**. This table presents descriptive statistics for the main variables used in the empirical tests. Excess returns are annualized. N_E represents the number of indices available in expansion, and N_R in recession for a firm. Statistics are similar for the case when $N_R \geq 2$ & $N_E \geq 4$. Data are from 1990 to 2006.

	Mean	median	Min	5%	10%	90%	95%	Max	SD	Number of firms
$N_R \geq 1$ & $N_E \geq 1$										
$Diff_E$	0.031	0.000	-3.000	-1.000	-0.500	0.667	1.000	3.500	0.578	1916
E-index	2.413	2.500	0.000	0.250	0.800	4.000	4.144	6.000	1.241	1916
$Diff_G$	-0.047	0.000	-6.000	-1.667	-1.000	1.000	1.500	6.500	1.047	2106
G-index	9.120	9.000	2.000	5.000	5.817	12.50	13.37	17.00	2.680	2106
Excess returns	0.120	0.123	-1.612	-0.126	-0.008	0.275	0.347	0.551	0.044	2106
β^{MKT}	0.916	0.835	-1.252	0.123	0.270	1.671	1.996	4.712	0.621	2106
β^{SMB}	0.556	0.398	-2.747	-0.402	-0.260	1.464	2.100	7.104	0.801	2106
β^{HML}	-0.350	-0.153	-4.426	-2.122	-1.563	0.438	0.646	6.451	0.917	2106
β^{RMW}	-0.432	-0.170	-9.423	-2.470	-1.712	0.517	0.895	8.593	1.135	2106
β^{CMA}	-0.757	-0.559	-9.000	-2.677	-2.189	0.261	0.489	2.977	1.117	2106
β^{MOM}	-0.244	-0.210	-3.602	-1.016	-0.743	0.245	0.423	6.287	0.539	2106
$N_R + N_E \geq 6$										
$Diff_E$	0.057	0.000	-1.300	-0.500	-0.333	0.500	0.733	1.500	0.368	654
E-index	2.484	2.625	0.000	0.333	0.875	4.000	4.375	6.000	1.218	654
$Diff_G$	0.030	0.000	-3.000	-1.000	-0.667	0.742	1.067	4.250	0.709	726
G-index	9.713	9.792	3.000	5.531	6.208	13.00	13.87	15.75	2.528	726
Excess returns	0.120	0.118	-1.385	0.009	0.040	0.223	0.270	0.652	0.032	726
β^{MKT}	0.885	0.813	-1.188	0.210	0.349	1.516	1.820	3.338	0.491	726
β^{SMB}	0.304	0.219	-2.634	-0.428	-0.298	0.996	1.294	5.205	0.620	726
β^{HML}	-0.205	-0.071	-3.649	-1.748	-1.061	0.404	0.484	2.614	0.675	726
β^{RMW}	-0.288	-0.111	-6.993	-1.852	-1.222	0.361	0.488	2.289	0.804	726
β^{CMA}	-0.568	-0.422	-3.748	-2.297	-1.583	0.165	0.334	9.591	0.867	726
β^{MOM}	-0.290	-0.248	-3.058	-0.840	-0.646	0.035	0.122	1.414	0.335	726

Table 5 : **Summary Statistics - Instruments**. This table presents descriptive statistics for the instrumental variables used in the empirical tests. Excess (monthly) returns are annualized. Data are from 1995 to 2006.

	Mean	Min	5%	10%	median	90%	95%	Max	Number of firms
Excess returns	0.128	-0.090	0.039	0.056	0.114	0.221	0.266	0.402	469
IPO									
$\widehat{Diff_E}$	-0.005	-0.434	-0.151	-0.078	-0.013	0.089	0.095	0.217	469
$\widehat{\overline{Eindex}}$	2.612	2.110	2.193	2.295	2.657	2.777	2.866	3.268	469
$\widehat{Diff_G}$	0.111	-0.639	-0.058	-0.036	0.049	0.339	0.426	0.833	469
$\widehat{\overline{Gindex}}$	9.513	7.649	8.010	8.156	9.654	10.26	10.277	12.25	469
GEO									
$\widehat{Diff_E}$	0.015	-0.738	-0.208	-0.163	0.028	0.222	0.262	0.677	469
$\widehat{\overline{Eindex}}$	2.597	1.437	1.932	2.054	2.607	3.033	3.117	3.406	469
$\widehat{Diff_G}$	0.030	-3.000	-1.000	-0.667	0.000	0.742	1.067	4.250	469
$\widehat{\overline{Gindex}}$	9.713	3.000	5.531	6.208	9.792	13.00	13.87	15.75	469

Table 6 : **Cross-sectional regressions - Raw indices**. This table reports the coefficients for the cross-sectional regressions of firms' annualized average excess returns on, $Diff = Ind_R - Ind_E$ and other controls variables, when $N_E + N_R \geq 6$. N_E represents the number of indices available in expansion, and N_R in recession for a firm. p-values are shown in parentheses below the coefficients. ***, ** and * indicate that coefficients are at the 1%, 5% and 10% significance levels, respectively. Data are from 1990 to 2006.

	E-index				G-index			
$Diff$	**3.042*** **		**2.982** **	**2.629** **	**1.618*** **		**1.301** **	0.754
	(0.009)		**(0.013)**	**(0.012)**	**(0.005)**		**(0.031)**	(0.155)
$\overline{Index}$		**-1.060*** **	**-1.024*** **	**-0.615** **		**-0.471*** **	**-0.437*** **	**-0.291** **
		(0.002)	**(0.004)**	**(0.049)**		**(0.003)**	**(0.007)**	**(0.041)**
$Diff^2$			-0.906	0.665			0.294	0.282
			(0.585)	(0.648)			(0.329)	(0.295)
MKT				13.12***				13.34***
				(0.000)				(0.000)
SMB				-1.774*				-0.532
				(0.058)				(0.538)
HML				-7.340***				-8.238***
				(0.000)				(0.000)
RMW				0.161				2.575***
				(0.877)				(0.003)
CMA				8.222***				7.978***
				(0.000)				(0.000)
MOM				11.173***				10.328***
				(0.000)				(0.000)
Num. of firms	654	654	654	654	726	726	726	726
R-square	0.010	0.014	0.023	0.286	0.011	0.012	0.022	0.273

Table 7 : **Cross-sectional regressions - Raw indices** (Robustness). This table reports the coefficients for the cross-sectional regressions of firms' annualized average excess returns on, $Diff = Ind_R - Ind_E$, $\overline{Index}$, and other controls variables, as shown in equation 15. The analysis is restricted to the firms for which $N_E \geq 4$ and $N_R \geq 2$. N_E represents the number of indices available in expansion, and N_R in recession for a firm. p-values are shown in parentheses below the coefficients. ***, ** and * indicate that coefficients are at the 1%, 5% and 10% significance levels, respectively. Data are from 1990 to 2006.

	E-index				G-index			
$Diff$	**2.672****		**2.601****	**2.162****	**1.534****		**1.257****	0.6415
	(0.031)		**(0.038)**	**(0.045)**	**(0.013)**		**(0.045)**	(0.247)
$\overline{Index}$		**-0.993*****	**-0.971*****	-0.471		**-0.456*****	**-0.413****	-0.221
		(0.006)	**(0.008)**	(0.138)		**(0.005)**	**(0.012)**	(0.130)
$Diff^2$			-0.699	1.325			0.342	0.317
			(0.689)	(0.382)			(0.312)	(0.302)
MKT				13.03***				12.85***
				(0.000)				(0.000)
SMB				-3.397***				-1.576*
				(0.000)				(0.084)
HML				-4.589***				-6.357***
				(0.002)				(0.000)
RMW				-2.425**				0.7051
				(0.033)				(0.471)
CMA				6.748***				6.625***
				(0.000)				(0.000)
MOM				12.72***				11.37***
				(0.000)				(0.000)
Num. of firms	602	602	602	602	666	666	666	666
R-square	0.008	0.012	0.019	0.303	0.009	0.011	0.020	0.263

Table 8 : **Cross-sectional regressions - IPO cohort-based IV**. This table reports the coefficients for the cross-sectional regressions of firms' annualized average excess returns on $\widehat{Diff} = \widehat{Ind_R} - \widehat{Ind_E}$, $\overline{\widehat{Index}}$, and other controls variables, as shown in equation 15. The IPO-cohort based IVs capture the number of provisions adopted during the five previous years by firms that went public within a year of the focus firm and are not in the same industry. Recession and expansion dates are the same as for these used for the raw data. Data are from 1990 to 2006 in order to compare the results with these of the raw data. p-values are shown in parentheses below the coefficients. ***, ** and * indicate that coefficients are at the 1%, 5% and 10% significance levels, respectively.

IPO	E-index's IV				G-index's IV			
$\widehat{Diff}$	7.353*		**10.02****	4.784	0.908		2.886	1.138
	(0.085)		**(0.019)**	(0.161)	(0.303)		(0.322)	(0.631)
$\overline{\widehat{Index}}$		**-9.580*****	**-10.04*****	**-5.311*****		**-1.302*****	**-3.535*****	**-1.709*****
		(0.000)	**(0.000)**	**(0.000)**		**(0.000)**	**(0.000)**	**(0.000)**
$\widehat{Diff}^2$			103.6***	55.58**			-1.599	-3.014
			(0.000)	(0.010)			(0.802)	(0.559)
MKT				3.970***				3.720**
				(0.006)				(0.011)
SMB				-0.6434				-1.027
				(0.405)				(0.195)
HML				-1.399				-1.0737
				(0.364)				(0.487)
RMW				0.270				-0.1525
				(0.802)				(0.888)
CMA				-3.716***				-3.753***
				(0.002)				(0.002)
MOM				6.692***				6.594***
				(0.000)				(0.000)
Num of firms	469	469	469	469	469	469	469	469
R-square	0.006	0.071	0.102	0.461	0.021	0.146	0.149	0.462

Table 9 : **Cross-sectional regressions - GEO-based IV**. This table reports the coefficients for the cross-sectional regressions of firms' annualized average excess returns on, $\widehat{Diff} = \widehat{Ind_R} - \widehat{Ind_E}$, $\widehat{\overline{Index}}$, and other controls variables, as given by equation 15. The geography-based IVs measure provisions adopted during the five previous years by geographically proximate firms that are not in the same industry as the focus firm. Recession and expansion dates are the same as these used for the raw data. Data are from 1990 to 2006 in order to be able to compare the results with these of the raw data. p-values are shown in parentheses below the coefficients. ***, ** and * indicate that coefficients are at the 1%, 5% and 10% significance levels, respectively.

GEO	E-index's IV				G-index's IV			
$\widehat{Diff}$	-1.636		1.2265	**3.847****	0.908		**2.420****	**2.612*****
	(0.387)		(0.544)	**(0.013)**	(0.303)		**(0.026)**	**(0.001)**
$\widehat{\overline{Index}}$		**-3.561*****	**-3.787*****	-0.518		**-1.302*****	**-1.422*****	-0.0304
		(0.000)	**(0.000)**	(0.508)		**(0.000)**	**(0.000)**	(0.9223)
$\widehat{Diff}^2$			1.8403	5.400			-1.808*	-0.5347
			(0.735)	(0.196)			(0.088)	(0.5113)
MKT				4.295***				3.857***
				(0.004)				(0.009)
SMB				-0.056				-0.121
				(0.942)				(0.875)
HML				-1.975				-1.986
				(0.209)				(0.205)
RMW				0.931				7.835
				(0.395)				(0.472)
CMA				-3.850***				-3.996***
				(0.002)				(0.001)
MOM				6.998***				6.882***
				(0.000)				(0.000)
Num of firms	469	469	469	469	469	469	469	469
R-square	0.002	0.032	0.033	0.444	0.002	0.023	0.034	0.450

Table 10 : **Cross-sectional regressions - E-index** (Out-of-sample). The analysis is made on the period from 2007 to 2018. This table reports the coefficients of the cross-sectional regressions of firms' annualized average excess returns on indices related and Fama-French factors. p-values are shown in parentheses below the coefficients. ***, ** and * indicate that coefficients are at the 1, 5 and 10% significance levels, respectively.

E-index - OOS	2007-2018				2014				**During the crisis - 2008-2009**			
$Diff$	-0.748**		-1.266***	-0.730**	**0.326**		**0.753**	**0.505**	**-2.411*** **		**-3.642*** **	**-2.570*** **
	(0.013)		(0.000)	(0.042)	(0.718)		(0.509)	(0.650)	**(0.002)**		**(0.000)**	**(0.006)**
$\overline{Index}$		0.413	0.669**	0.610**		**-2.151** **	**-2.025** **	**-1.000**		-0.318	0.2457	0.358
		(0.153)	(0.027)	(0.034)		**(0.012)**	**(0.024)**	(0.253)		(0.695)	(0.761)	(0.629)
$Diff^2$			-0.453	-0.221			-0.1961	-0.1817			-1.583**	-1.1885*
			(0.124)	(0.420)			(0.824)	(0.830)			(0.045)	(0.096)
MKT				-0.258				-8.272**				-14.69***
				(0.817)				(0.016)				(0.000)
SMB				0.2757				-5.996***				11.60***
				(0.616)				(0.000)				(0.000)
HML				2.113***				10.605***				-1.119***
				(0.008)				(0.000)				(0.593)
RMW				0.781*				1.206				8.791***
				(0.095)				(0.397)				(0.000)
CMA				-4.681***				-7.824***				-4.589***
				(0.000)				(0.000)				(0.000)
MOM				1.888*				2.230				-26.04***
				(0.077)				(0.495)				(0.000)
Num of firms	1133	1133	1133	1133	1133	1133	1133	1133	1133	1133	1133	1133
R-square	0.006	0.002	0.012	0.149	0.008	0.000	0.012	0.202	0.008	0.000	0.012	0.202

Table 11 : **Summary Statistics - Instruments** (Robustness). This table presents descriptive statistics for the instrumental variables used in the empirical tests. Excess (monthly) returns are annualized from 1995 to 2015. Instruments data are from 1995 to 2008.

	Mean	Min	5%	10%	median	90%	95%	Max	Number of firms
Excess returns	0.122	-0.468	0.036	0.061	0.113	0.196	0.232	1.279	484
IPO									
$\widehat{Diff_E}$	0.089	-0.228	-0.020	0.025	0.073	0.157	0.189	0.223	484
$\overline{\widehat{Eindex}}$	2.613	2.152	2.196	2.300	2.661	2.782	2.865	3.268	484
$\widehat{Diff_G}$	0.113	-0.639	-0.058	-0.036	0.052	0.339	0.412	0.833	484
$\overline{\widehat{Gindex}}$	9.487	7.649	8.014	8.155	9.652	10.26	10.26	12.25	484
GEO									
$\widehat{Diff_E}$	0.015	-0.737	-0.208	-0.163	0.024	0.223	0.265	0.677	484
$\overline{\widehat{Eindex}}$	2.599	1.437	1.932	2.051	2.613	3.060	3.130	3.406	484
$\widehat{Diff_G}$	0.265	-1.200	-0.326	-0.046	0.249	0.719	0.897	2.050	484
$\overline{\widehat{Gindex}}$	9.189	6.797	7.670	8.025	9.188	10.32	10.47	10.98	484

Table 12 : **Cross-sectional Regressions - Instruments** (Exploiting data from the 2007-09 financial crisis). This table presents descriptive statistics for the instrumental variables used in the empirical tests. Excess (monthly) returns are annualized. Data are from 1995 to 2015 (Panel A1 and Panel A2) and 1995 to 2008 (Panel B1 and Panel B2). The sample consists of the same firms as in Table 5, i.e. instruments data are from 1995 to ***2008***. ***, ** and * indicate that coefficients are at the 1, 5 and 10% significance levels, respectively. All R-squares are between 0.27 and 0.30 (50 and 60%) for Panels A.2 and B.2 (Panels A.2 and B.2). FF5+1 denotes the Fama-French five factors plus momentum. In Panels A1 and B1, recessions date are in 2000 and 2002. In Panels A2 and B2, recessions date are in 2000, 2002, and 2008.

IVs	E	G	E	G	E	G	E	G
	IPO		GEO		IPO		GEO	
	Panel A.1: 1995 - 2015				Panel B.1: 1995 - 2008			
$\widehat{Diff}$	7.22*	3.21	2.98*	2.25**	2.29	-3.62	0.65	2.98*
$\overline{\widehat{Index}}$	-3.19**	-1.43***	0.33	0.04	-2.09	-1.48*	-1.41	-0.49
$\widehat{Diff}^2$	YES	YES	YES	YES	YES	YES	YES	YES
FF5+1	YES	YES	YES	YES	YES	YES	YES	YES
	Panel A.2: 1995 - 2015				Panel B.2: 1995 - 2008			
$\widehat{Diff}$	-6..61	5.24	4.66**	3.66***	-13.31	-3.69	4.91	4.19**
$\overline{\widehat{Index}}$	-3.27**	-1.69***	0.87	-0.22	-3.62*	-1.20*	-0.24	-0.63
$\widehat{Diff}^2$	YES	YES	YES	YES	YES	YES	YES	YES
FF5+1	YES	YES	YES	YES	YES	YES	YES	YES

Table 13 : **Portfolio sorting (1/2).** This table reports average excess returns (ExRet) and risk-adjusted returns (RiskAdj) of three portfolios sorted with respect to $\widehat{Diff}$ of the geography-based instruments (Panel A) and to $\overline{\widehat{Index}}$ of IPO-cohort based instruments (Panel B). On the left, results are on the left for the G-index and the right those of the E-index. We obtain the risk-adjusted returns as followed $RiskAdj^i = ExRet^i - d\left(\widehat{Diff^i}\right)^2 - \sum_{j=1}^{6} e_j \beta^{i,j}$. Each firm i's exposure to the factor j, $\beta^{i,j}$ with $j \in [1,6]$, is obtained by performing time-series regressions $ExcessReturns_t^i = \alpha^i + \sum_{j=1}^{6} \beta^{i,j} Factors_t^j + e_t^i$. Hence, the regression coefficients d and e_j are these reported in the last column of Tables 8 and 9. Data covers the period from 1990 to 2006, as for the main empirical exercise.

	G-index			E-index		
Panel A: GEO-IVs	$\widehat{Diff}$	ExRet	RiskAdj	$\widehat{Diff}$	ExRet	RiskAdj
High	0.644	13.010	10.894	0.191	13.084	9.357
Medium	0.246	12.519	9.169	0.021	11.404	8.236
Low	-0.100	12.800	8.541	-0.166	13.843	7.969
High-Low		0.210	**2.353**		-0.759	**1.388**
Panel B: IPO-IVs	$\overline{\widehat{Index}}$	ExRet	RiskAdj	$\overline{\widehat{Index}}$	ExRet	RiskAdj
High	10.176	10.765	9.098	2.784	11.941	7.515
Medium	9.687	11.503	8.282	2.661	11.103	8.599
Low	8.684	16.033	11.202	2.392	15.272	9.424
High-Low		**-5.267**	**-2.104**		**-3.331**	**-1.910**

Table 14 : **Portfolio sorting (2/2).** This table reports risk-adjusted returns (Risk adj.) of 4, 5, 6, and 8 portfolios sorted according to $\widehat{Diff}$ of their geography-based instruments (Panel A) and $\widehat{\widehat{Index}}$ of their IPO-cohort based instruments (Panel B). Part I of Panel A and B display results for the G-index and Part II results for the E-index. On the left, results are on the left for the G-index and the right those of the E-index. We obtain the risk-adjusted returns as followed $RiskAdj^i = ExRet^i - d\left(\widehat{Diff^i}\right)^2 - \sum_{j=1}^{6} e_j \beta^{i,j}$. Each firm i's exposure to the factor j, $\beta^{i,j}$ with $j \in [1,6]$, is obtained by performing time-series regressions $ExcessReturns_t^i = \alpha^i + \sum_{j=1}^{6} \beta^{i,j} Factors_t^j + e_t^i$. Hence, the regression coefficients d and e_j are these reported in the last column of Tables 8 and 9. Data covers the period from 1990 to 2006, as for the main empirical exercise.

Panel A: GEO-IVs

	4 portfolios		5 portfolios		6 portfolios		8 portfolios	
I - G-index	$\widehat{Diff}$	Risk adj.	$\widehat{Diff}$	Risk adj.	$\widehat{Diff}$	Risk adj.	$\widehat{Diff}$	Risk adj.
High	0.726	11.389	0.783	11.765	0.842	12.667	0.908	13.133
Low	-0.153	8.556	-0.198	8.693	-0.237	8.464	-0.312	8.842
High-Low		**2.833**		**3.073**		**4.203**		**4.291**
II - E-index	$\widehat{Diff}$	Risk adj.	$\widehat{Diff}$	Risk adj.	$\widehat{Diff}$	Risk adj.	$\widehat{Diff}$	Risk adj.
High	0.225	9.754	0.247	9.846	0.262	9.308	0.287	9.335
Low	-0.196	7.779	-0.217	7.976	-0.241	7.862	-0.266	7.617
High-Low		**1.975**		**1.871**		**1.447**		**1.718**

Panel B: IPO-IVs

	4 portfolios		5 portfolios		6 portfolios		8 portfolios	
I - G-index	$\widehat{\widehat{Index}}$	Risk adj.	$\widehat{\widehat{Index}}$	Risk adj.	$\widehat{\widehat{Index}}$	Risk adj.	$\widehat{\widehat{Index}}$	Risk adj.
High	10.254	9.417	10.321	9.496	10.403	9.782	10.485	9.782
Low	8.423	11.937	8.265	11.962	8.177	12.235	8.049	12.117
High-Low		**-2.520**		**-2.466**		**-2.453**		**-2.335**
II - E-index	$\widehat{\widehat{Index}}$	Risk adj.	$\widehat{\widehat{Index}}$	Risk adj.	$\widehat{\widehat{Index}}$	Risk adj.	$\widehat{\widehat{Index}}$	Risk adj.
High	2.806	7.229	2.823	7.445	2.838	7.246	2.875	7.281
Low	2.324	10.178	2.274	10.815	2.242	10.600	2.219	10.285
High-Low		**-2.949**		**-3.370**		**-3.355**		**-3.004**

Internet Appendix to

"Governance Risk and the Cross-Section of Stock Returns: Do Business Cycles Help to Solve the Puzzle?"

A State-price density and discount rate

The representative agent (insiders and investors) has Epstein-Zin-Weil preference. This preference separates the impacts of risk aversion, γ, from the elasticity of intertemporal substitution, defined by the EIS coefficient, ψ. In this section, the formulas for the state-price density and the equilibrium risk-free rates are provided.[21]

The representative agent's state-price density π_t when $\psi \neq 1$ is given by

$$\pi_t \quad = \quad \left(\beta e^{-\beta t}\right)^{\frac{1-\gamma}{1-\frac{1}{\psi}}} C_t^{-\gamma} \left(p_{C,s_t}^{G}\right)^{-\frac{\gamma-\frac{1}{\psi}}{1-\frac{1}{\psi}}}, \tag{A.1}$$

where $G = e^{\int_0^t p_{C,s_u}^{-1} du}$ is a positive time-invariant number[22] and p_{C,s_t} is the price-consumption ratio that satisfies the following implicit non-linear equation:

$$\begin{aligned} p_{C,s_t}^{-1} \quad = \quad & \bar{r}_{s_t} - \theta_{s_t} + \gamma\sigma_{s_t}^2 - \\ & \left(1 - \frac{1}{\psi}\right)\lambda_{s_t}\left(\frac{\left(\frac{p_{C,j}}{p_{C,s_t}}\right)^{\frac{1-\gamma}{1-\frac{1}{\psi}}} - 1}{1-\gamma}\right), \; s_t, j \in \{R, E\}, j \neq s_t \end{aligned}$$

with

$$\bar{r}_{s_t} = \beta + \frac{1}{\psi}\theta_{s_t} - \frac{1}{2}\gamma\left(1 + \frac{1}{\psi}\right)\sigma_{s_t}^2. \tag{A.2}$$

In equilibrium, the state-price density dynamic follows [23]

$$\begin{aligned} \frac{d\pi_t}{\pi_t} \quad &= \quad -r_{s_t} dt + \frac{dM_t}{M_t} \\ &= \quad -r_{s_t} dt - \Theta_{s_t}^{B} dB_{c,t} - \Theta_{s_t}^{P} dJ_{s_t,t}, \end{aligned} \tag{A.3}$$

where M is a martingale under the physical measure, $J_{s_t,t}$ a Poisson process which jumps upward by one whenever the state of the economy switches from s_t to $j \neq s_t$, $\Theta_{s_t}^B = \gamma\sigma_{s_t}$ is the market price of risk due to Brownian shocks in state s_t, $\Theta_{s_t}^P = 1 - \Delta_{s_t}$ is the market

[21] For additional details and a complete derivation, we refer the reader to the Appendix of Bhamra et al. (2010b) for two states, and to the Appendix of Chen (2010) for N states.

[22] $p_C > 0$ is defined as the price-consumption ratio.

[23] See Bhamra et al. (2010b) for a detailed proof.

price of risk due to Poisson shocks when the economy switches out of state $s_t = \{R, E\}$ and $\Delta_{s_t} = \frac{\pi_j}{\pi_{s_t}}\Big|, s_t \neq j$ quantifies the jump in the state-price density π_{s_t} at the time the economy switches from state s_t.

Finally, r_{s_t} represents the equilibrium real risk-free rate, which is given by

$$r_{s_t} = \begin{cases} \bar{r}_R + \lambda_R \left[\frac{\gamma-\frac{1}{\psi}}{1-\gamma} \left(\Delta^{-\frac{\gamma-1}{\gamma-\frac{1}{\psi}}} - 1 \right) - \left(\Delta^{-1} - 1 \right) \right] & , \ s_t = R \\ \bar{r}_E + \lambda_E \left[\frac{\gamma-\frac{1}{\psi}}{1-\gamma} \left(\Delta^{\frac{\gamma-1}{\gamma-\frac{1}{\psi}}} - 1 \right) - \left(\Delta - 1 \right) \right] & , \ s_t = E \end{cases}$$

with $\Delta_E = \Delta_R^{-1} = \Delta$, where Δ is the solution of $G(\Delta) = 0$ from

$$G(x) = x^{-\frac{1-\frac{1}{\psi}}{\gamma-\frac{1}{\psi}}} - \frac{\bar{r}_E + \gamma\sigma_E^2 - \theta_E + \lambda_E \frac{1-\frac{1}{\psi}}{\gamma-1} \left(x^{\frac{\gamma-1}{\gamma-\frac{1}{\psi}}} - 1 \right)}{\bar{r}_R + \gamma\sigma_R^2 - \theta_R + \lambda_R \frac{1-\frac{1}{\psi}}{\gamma-1} \left(x^{-\frac{\gamma-1}{\gamma-\frac{1}{\psi}}} - 1 \right)}, \quad \psi \neq 1$$

The agent has preference for earlier resolution of uncertainty in the case when $\gamma > \frac{1}{\psi}$ and thus cares about the rate of arrival of news, denoted by p. When p is small, the speed at which information arrives is low, thereby increasing the risk of the intertemporal substitution for an agent averse to such risk. The rate at which the distribution for the state of the economy converges to its steady state is given by $p = \lambda_R + \lambda_E$, where λ_{s_t} is the probability per unit of time of leaving state s_t. The quantity $1/\lambda_{s_t}$ is the expected duration of state s_t. Recessions are shorter than expansions; hence, $1/\lambda_R < 1/\lambda_E$.

The physical probabilities λ_R and λ_E are converted to their risk-neutral counterparts $\hat{\lambda}_R$ and $\hat{\lambda}_E$ through a risk distortion factor Δ_E, which is defined as the change in the state-price density π_t at the transition time from expansion to recession. The risk-neutral probabilities per unit of time of changing state are then given by

$$\hat{\lambda}_E = \Delta_E \lambda_E \quad \text{and} \quad \hat{\lambda}_R = \frac{1}{\Delta_E} \lambda_R. \tag{A.4}$$

The agent prefers earlier resolution of the uncertainty, which implies that $\Delta_E > 1$. Hence, this agent prices securities as if recessions are longer ($\lambda_R > \hat{\lambda}_R$) and expansions are shorter ($\lambda_E < \hat{\lambda}_E$) than they are in reality. The risk-neutral rate of arrival of news is $\hat{p} = \hat{\lambda}_R + \hat{\lambda}_E$, which implies that the business cycle risk-neutral distribution is determined by $\left(\hat{f}_R, \hat{f}_E \right) = \left(\frac{\hat{\lambda}_E}{\hat{p}}, \frac{\hat{\lambda}_R}{\hat{p}} \right)$.

The equilibrium risk-free rate prevailing in equilibrium in state s_t is given by

$$r_{s_t} = \bar{r}_{s_t} - \left(\frac{\gamma - \frac{1}{\psi}}{\gamma - 1}\right)\lambda_{s_t}\left(1 - \Delta_{s_t}^{\frac{\gamma-1}{\gamma-\frac{1}{\psi}}}\right) + \lambda_{s_t}\left(1 - \Delta_{s_t}\right), \quad \psi \neq 1,\ s_t = \{R, E\}, \tag{A.5}$$

where

$$\bar{r}_{s_t} = \beta + \frac{1}{\psi}\theta_{s_t} - \frac{1}{2}\gamma\left(1 + \frac{1}{\psi}\right)\sigma_{s_t}^2. \tag{A.6}$$

Higher uncertainty ($\sigma_E < \sigma_R$) and lower economic growth ($\theta_E > \theta_R$) in recession induce greater demand for the risk-free bond, thereby reducing the equilibrium interest rate ($r_E > r_R$). The risk-free interest rate is therefore procyclical.

Cash flow and bond discount rates are respectively given by[24]:

$$r_{a,s_t} = r_{s_t} - \mu_{s_t} + \frac{\left(r_j - \mu_j\right) - \left(r_{s_t} - \mu_{s_t}\right)}{\hat{p} + r_j - \mu_j}\hat{p}\hat{f}_j, \quad j \neq s_t \tag{A.7}$$

and

$$r_{b,s_t} = r_{s_t} + \frac{r_j - r_{s_t}}{\hat{p} + r_j}\hat{p}\hat{f}_j, \quad j \neq s_t, \tag{A.8}$$

B Asset prices

B.1 Stock price

The present value of net profit over one financing period is defined by

$$I_{s_0 s_t} = (1 - \eta)\, E_t\left[\int_t^{\tau} \frac{\pi_u}{\pi_t}\left(X_u - c_{s_0}\right) du \mid s_t\right], \quad s_t = \{R, E\} \tag{B.1}$$

where π_t is the discount factor; $\tau = min\left(\tau_D, \tau_U\right) = \tau_D \wedge \tau_U$ with τ_U and τ_D being the next refinancing and default times, respectively; η is the tax rate and c_{s_0} the optimal coupon rate. One financing period is the time lapse from today (time t) to the expected first time of the next refinancing or default event. $I^i_{s_0 s_t}$ can also be rewritten as follows:

$$I_{s_0 s_t} = \underbrace{E_t\left[\int_t^{\infty} \frac{\pi_u}{\pi_t}\left\{(1-\eta)\left(X_u - c_{s_0}\right)\right\} du \mid s_t\right]}_{Part\ 1} - \underbrace{E_t\left[\int_{\tau_D \wedge \tau_U}^{\infty} \frac{\pi_u}{\pi_t}\left\{(1-\eta)\left(X_u - c_{s_0}\right)\right\} du \mid s_t\right]}_{Part\ 2}$$

[24] The discount rates are computed following Proposition 5 (p. 660) of Bhamra et al. (2010b) and given in Section A.

$$I_{s_0 s_t} = \underbrace{A_{s_t} - (1-\eta)\frac{c_{s_0}}{r_{b,s_t}}}_{Part\ 1} - \underbrace{\left\{\sum_{s_D}\left[A_{s_D} - (1-\eta)\frac{c_{s_0}}{r_{b,s_D}}\right]\widetilde{q}_{D s_t s_D} + \sum_{s_U}\left[A_{s_U} - (1-\eta)\frac{c_{s_0}}{r_{b,s_U}}\right]\widetilde{q}_{U s_t s_U}\right\}}_{Part\ 2}$$

where $A_{s_t} = (1-\eta)\frac{X_t}{r_{a,s_t}}$ is the present value of expected future cash flow; r_{a,s_t} and r_{b,s_t} are the cash flow and coupon discount rates, respectively; $\widetilde{q}_{D s_t s_D}(X) = q_{D s_t s_D} 1_{\{X \leq X s_U\}}$ and $\widetilde{q}_{U s_t s_U}(X) = q_{U s_t s_U} 1_{\{X \geq X s_D\}}$ with $q_{D s_t s_D}$ and $q_{U s_t s_U}$ defined as in section C. $1_{\{A\}}$ is the indicator function of the event A. At the refinancing point and beyond, the option to default is worthless, i.e. $\widetilde{q}_{D s_t s_D}\left(X s_{U,s_t}\right) = 0$, and, at the default, the option to restructure is worthless when $\widetilde{q}_{U s_t s_U}(X s_D) = 0$. Here, $s_D, s_U = \{R, E\}$ are the states when default and refinancing may occur. Part 1 gives the present value of net income assuming no default or refinancing. Part 2 shows its hypothetical valuation from default onward on the left (refinancing onward on the right). Arrow-Debreu securities $\widetilde{q}_{D s_t s_D}$ and $\widetilde{q}_{U s_t s_U}$ represent the probability of occurrence of a default and a refinancing event. They evolve in opposite directions. Hence, subtracting Part 2 from Part 1 gives the present value of net income from now to a default or refinancing event.

The present value of net profit, $N_{s_0 s_t}$, is defined as the value over one cycle plus all future net cash flows at refinancing:

$$N_{s_0 s_t} = I_{s_0 s_t} + \sum_{s_U} N_{s_0 s_U}\widetilde{q}_{U s_t s_U}$$

From the first-order homogeneity property, $\frac{N_{s_0 s_U}}{N_{s_0 s_t}} = \frac{X_U}{X_0}$, we have:

$$N_{s_0 s_t} = I_{s_0 s_t} + N_{s_0 s_t}\sum_{s_U}\frac{X_U}{X_0}\widetilde{q}_{U s_t s_U},$$

where X_0 and X_U are, respectively the cash flow level at the initial financing time and refinancing. Let define $\Phi_{s_0 s_t}$ as the scaling factor that allows to obtain the total value of the claim to cash flow at any dates ($N_{s_0 s_t}$) from its value over one financing cycle ($I_{s_0 s_t}$), i.e. $N_{s_0 s_t} = \Phi_{s_0 s_t} I_{s_0 s_t}$. Hence, the scaling factor $\Phi_{s_0 s_t}$ is so that:

$$\Phi_{s_0 s_t} I_{s_0 s_t} = I_{s_0 s_t} + I_{s_0 s_t}\Phi_{s_0 s_t}\sum_{s_U}\frac{X_U}{X_0}\widetilde{q}_{U s_t s_U}$$

and

$$\Phi_{s_0 s_t} = \left(1 - \sum_{s_U} \frac{X_U}{X_0} \widetilde{q}_{U s_t s_U}\right)^{-1}. \tag{B.2}$$

B.2 Bond price

The present debt value, $B_{s_0 s_t}$, is the sum of the debt value during one cycle $b_{s_0 s_t}$ and the present value of the debt issue at par when the firm restructures its debt. The debt value during one cycle $b_{s_0 s_t}$ is the discounted coupon stream c_{s_0} before default plus the present value of the recovered firm asset liquidation value at default $(1-\xi)$, where ξ is the liquidation cost. The bond value is equal to

$$\begin{aligned} B_{s_0 s_t} &= b_{s_0 s_t} + E_t\left[B_{s_0 s_U}\right], \quad s_t = \{R, E\} \\ &= b_{s_0 s_t} + E_t\left[\Phi_{s_0 s_U} b_{s_0 s_U}\right] \\ &= b_{s_0 s_t} + \sum_{s_U} \Phi_{s_0 s_t} b_{s_0 s_t} \widetilde{q}_{U s_t s_U} \end{aligned}$$

where

$$\begin{aligned} b_{s_0 s_t} &= E_t\left[\int_t^{\tau} c_{s_0} \frac{\pi_u}{\pi_t} du \mid s_t\right] + E_t\left[\frac{\pi_{t_D}}{\pi_t} (1-\xi) A_{t_D} \mid s_t\right], \quad s_t = \{R, E\} \\ &= \frac{c_{s_0}}{r_{b,s_t}} - \sum_{s_U} \frac{c_{s_0}}{r_{b,s_U}} \widetilde{q}_{U s_t s_U} - \sum_{s_D} \frac{c_{s_0}}{r_{b,s_D}} \widetilde{q}_{D s_t s_D} + (1-\xi) \sum_{s_D} A_{s_D} \widetilde{q}_{D s_t s_D} \end{aligned}$$

and $A_{s_D} = (1-\eta) \frac{X_D}{r_{a,s_D}}$.

B.3 Equity risk premium

Firm i's equity premium, $RP_{s_0 s_t}$, for the current state $s_t = \{R, E\}$ is

$$RP^i_{s_0 s_t} = \rho \Theta^B_{s_t} \sigma^B_{s_t,i} + \lambda_{s_t} \Theta^P_{s_t} \sigma^P_{s_t,i}, \quad s_t = \{R, E\}$$

where $\sigma^B_{s_t,i} = \frac{X_t}{P^i_{s_0 s_t}} \frac{\partial P^i_{s_0 s_t}}{\partial X_t} \sigma^{sy}_{s_t}$ is the systematic volatility of stock returns caused by aggregate cash flow shocks, where $P_{s_0 s_t}$ represents the equity value and $\sigma^P_{s_t,i} = \frac{P^i_{s_0 j}}{P^i_{s_0 s_t}} - 1$, $s_t \neq j = \{R, E\}$ the volatility of stock returns caused by the change of state of the economy. Here, $\Theta^B_{s_t}$ and $\Theta^P_{s_t}$ represent the prices of risk due to Brownian shocks and the change in the economic conditions respectively. See Section A.

Asset pricing implication 2. *Let us assume that Firms 1 and 2 are identical except for their governance risk. s_0 is the financing state and is not necessarily the same for both firms. If Firm 1 has a greater change in governance risk in bad versus good times, that is* $Diff^1 = \kappa_R^1 - \kappa_E^1 > Diff^2 = \kappa_R^2 - \kappa_E^2$, *then* $RP^1_{s_0 s_t} > RP^2_{s_0 s_t}$ *for* $s_t = \{R, E\}$.

Proof of Asset pricing implication 2:

First, from Section 3.1, a firm cash flow expected growth is lower and more volatile in recession periods. That is $\mu_E > \mu_R$ and $\sigma^{sy}_{s_t}$ is countercyclical, so $\sigma^{sy}_R > \sigma^{sy}_E$. Hence, conditional to s_0, the present value of the net income is higher in expansion, $I_{s_0 E} > I_{s_0 R}$. Second, the present value of Arrow-Debreu restructuring claim is higher in expansion than in recession, hence

$$\underbrace{\sum_{s_U} \frac{X_U}{X_0} \widetilde{q}_{U,Es_U}}_{Expansion} \quad > \quad \underbrace{\sum_{s_U} \frac{X_U}{X_0} \widetilde{q}_{U,Rs_U}}_{Recession} \tag{B.3}$$

Multiplying both sides of equation B.3 by -1 then adding +1 gives

$$1 - \sum_{s_U} \frac{X_U}{X_0} \widetilde{q}_{U,Es_U} \quad < \quad 1 - \sum_{s_U} \frac{X_U}{X_0} \widetilde{q}_{U,Rs_U} \tag{B.4}$$

After taking the inverse of equation B.4, it comes $\Phi_{s_0 E} > \Phi_{s_0 R}$. In other words, the scaling factor is greater in the good state. This leads to $\Phi_{s_0 E} I_{s_0 E} > \Phi_{s_0 R} I_{s_0 R}$, because cash flow growth are higher in expansion $I_{s_0 E} > I_{s_0 R}$

$$\Phi_{s_0 E} I_{s_0 E} > \Phi_{s_0 R} I_{s_0 R}. \tag{B.5}$$

Equation B.5 tells us that, in case there is business cycles and no governance risk, a firm's stock price is higher in expansion periods. Now. assume two firms 1 and 2 are identical in every way except for their governance practices. Firms 1 and 2 have the same equity value in both states, in absence of governance risk. Hence, $\Phi^1_{s_0 E} I^1_{s_0 E} = \Phi^2_{s_0 E} I^2_{s_0 E}$ and $\Phi^1_{s_0 R} I^1_{s_0 R} = \Phi^2_{s_0 R} I^2_{s_0 R}$. It comes $P^1_{s_0 E} = P^2_{s_0 E}$, $P^1_{s_0 R} = P^2_{s_0 R}$, and $P^1_{s_0 E} > P^1_{s_0 R}$. Now, assume firms 1 and 2 have respectively pro- and countercyclical governance policies. This means firm 1 has higher governance risk in recession, $\kappa^1_R > \kappa^2_R$, and firm 2 has higher governance risk in bad times, $\kappa^1_E < \kappa^2_E$,

or also $Diff^1 = \kappa_R^1 - \kappa_E^1 > Diff^2 = \kappa_R^2 - \kappa_E^2$. From $\kappa_E^1 < \kappa_E^2$, $1 - \kappa_E^1 > 1 - \kappa_E^2$, then $\left(1 - \kappa_E^1\right) \Phi_{s_0E}^1 I_{s_0E}^1 > \left(1 - \kappa_E^2\right) \Phi_{s_0E}^2 I_{s_0E}^2$ so $P_{s_0E}^1 > P_{s_0E}^2 > 0$ ***(A),*** and $\kappa_R^1 > \kappa_R^2$ so $1-\kappa_R^1 < 1-\kappa_R^2$, then $\left(1 - \kappa_R^1\right) \Phi_{s_0R}^1 I_{s_0R}^1 < \left(1 - \kappa_R^2\right) \Phi_{s_0R}^2 I_{s_0R}^2$ and $0 < P_{s_0R}^1 < P_{s_0R}^2$ ***(B)***.
Multiplying ***(A)*** and the inverse of ***(B)***, $0 < \frac{P_{s_0E}^2}{P_{s_0R}^2} < \frac{P_{s_0E}^1}{P_{s_0R}^1} \Longrightarrow \sigma_R^{P,1} > \sigma_R^{P,2}$. Because $\Theta_l^P = 1 - \Delta_R > 0$ (from Section A, $\Delta_E > 1$ and $\Delta_R = 1/\Delta_E$) and $\lambda_R > 0 \Longrightarrow \lambda_R \Theta_R^P \sigma_R^{P,1} > \lambda_R \Theta_R^P \sigma_R^{P,2}$.
In expansion, $0 < \frac{P_{s_0R}^1}{P_{s_0E}^1} < \frac{P_{s_0R}^2}{P_{s_0E}^2} \Longrightarrow \sigma_E^{P,1} < \sigma_E^{P,2}$. Because $\Theta_E^P = 1 - \Delta_E < 0$ and $\lambda_E > 0 \Longrightarrow \lambda_E \Theta_E^P \sigma_E^{P,1} > \lambda_E \Theta_E^P \sigma_E^{P,2}$. Hence, the compensation for business cycle risk is higher for the firm with greater $Diff$.
Moreover, we have, $\sigma_{s_t}^{B,1} = \frac{X_t}{(1-\kappa_{s_t}^1)\Phi_{s_0 s_t} I_{s_0 s_t}} \frac{\partial\left[\left(1-\kappa_{s_t}^1\right)\Phi_{s_0 s_t} I_{s_0 s_t}\right]}{\partial X_t} \sigma_{s_t}^{sy} = \frac{X_t}{\Phi_{s_0 s_t} I_{s_0 s_t}} \frac{\partial\left(\Phi_{s_0 s_t} I_{s_0 s_t}\right)}{\partial X_t} \sigma_{s_t}^{sy}$ because κ_{s_t} is assumed independent from cash flow X_t.
Similarly, $\sigma_{s_t}^{B,2} = \frac{X_t}{(1-\kappa_{s_t}^2)\Phi_{s_0 s_t} I_{s_0 s_t}} \frac{\partial\left[\left(1-\kappa_{s_t}^2\right)\Phi_{s_0 s_t} I_{s_0 s_t}\right]}{\partial X_t} \sigma_{s_t}^{sy} = \frac{X_t}{\Phi_{s_0 s_t} I_{s_0 s_t}} \frac{\partial\left(\Phi_{s_0 s_t} I_{s_0 s_t}\right)}{\partial X_t} \sigma_{s_t}^{sy}$, leading to $\sigma_{s_t}^{B,1} = \sigma_{s_t}^{B,2}$. Next, $\Theta_{s_t}^{B,1} = \Theta_{s_t}^{B,2} = \gamma \sigma_{s_t}$, so $\rho \Theta_{s_t}^{B,1} \sigma_{s_t}^{B,1} = \rho \Theta_{s_t}^{B,2} \sigma_{s_t}^{B,2}$. So, the compensation for C-CAPM is same for both firms.
In total, if $Diff^1 = \kappa_R^1 - \kappa_E^1 > Diff^2 = \kappa_R^2 - \kappa_E^2$ *then* $RP_{s_0 s_t}^1 > RP_{s_0 s_t}^2$ *for* $s_t = \{R, E\}$. Hence, the component of the risk premium that comes from the business cycle risk (i.e. unpredictable changes in economic conditions) drives the cross-sectional differences in risk premium.

C Arrow-Debreu default claims

This appendix derives the two kinds of Arrow-Debreu claims that are used to value the cash flow. The first kind captures the default triggered by a firm's cash flow falling below the default boundary, whereas the second kind accounts additionally for the default related to a change in the state of the economy. In the second case, default can occur instantaneously due to a change in state, although the firm's cash flow remains unchanged. This situation can occur when the economy is in a good ($s_t = E$) and switches to a bad state ($s_t = R$), and when the firm's cash flow is above the good state's default boundary but below the bad state's default boundary since the default boundary is countercyclical ($X_{D,R} > X_{D,E}$). The first kind of the Arrow-Debreu claims is defined as

$$q_{D,s_t s_D} = E_t \left[\frac{\pi_{t_D}}{\pi_t} Prob\left(s_D \mid s_t\right) \mid s_t \right], \tag{C.1}$$

while the second kind corresponds to

$$q'_{D,s_t s_D} = E_t\left[\frac{\pi_{t_D}}{\pi_t}\frac{X_{t_D}}{X_{s_t}} Prob\left(s_D \mid s_t\right) \mid s_t\right]. \tag{C.2}$$

C.1 First kind

The Arrow-Debreu default security $q_{s_t s_D}$ is the present time t value of a security that pays one unit of consumption at the moment of default t_D, where s_t represents the present state of the economy, and s_D the state at the time of default. The time of default is the first time that the cash flow level of the firm falls to the boundary X_{D,s_D}. By definition, this Arrow-Debreu claim is given by

$$q_{D,s_t s_D} = E_t\left[\frac{\pi_{t_D}}{\pi_t} Prob\left(s_D \mid s_t\right) \mid s_t\right], \tag{C.3}$$

which is solution of the two ordinary differential equations (ODEs)

$$\frac{1}{2}\sigma^2_{X,s_t} X^2 \frac{d^2 q_{D,s_t s_D}}{dX^2} + \mu_{s_t} X \frac{d q_{D,s_t s_D}}{dX} \quad + \hat{\lambda}_{s_t}\left(q_{j s_D} - q_{s_t s_D}\right) - r_{s_t} q_{s_t s_D} \quad = 0,\ s_t = \{R, E\},$$

where $\sigma_{x,s_t} = \sqrt{\left(\sigma^{sp}\right)^2 + \left(\sigma^{sy}_{s_t}\right)^2}$ denotes the total volatility of cash flow in state s_t.
The above ODEs are obtained by applying Ito's Lemma to the classical non-arbitrage condition

$$E^Q_t\left[dq_{D,s_t s_D} - r_{s_t} q_{D,s_t s_D}\right] = 0,$$

The Arrow-Debreu claim payoffs are such that:

$$q_{D,s_t s_D}(X) = \begin{cases} 1, & s_t = s_D, \quad X \leq X_{D,s_t} \\ 0, & s_t \neq s_D, \quad X \leq X_{D,s_t}. \end{cases}, \quad s_t, s_D = \{R, E\}$$

Therefore, each state of the economy is characterized by a specific default boundary. The default barriers are higher in recession and lower in expansion, i.e, $X_{D,E} \leq X_{D,R}$. Each of the four Arrow-Debreu claims is then determined over three separate intervals: $X \geq X_{D,R}$, $X_{D,R} \geq X \geq X_{D,E}$ and $X \leq X_{D,E}$.

From the payoff equations, it is possible to infer the values of the four Arrow-Debreu claims in the interval $X \leq X_{D,E}$. For the interval $X \geq X_{D,R}$, assuming a solution that follows the general form:

$$q_{D,s_t s_D}(X) = h_{s_t s_D} X^k$$

implies that k must be a root of the quartic equation

$$\left[\frac{1}{2}\sigma_{X,E}^2 k(k-1) + \mu_R k + \left(-\hat{\lambda}_R - r_R\right)\right]\left[\frac{1}{2}\sigma_{X,E}^2 k(k-1) + \mu_E k + \left(-\hat{\lambda}_E - r_E\right)\right] - \hat{\lambda}_R\hat{\lambda}_E = 0.$$

The Arrow-Debreu claims can be written as

$$q_{D,s_t s_D}(X) = \sum_{m=1}^{4} h_{s_t s_D m} X^{k_m}$$

with $k_1, k_2 < 0$ and $k_3, k_4 > 0$. However, when X goes to infinity the Arrow-Debreu claims must be zero, which indicates that $h_{s_t s_D,3} = h_{s_t s_D,4} = 0$. Hence,

$$\begin{aligned} q_{D,Rs_D}(Y) &= \sum_{m=1}^{2} h_{Rs_D,m} X^{k_m} \\ q_{D,Es_D}(Y) &= \sum_{m=1}^{2} h_{Es_D,m}\varepsilon(k_m) X^{k_m}, \end{aligned}$$

where

$$\varepsilon(k_m) = -\frac{\hat{\lambda}_H}{\frac{1}{2}\sigma_{X,H}^2 k(k-1) + \mu_E k - \left(\hat{\lambda}_E + r_E\right)} = -\frac{\frac{1}{2}\sigma_{X,R}^2 k(k-1) + \mu_R k - \left(\hat{\lambda}_R + r_R\right)}{\hat{\lambda}_R}.$$

Finally, over the interval $X_{D,R} \geq X \geq X_{D,E}$, both $q_{D,RR}$ and $q_{D,RE}$ are known from the payoffs equations and are respectively equal to 1 and 0, respectively. Then,

$$\begin{aligned} q_{D,ER}(X) &= \frac{\hat{\lambda}_E}{r_E + \hat{\lambda}_E} + \sum_{m=1}^{2} s_{R,m} X^{j_m} \\ q_{D,EE}(X) &= \sum_{m=1}^{2} s_{E,m} X^{j_m}, \end{aligned}$$

where

$$\frac{1}{2}\sigma_{X,E}^2 j(j-1) + \mu_R j - \left(\hat{\lambda}_E + r_E\right) = 0$$

for $j_1 < j_2$.

To summarize, the four Arrow-Debreu claims can be written as follows

$$
q_{D,RR} = \begin{cases} \sum_{m=1}^{2} h_{RR,m} X^{k_m}, & X \geq X_{D,R} \\ 1, & X_{D,R} \geq X \geq X_{D,E} \\ 1, & X \leq X_{D,E} \end{cases}
$$

$$
q_{D,RE} = \begin{cases} \sum_{m=1}^{2} h_{RE,m} X^{k_m}, & X \geq X_{D,E} \\ 0, & X_{D,R} \geq X \geq X_{D,E} \\ 0, & X \leq X_{D,E} \end{cases}
$$

$$
q_{D,ER} = \begin{cases} \sum_{m=1}^{2} h_{RR,m} \varepsilon(k_m) X^{k_m}, & X \geq X_{D,R} \\ \frac{\hat{\lambda}_E}{r_E + \hat{\lambda}_E} + \sum_{m=1}^{2} s_{R,m} X^{j_m}, & X_{D,R} \geq X \geq X_{D,E} \\ 0, & X \leq X_{D,E} \end{cases}
$$

$$
q_{D,EE} = \begin{cases} \sum_{m=1}^{2} h_{RE,m} \varepsilon(k_m) X^{k_m}, & X \geq X_{D,R} \\ \sum_{m=1}^{2} s_{E,m} X^{j_m}, & X_{D,R} \geq X \geq X_{D,E} \\ 1, & X \leq X_{D,E}. \end{cases}
$$

The eight constants are determined by eight boundary conditions, which are

$$
\lim_{X \to X_{D,R}} q_{D,EE} = 1, \quad \lim_{X \to X_{D,R}} q_{D,RE} = 0
$$

$$
\lim_{X \to X_{D,R}^{+}} q_{D,ER} = \lim_{X \to X_{D,R}^{-}} q_{D,ER}, \quad \lim_{X \to X_{D,R}^{+}} q_{D,EE} = \lim_{X \to X_{D,R}^{-}} q_{D,EE}
$$

$$
\lim_{X \to X_{D,R}^{+}} \dot{q}_{D,ER} = \lim_{X \to X_{D,R}^{-}} \dot{q}_{D,ER}, \quad \lim_{X \to X_{D,R}^{+}} \dot{q}_{EE} = \lim_{X \to X_{D,R}^{-}} \dot{q}_{D,EE}
$$

$$
\lim_{X \to X_{D,E}} q_{D,ER} = 0, \quad \lim_{X \to X_{D,E}} q_{D,EE} = 1.
$$

C.2 Second kind

The same approach is used to derive the second kind of Arrow-Debreu default claims, which accounts for the possibility that a default can occur when the state of the economy changes. The only claim that is different from that of the first kind is $q_{D,ER}$, whose expression is now given by

$$q'_{D,ER} = \begin{cases} \sum_{m=1}^{2} h_{RR,m} \varepsilon\left(k_m\right) X^{k_m}, & X \geq X_{D,R} \\ \frac{\hat{\lambda}_E}{r_E + \hat{\lambda}_E - \mu_E} \frac{X}{X_{D,R}} + \sum_{m=1}^{2} s_{R,m} X^{j_m}, & X_{D,R} \geq X \geq X_{D,E} \\ 0, & X \leq X_{D,E}. \end{cases}$$

D Arrow-Debreu refinancing claims

The first kind captures the refinancing triggered by the a firm's cash flow reaching an upper boundary, whereas the second kind accounts additionally for the refinancing due to a change in the state of the economy. In the second case, a firm restructures instantaneously due to a change, in state although the firm's cash flow remains unchanged. This situation can occur when the economy is good ($s_t = E$) and switches to a bad state ($s_D = R$) and when the firm's cash flow is above the good state's refinancing level but below the bad state's default boundary since the default boundary is countercyclical ($X_{U,R} > X_{U,E}$). The first kind of the Arrow-Debreu refinancing claims is defined as

$$q_{U,s_t s_U} \quad = \quad E_t \left[\frac{\pi_{\tau_U}}{\pi_t} Prob\left(s_U \mid s_t\right) \mid s_t \right], \tag{D.1}$$

while the second kind corresponds to

$$q'_{U,s_t s_U} \quad = \quad E_t \left[\frac{\pi_{\tau_U}}{\pi_t} \frac{X_{\tau_U}}{X_{U,s_t}} Prob\left(s_D \mid s_t\right) \mid s_t \right]. \tag{D.2}$$

D.1 First kind

The Arrow-Debreu refinancing security $q_{U,s_t s_U}$ is the present time t value of a security that pays one unit of consumption at the moment of default τ_U, where s_t represents the present state of the economy, and s_U represents the state at the time of default. The time of default is the first time that the cash flow level of the firm falls to the boundary X_{U,s_U}. By definition, this Arrow-Debreu claim is given by

$$q_{U,s_t s_U} \quad = \quad E_t^Q \left[\frac{\pi_{\tau_U}}{\pi_t} Prob\left(s_U \mid s_t\right) \mid s_t \right],$$

which is solution of the two ordinary differential equations (ODE)

$$\frac{1}{2}\sigma_{X,s_t}^2 X^2 \frac{d^2 q_{U,s_t s_U}}{dX^2} + \mu_{s_t} X \frac{d q_{U,s_t s_U}}{dX} \quad + \hat{\lambda}_{s_t}\left(q_{U,j s_U} - q_{U,s_t s_U}\right) - r_{s_t} q_{U,s_t s_U} \quad = 0,\ s_t = \{R, E\},$$

where $\sigma_{X,s_t} = \sqrt{(\sigma^{sp})^2 + \left(\sigma_{s_t}^{sy}\right)^2}$ denotes the total volatility of cash flow in state s_t.

The above ODEs are obtained by applying Ito's Lemma to the classical non-arbitrage condition

$$E_t^Q \left[dq_{U,s_t s_U} - r_{s_t} q_{U,s_t s_U} \right] = 0,$$

The Arrow-Debreu refinancing claim payoffs are such that:

$$q_{U,s_t s_U}(X) = \begin{cases} 1, & s_t = s_U, \quad X \leq X_{U,s_t} \\ 0, & s_t \neq s_U, \quad X \leq X_{U,s_t}. \end{cases}, \quad s_t, s_U = \{R, E\} \tag{D.3}$$

Therefore, each state of the economy is characterized by a specific default boundary. The default barriers are higher in recession and lower in expansion, i.e., $X_{U,E} \leq X_{U,R}$. Each of the four Arrow-Debreu claims is then determined over three separate intervals: $X \geq X_{U,R}$, $X_{U,R} \geq X \geq X_{U,E}$, and $X \leq X_{U,E}$.

From the payoff equations, the values of the four Arrow-Debreu claims can be inferred in the interval $X \leq X_{D,E}$. For the interval $X \geq X_{D,R}$, assume a solution that follows the general form:

$$q_{U,s_t s_D}(X) = h_{s_t s_D} X^k,$$

which implies that k must be a root of the quartic equation

$$\left[\frac{1}{2}\sigma_{X,E}^2 k(k-1) + \mu_R k + \left(-\hat{\lambda}_R - r_R\right)\right]\left[\frac{1}{2}\sigma_{X,E}^2 k(k-1) + \mu_E k + \left(-\hat{\lambda}_E - r_E\right)\right] - \hat{\lambda}_R \hat{\lambda}_E = 0.$$

The Arrow-debreu claims can be written as

$$q_{U,s_t s_D}(X) = \sum_{m=1}^{4} h_{s_t s_D m} X^{k_m}$$

with $k_1, k_2 < 0$ and $k_3, k_4 > 0$. However, when X goes to infinity the Arrow-Debreu claims must be zero, which indicates that $h_{s_t s_D,3} = h_{s_t s_D,4} = 0$. Hence,

$$\begin{aligned} q_{U,Rs_D}(X) &= \sum_{m=1}^{2} h_{Rs_D,m} X^{k_m} \\ q_{U,Es_D}(X) &= \sum_{m=1}^{2} h_{Es_D,m} \varepsilon(k_m) X^{k_m}, \end{aligned}$$

where

$$\varepsilon\left(k_m\right) = -\frac{\hat{\lambda}_H}{\frac{1}{2}\sigma_{X,H}^2 k\left(k-1\right) + \mu_E k - \left(\hat{\lambda}_E + r_E\right)} = -\frac{\frac{1}{2}\sigma_{X,R}^2 k\left(k-1\right) + \mu_R k - \left(\hat{\lambda}_R + r_R\right)}{\hat{\lambda}_R}.$$

Finally, over the interval $X_{D,R} \geq X \geq X_{D,E}$, both $q_{D,RR}$ and $q_{D,RE}$ are known from the payoffs equations and are respectively equal to 1 and 0, respectively. Then

$$\begin{aligned} q_{U,ER}\left(X\right) &= \frac{\hat{\lambda}_E}{r_E + \hat{\lambda}_E} + \sum_{m=1}^{2} s_{R,m} X^{j_m} \\ q_{U,EE}\left(X\right) &= \sum_{m=1}^{2} s_{E,m} X^{j_m}, \end{aligned}$$

where

$$\frac{1}{2}\sigma_{X,E}^2 j\left(j-1\right) + \mu_R j - \left(\hat{\lambda}_E + r_E\right) = 0$$

with $j_1 < j_2$.

To summarize, the four Arrow-Debreu claims can be written as follows

$$q_{U,RR} = \begin{cases} 1, & X \geq X_{U,R} \\ \sum_{m=1}^{2} s_{R,m} X^{j_m}, & X_{U,R} \geq X \geq X_{U,E} \\ \sum_{m=1}^{2} h_{RR,m} X^{k_m}, & X \leq X_{U,E} \end{cases}$$

$$q_{U,RE} = \begin{cases} 0, & X \geq X_{U,E} \\ \frac{\hat{\lambda}_R}{r_R + \hat{\lambda}_R} + \sum_{m=1}^{2} s_{E,m} X^{j_m}, & X_{U,R} \geq X \geq X_{U,E} \\ \sum_{m=1}^{2} h_{RE,m} X^{k_m}, & X \leq X_{U,E} \end{cases}$$

$$q_{U,ER} = \begin{cases} 0, & X \geq X_{U,R} \\ 0, & X_{U,R} \geq X \geq X_{U,E} \\ \sum_{m=1}^{2} h_{RR,m} \varepsilon\left(k_m\right) X^{k_m}, & X \leq X_{U,E} \end{cases}$$

$$q_{U,EE} = \begin{cases} 1, & X \geq X_{U,R} \\ 1, & X_{U,R} \geq X \geq X_{U,E} \\ \sum_{m=1}^{2} h_{RE,m} \varepsilon\left(k_m\right) X^{k_m}, & X \leq X_{U,E}. \end{cases}$$

The eight constants are determined by eight boundary conditions, which are

$$\lim_{X \to X_{D,R}} q_{U,EE} = 1, \quad \lim_{X \to X_{D,R}} q_{U,RE} = 0$$

$$\lim_{X \to X_{D,R}^+} q_{U,ER} = \lim_{X \to X_{D,R}^-} q_{U,ER}, \quad \lim_{X \to X_{D,R}^+} q_{U,EE} = \lim_{X \to X_{D,R}^-} q_{U,EE}$$

$$\lim_{X \to X_{D,R}^+} \dot{q}_{U,ER} = \lim_{X \to X_{D,R}^-} \dot{q}_{U,ER}, \quad \lim_{X \to X_{D,R}^+} \dot{q}_{U,EE} = \lim_{X \to X_{D,R}^-} \dot{q}_{U,EE}$$

$$\lim_{X \to X_{D,E}} q_{U,ER} = 0, \quad \lim_{X \to X_{D,E}} q_{U,EE} = 1.$$

D.2 Second kind

The same approach is used to derive the second kind of Arrow-Debreu refinancing claim, which accounts for the possibility that a default can when the state of the economy changes. The only claim that is different from that of the first kind is q_{ER}, whose expression is now given by

$$q^{\cdot}_{U,RE} = \begin{cases} 0, & X \geq X_{U,E} \\ \frac{\hat{\lambda}_R}{r_R + \hat{\lambda}_R} + \sum_{m=1}^{2} s_{E,m} X^{j_m}, & X_{U,R} \geq X \geq X_{U,E} \\ \sum_{m=1}^{2} h_{RE,m} X^{k_m}, & X \leq X_{U,E} \end{cases}$$