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Do country risk factors attenuate the effect of taxes on corporate risk-taking?

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Do country risk factors attenuate the effect of taxes on corporate risk-taking?

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Do country risk factors attenuate the effect of taxes on corporate risk-taking?

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Do country risk factors attenuate the effect of taxes on corporate risk-taking?

Abstract

This study examines whether country-specific risk attenuates the association between tax policies and corporate risk-taking. We define country-specific risk (political and fiscal budget risk) as taxpayer's risk that tax refunds on losses cannot be paid due to the institutional environment or fiscal reasons. We exploit a cross-country panel with 234 changes in corporate tax rates and 49 changes in loss offset rules. We investigate whether government risk-sharing via loss offset rules and tax rates affects risk-taking conditional on country risk. We also examine whether tax rate changes, that scale the risk-sharing effect, influence the propensity to conduct risky projects in different country-level risk environments. Our results suggest that country-level risk fully attenuates the previously documented association between tax policies and corporate risk-taking. It attenuates both the effectiveness of loss offset rules and tax rate changes on corporate risk-taking. While changes in tax policy are attractive to policymakers because alternative instruments to encourage risk-taking cannot as easily be adjusted, we provide significant evidence that country risk considerably limits policymakers' ability to induce firm risk-taking via changes in tax policies.

Keywords: Corporate risk-taking; country risk; cross-country study; fiscal risk; risky investments

JEL classification: H25, H32, G32

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1. Introduction

This study investigates whether country-specific risk mitigates the effectiveness of tax policy changes that aim to encourage corporate risk-taking. Corporate risk-taking, reportedly “depend[s] on country-specific circumstances [and] policy and institutional risk factors ...” (IMF 2017). Tax loss offset regimes as one feature of such country-specific circumstances are commonly used as a tax policy device to encourage corporate risk-taking and investment because they allow taxpayers to offset tax losses and thereby either reduce tax payments or receive tax refunds. Tax loss offsets are attractive to policymakers because alternative instruments that aim to encourage corporate risk-taking cannot as easily be adjusted. For example, governance institutions and the administrative environment are difficult to change quickly and thus are relatively stable over time (John, Litov, and Yeung 2008; Dharmapala and Hines 2009).

Corporate risk-taking is associated with economic growth (Djankov, Ganser, McLiesh, Ramalho, Shleifer 2010; Giambona, Graham, and Harvey 2017; UNCTAD 2016). For example, John et al. (2008) estimate that a one standard deviation increase in corporate risk-taking is associated with a 4.2% to 33.2% increase in real GDP per capita from its mean (p. 1715 and p. 1721). Corporate tax rate cuts and comprehensive loss offset rules trigger additional risk-taking by firms because these favorable tax rules decrease the cost of investing in risky projects (IMF 2017, p.7).

The effectiveness of such tax policy changes potentially depends on country-specific risk factors which may prevent that tax losses ultimately lead to lower taxes on profits or tax refunds. In this respect, we distinguish between *political* and *fiscal budget risk* and investigate

theoretically and empirically the effect of *political* and *fiscal budget risk* counteracting the tax incentive from loss offset provisions. These two types of country risk are crucial for loss offset provisions to effectively encourage risk-taking because they determine whether tax refunds are viable. Firms will only alter their behavior as a result of such tax policy changes if they can reasonably expect to receive timely tax refunds. Therefore, we investigate how these two types of country risk affect the ability of taxation (tax rate and loss offset changes) to encourage corporate risk-taking.

First, we define *political risk* to capture overall country governance and the rule of law. Both create the institutional environment to administer the process of collecting taxes on profits and refunding taxes on losses. Countries with low *political risk* are characterized by high institutional quality to implement and administer tax policy efficiently (Kaufmann, Kraay, and Mastruzzi 2011; Vegh and Vuletin 2015) and payout tax refunds reliably. These countries are expected to provide timely tax refunds. They credibly commit not to expropriate companies through unfavorable regulation and to refund taxes quickly while countries with low institutional quality (high *political risk*) do not (Dharmapala and Hines 2009). For example, Donnelley (2017) describes how institutional inefficiencies (*political risk*) in South Africa systematically delayed tax refunds to taxpayers. The delay was caused by the South African tax authority and led companies to hold back liquid funds that otherwise would have been available for investments. These tax refund delays caused firms to question the timing and amount of any future refunds (Khumalo 2017; PWC 2018).

Second, we consider *fiscal budget risk*. Fiscal budget risk arises when governments face liquidity constraints (high debt ratios or low credit ratings) that reduce their ability to pay tax refunds for firms' losses. Fiscal budget constraints can lead tax administrators to withhold tax

refunds. Anecdotal evidence supports the notion that firms are aware of and concerned about *fiscal budget risk*. This type of country risk is not only existent in countries with a relatively low level of governance such as Pakistan and Ukraine (IMF 2016; Daily Times 2017) but also in countries like the U.S. where companies expressed concerns about receiving timely tax refunds during and after recent government shutdowns, consistent with *fiscal budget risk* (Parlapiano and Yourish 2018).

Two streams of research motivate our paper. First, Domar and Musgrave (1944) demonstrate that risk-averse investors increase risk-taking when governments share corporate risks through comprehensive loss offset provisions and the underlying tax rate (Domar-Musgrave effect). Domar and Musgrave predict, that under loss offset restrictions tax rate increases (decreases) above a critical tax rate level are expected to discourage (encourage) risk-taking. Recent empirical studies provide some evidence that firms share risk with the government through the corporate tax system (Langenmayr and Lester 2018; Ljungqvist, Zhang, and Zou 2017). However, prior literature only finds a negative association between tax rate *increases* and risk-taking, but not corresponding effects for tax rate cuts. This asymmetry in risk-taking responses to tax rate cuts and increases is inconsistent with Domar and Musgrave's theory. One potential explanation for this inconsistency is that country-level risk factors are in play that affect the critical tax rate and thus provide scope for no or even reversed tax effects.¹ Although country-specific risk factors can add risk to investments, prior studies either disregard country risk factors completely or only control for political risks. The second stream of literature documents that country risk factors matter in business decisions. These studies provide evidence for negative effects of country risk factors on investment, financing and capital structure

¹ Specifically, prior studies use a project risk proxy that does not capture all types of risk that affect risk-taking decisions such as country risk.

decisions, as well as risk-taking (Busse and Hefeker 2007; Dharmapala and Hines 2009; Graham and Harvey 2001; Desai, Foley, and Hines 2008; de Jong, Kabir, and Nguyen 2008; John et al. 2008).

Against the background of inconclusive findings of prior empirical literature, we develop an analytical model that describes the interactive effect of country risk and changes in tax rates and loss offsets.² This model and our illustrations yield three predictions. First, country risk factors reduce the effectiveness of loss offset provisions to induce risk-taking. Second, in the presence of country risk, it is more likely that a tax rate increase discourages risk-taking than in absence of country risk. Specifically, our model predicts that the critical tax rate that neutralizes the risk sharing mechanism is much lower in countries that are characterized by a high risk level. Third, this effect is scaled by the underlying corporate tax rate.

We empirically test our predictions by exploiting 51 increases and 183 decreases in corporate tax rates and 49 changes in loss offset provisions affecting 25,906 firms from 1992 to 2012 across 64 countries. Consistent with prior literature (John et al. 2008; Langenmayr and Lester 2018), we use the standard deviation of the firm's return on assets (*ROA*) from the industry-country average *ROA* to measure risk-taking. This removes potential effects of macroeconomic cycles and allows us to isolate firm-specific risk-taking responses to changes in tax rates and loss offsets.

We first validate prior research and find a positive association between changes in loss offset provisions and corporate risk-taking. Next, we provide evidence that country risk factors attenuate the association between these changes in loss offset provisions and corporate risk-

² We document that country risk factors provide one explanation for the inconclusive findings of prior literature within the Domar-Musgrave framework. However, further or alternative potential explanations provide the findings in prospect (Kahneman and Tversky 1979) and salience theoretical analyses (Bordalo, Gennaioli, and Shleifer 2012), which should be scrutinized empirically in future research.

taking. Specifically, we find that high *political risk* attenuates that association between these changes in loss offset rules and corporate risk-taking. To put our findings in perspective: the adoption of a loss carryback regime in countries with *political risk* below the median (e.g., Spain) is associated with a 13.8 percent *increase* in corporate risk-taking while a carryback rule adoption in countries above the median (e.g., Mexico) does not significantly increase risk-taking.

We also find that high *fiscal budget risk* (high government debt to GDP ratios) fully attenuates the association between changes in loss offset rules and corporate risk-taking. This negative impact on the effectiveness is of similar magnitude as *political risk*. Overall, our findings indicate that loss carrybacks in such high-risk countries are not an effective tool to foster corporate risk-taking.

Second, our theoretical model predicts that tax rate increases discourage risk-taking in environments with high country risk. Our empirical results confirm this prediction for both country risk factors and indicate a more pronounced negative impact of *fiscal budget risk*. Lastly, we test our third prediction that tax rates scale the effect of country risk. Consistent with our predictions, we find that the negative effect of country risk is more pronounced in countries with high corporate tax rates compared to countries with low tax rates. This finding validates our theoretical model and is in line with our extended Domar-Musgrave framework that predicts a more pronounced negative effect of country risk in the presence of a high corporate tax rate.

We perform several robustness tests to examine the sensitivity of our results and mitigate endogeneity concerns. While our cross-country study incorporates a large number of tax “shocks” with large tax rate changes, we assume comparable economic development and cycles between treated firms and their controls in different countries (e.g., comparable economic development and economic cycle). To mitigate these concerns, we use three approaches. First,

we use OLS and changes designs that limit counterfactuals to firms that face similar economic environments.³ Specifically, we limit counterfactuals to a group of firm observations in countries that have similar GDP growth rates and development levels. Second, we use several different specifications with fixed effects and a country-industry adjusted risk measure to remove confounding effects from time-invariant country-level conditions or policies. Third, further tests with alternative risk measures, different subsamples and placebo reforms support our findings.

Our study contributes to research that investigates the effects of tax policy on corporate risk-taking (Langenmayr and Lester 2018; Ljungqvist et al. 2017) and investment (Djankov et al. 2010; Edgerton 2010; Dobridge 2016; Bethmann, Jacob, Müller 2018; Zwick and Mahon 2017). Specifically, we provide theoretical and empirical evidence that the effect of loss offset rules and changes in corporate tax rates on corporate risk-taking are contingent on the inherent country risk factors. We demonstrate that the negative effect of country risk factors is more pronounced for tax rate increases in countries with a high corporate tax rate. This helps reconcile results in prior literature (Ljungqvist et al. 2017) that documents asymmetric effects of tax rate increases and decreases in corporate risk-taking but abstract from a detailed analysis of country risk factors.

Further, we extend the literature on the negative effects of country risk on corporate risk-taking (John et al. 2008; Djankov et al. 2010; Vegh and Vuletin 2015). We are the first to document that the effectiveness of tax policy to foster investment and risk-taking crucially depends on fiscal budget constraints. This finding extends prior literature that only considers the importance of political risk factors, such as the quality of institutions (Dharmapala and Hines 2009). Our results indicate that the negative effect of *both* country risk factors is economically

³ See section 4.4 for further details that specifically limit the counterfactuals. Univariate tests indicate a correlation of -0.259 for our aggregated political risk and fiscal budget risk measures. To mitigate potential endogeneity concerns we control for other macroeconomic developments and risk factors that potentially affect our results (GDP growth, inflation) in all regressions.

significant and thus considerably limit the effectiveness of tax policy changes. While changes in tax policy are attractive to policymakers because alternative instruments to encourage risk-taking cannot as easily be adjusted, our findings suggest that changes in loss offset rules are less effective or even completely ineffective to induce risk-taking if countries face fiscal budget risk.

Our paper proceeds as follows. In section 2, we provide an overview of corporate tax loss rules, present our theoretical model of how taxes and country risk affect risk-taking and derive our hypotheses. In section 3, we present our empirical setup and data. Section 4 presents detailed results followed by the conclusion in section 5.

2. Background and hypotheses development

2.1 Corporate tax rates and loss offset rules as policy instruments

Two major characteristics of tax systems that affect corporate risk-taking are the tax rate and loss offset rules (Bethmann et al. 2018; Langenmayr and Lester 2018). The tax rate is the percentage of corporations' income that is owed to or refunded by the government. Prior literature indicates that firms decrease risk-taking in response to tax rate increases but do not respond to tax rate cuts (Ljungqvist et al. 2017). Loss offset rules that allow firms to carry losses forward and backward recoup (a portion of) their losses in the case of losses. For a loss carryback (LCB), firms that experience a net operating loss (NOL) receive a refund in the current year for taxes paid in previous years, providing an immediate cash inflow. For a loss carryforward (LCF), firms can offset future taxable income with NOLs.

In contrast to loss carrybacks, loss carryforwards comprise the option but not a guarantee to receive a tax reduction in the future. Empirical research provides evidence that half of the accumulated tax value of loss carryforwards erodes because of loss offset restrictions and

insufficient profits in future to offset (Cooper and Knittel 2006, Edgerton 2010). While firms prefer carrybacks because of the immediate cash inflow effect, governments suffer from an immediate negative cash flow effect. Tax refunds amplify the negative budgetary effects for governments, i.e., decreasing tax revenues that arise from macroeconomic crises (Dwenger 2008; Dobridge 2016).

2.2 Theoretical model

The seminal paper by Domar and Musgrave (1944) lays the theoretical foundation that explains the effect of taxation on risk-taking of investors.⁴ They model an investor who “weigh[s] the advantage of a greater return or yield, against the disadvantage of a possible loss or risk” (Domar and Musgrave 1944, p. 388). Generally, taxes reduce yields and thus discourage investments of a risk-averse investor. However, the authors demonstrate under a complete loss offset that the government’s “share-in” can increase risk-taking of risk-averse investors. If risk-averse investors maximize their expected utility they attribute a higher weight to the increase in utility from an expected tax refund on losses than disutility to the expected tax burden on profits. The size of this effect is driven by three factors: the tax rate (the higher the tax rate the more pronounced is this sharing effect), the degree of risk aversion, and the extent of loss offset provisions. However, in the case of absent or limited loss offset possibilities, taxes cause the investor to reduce risk-taking once taxes are imposed. Because of these two opposing effects, the overall effect is either positive or negative.

<Insert Figure 1 about here>

⁴ Prior literature identifies several determinants of corporate risk-taking. These include corporate governance (John et al. 2008), creditor rights (Acharya, Amihud, and Litov 2011), inside debt (Choy, Lin, and Officer 2014), managerial incentives (May 1995; Rajgopal and Shevlin 2002), shareholder diversification (Faccio, Marchica, and Mura 2011), and regulatory acts (Bargeron, Lehn, and Zutter 2010). We focus on the effect of taxes on corporate risk-taking but control for these findings in our regression model.

As illustrated in Figure 1, the Domar and Musgrave findings indicate that risk-taking (σ) increases in the extent of loss offset (λ) for a given tax rate (t). However, under a given limited loss offset rule it is more likely that this effect reverses for a high tax rate. If the tax rate exceeds a critical threshold then the investors will actually decrease risk-taking for a given level of loss offset.

To illustrate the forces at work both without and with country risk we develop the model stepwise. In a first step, we abstract from country risk. Consistent with prior literature (Domar and Musgrave 1944, Atkinson and Stiglitz 1980, Langenmayer and Lester 2018), we assume a firm that aims to invest a fixed amount I chooses the level of risk (σ) involved. With probability p the invested amount I generates a profit given by the function $f_g(\sigma)$ with $f_g(\sigma) > 0$ (good state of nature), with probability $(1 - p)$ a loss of $f_b(\sigma) < 0$ is incurred (bad state of nature). We assume a net-of-taxes utility function of a risk-averse investor

$$U[(1 - t)(f_g(\sigma) - I)] = U[f_g] - B,$$

where B denotes the decrease in utility due to the tax payment on the profit in the good state of nature, and

$$U[(1 - t)(f_b(\sigma) - I)] = U[f_b] + A,$$

where A denotes the increase in utility due to the tax refund from loss offset in the bad state of nature. Due to risk-aversion, the utility gain from a full tax refund is larger than a corresponding expected utility loss from taxes on profits ($A > B$).

We assume for the post-tax profit in the good state of nature

$$\pi_g = (1 - t) \cdot (f_g(\sigma) - I) > 0$$

and bad state of nature

$$\pi_b = (1 - \lambda t) \cdot (f_b(\sigma) - I) < 0$$

for the after-tax loss, where $\lambda = 1$ indicates a full loss offset while $\lambda < 0$ describes loss offset restrictions and $\lambda = 0$ the absence of loss offset provisions. More generous loss offset rules increase the optimal level of risk-taking (Domar and Musgrave 1944, Atkinson and Stiglitz 1980) due to increased risk sharing with the government. The expected tax refund on losses adds more to the risk-averse investor's expected utility than a corresponding expected tax burden on profits decreases utility (Figure 2).

<Insert Figure 2 about here>

The direction of the overall tax effect switches for tax rates higher than the critical tax rate because A (utility from tax refund) decreases in the tax rate such that at the critical tax rate $A = B$. For tax rates higher than the critical tax rate the tax effect on profits overcompensates the risk-sharing effect from the tax refund to a risk-averse investor in case of loss offset restrictions. For high tax rates, the utility loss due to loss offset restrictions in comparison to a full loss offset is higher than for low tax rates because of risk aversion (curvature of the utility function, see Appendix A for details).

For tax rates above the critical tax rate, the higher utility loss due to the loss offset restrictions cannot be compensated for by the high weight a risk-averse investor allocates to the tax refund. As a consequence, the disutility from taxes on profits dominates the effects with respect to losses, leading to an overall disincentive of taxation on risk-taking.

To show this mechanism formally we determine the partial derivative of the expected risk-utility function

$$E[U] = p \cdot U[\pi_g] + (1 - p) \cdot U[\pi_b], \quad (1)$$

with respect to σ . Then, we obtain by implicit differentiation of the first order condition (*FOC*)

$\frac{\partial E[U]}{\partial \sigma} = 0$ with respect to λ finally (see Appendix B)

$$\frac{d\sigma}{d\lambda} = \frac{(1-p) \cdot t \cdot f'_b(\sigma) \cdot [U'[\pi_b] + U''[\pi_b] \cdot \pi_b]}{SOC} > 0, \quad (2)$$

with the second order condition, $SOC < 0$, in the denominator (see proof in Appendix B).

Greater loss offset λ unambiguously increases risk-taking. Although the direction of the loss offset effect on risk-taking is uniformly positive, the tax rate t scales both the size of the tax refund and the risk-taking effect (numerator).

By contrast, the overall effect of the tax rate on corporate risk-taking is ambiguous. While higher tax rates often induce increased risk-taking, tax rates that exceed a critical threshold lead to a reversed effect.⁵ This ambiguity is obvious in Figure 1 and can be formally described by:

$$\frac{d\sigma}{dt} = \frac{p \cdot U''[\pi_g] \cdot \pi_g \cdot f'_g(\sigma) + p \cdot U'[\pi_g] \cdot f'_g(\sigma) + (1-p) \cdot U''[\pi_b] \cdot \lambda \cdot \pi_b \cdot f'_b(\sigma) + (1-p) \cdot U'[\pi_b] \cdot \lambda \cdot f'_b(\sigma)}{SOC} \gtrless 0. \quad (3)$$

First, increasing the tax rate reduces the return from additional risk-taking in the good state of nature but simultaneously increases the marginal utility of the additional profit. Second, under full loss offset a higher tax rate increases risk-taking while under no loss offset the tax rate decreases risk-taking. Both effects are visible in the numerator. As after-tax losses (π_b) determine also the marginal utility, the effect from risk aversion is a function of the tax rate. Therefore, this effect decreases in the tax rate. The higher the tax rate the lower the marginal utility loss from loss offset restrictions (Figure 2 and Appendix A). As the denominator (SOC) has a uniform sign, which effect prevails depends on the relation of the probability of a good state, the level of risk-aversion and the tax rate displayed in the numerator (see Appendix C).⁶

⁵ A higher tax rate mitigates the intensity of this effect as a higher tax rate and the resulting larger tax refund leads to higher utility levels and thus lower marginal utility in the bad state. Moreover, the tax rate directly affects corporate risk-taking. However, the direction of this effect is ambiguous (Figure 1).

⁶ See Propositions 1 and 2 in Langenmayer and Lester (2018).

Empirical literature provides evidence that both loss offset rules and tax rates affect corporate risk-taking. Recently, both Langenmayr and Lester (2018) and Ljungqvist et al. (2017) provide evidence for a positive association of the available loss offset period and firm-specific operating risk around a statutory rule change.⁷ Using a cross-country sample of Western European countries and the U.S., the results of Langenmayr and Lester (2018) suggest that the benefits from loss offsets increase in the tax rate. Moreover, Langenmayr and Lester (2018) provide evidence that the effect of tax rates on risk-taking depends on firms' expectation to use tax losses. Ljungqvist et al. (2017) use staggered changes in corporate income tax rates across U.S. states to investigate the effect of tax rate changes on firms' risk-taking. Similar to Cullen and Gordon (2007), the authors find that firms decrease risk-taking after a tax rate increase but do not find evidence that firms increase risk-taking after a tax rate cut.⁸

In the spirit of Domar-Musgrave, these empirical studies assume a constant risk-sharing between government and firm and, therefore, do not capture all types of risk that characterize a risky investment for a variety of reasons. These studies either account for operational risk or political risk, but not both. In addition, they do not account for interactive effects of country risk factors and changes in tax rates and loss offset rules. However, the finance literature (Desai et al. 2008; John et al. 2008) provides strong evidence that several firm decisions, such as capital structure decisions, are directly influenced by political risk of countries in which the firm operates (Kesternich and Schnitzer 2010), or indirectly affected by different country factors (de Jong et al. 2008).

⁷ The focus of our study is on corporate risk-taking. However, recent literature provides evidence that managers adjust firm risk-taking based on individual income tax incentives (Armstrong, Glaeser, Huang, and Taylor 2017; Yost 2017).

⁸ Ljungqvist et al. (2017) attribute this asymmetric response to tax rate cuts to the pressure of stakeholders (creditors or labor unions) that prevent firms from taking on more risk. However, the study does not provide detailed evidence on this finding.

We examine and define country risk as country-specific uncertainty that is triggered by two sources. *Political risk* and *fiscal budget risk* associated with the country-specific ability to collect and refund taxes (Eaton and Gersovitz 1983; Erb, Harvey, and Viskanta 1996; Kaufmann et al. 2011; Kesternich and Schnitzer 2010; Damodaran 2016). Theoretical arguments and prior literature suggest that these two sources of country risk affect the ability of tax rate changes and loss offset changes to encourage corporate risk-taking.⁹ *Political risk* arises from a country's underlying governance and institutional efficiency and is an important component that determines country risk.¹⁰ Prior literature identifies three main factors of political risk: differences in institutional development (La Porta, Lopez-de-Silanes, Shleifer, and Vishny 1998), legal protection of investors (Henisz 2000; John et al. 2008), and threat of opportunistic expropriation through changes in taxation, regulation, or other financial constraints (Desai et al. 2008; Kaufmann et al. 2011; Baker, Bloom, and Davis 2016). All three impact the propensity of a government to refund taxes on losses. *Political risk* is associated with reduced risk-taking, investment, and employment for firms within a country (Desai et al. 2008; John et al. 2008; Dharmapala and Hines 2009; Baker et al. 2016). While *political risk* can result in the non-payment of taxes (through lax enforcement by the tax administration) and arbitrary enforcement of tax payments, it can also be an obstacle to tax refunds.¹¹

⁹ By contrast, we do not find evidence that other types of country risk, such as macroeconomic risk, directly affect the government's ability to offset losses. We address the concern that macroeconomic effects nullify the comparability of the treatment and control groups in two ways. First, we use GDP growth rates as a control variable in all regressions. Second, we limit our counterfactuals to countries with similar economic environment in our robustness tests.

¹⁰ Hill (1998, p. 294) describes political risks as "risks associated with business or investment in a country which would not be present in another country with a more stable and developed business and economic climate and regulatory regime." Strongly related to this definition is the World Governance Index developed by Kaufmann et al. (2011).

¹¹ We proxy for political risk using indicators of governance (e.g., political stability and capacity of governments to implement policies. Please refer to section 3 for details.

Fiscal budget risk is the second component of country risk and it stems from financial constraints of a country's government.¹² One source of financial constraints arise from interest payments and repayment of principle in the future (Hamilton and Flavin 1986).¹³ The resulting fiscal budget constraints further limit the ability of a government to provide refunds for firms' loss offsets. This is particularly pronounced if many firms in an economic downturn make use of loss carrybacks because the government faces lower current revenues and is obligated to provide cash tax refunds (Alfonso, Gomes, and Rother 2011; Vegh and Vuletin 2015).¹⁴

In the first step of our theoretical model, we do not distinguish between different sources of risk. We implicitly assume that the overall risk exposure in the model is driven by all kinds and sources of risk, including country risk. However, to improve the empirical specification it is worthwhile to integrate country risk explicitly into the model in the second step. If the investment's risk exposure is affected by country risk, this translates in theoretical terms into a decrease in the effective loss offset potential. In the following $\hat{\lambda} = \theta\lambda$ captures the loss offset potential under country risk, where θ is the country risk coefficient. $\theta = 1$ describes the absence of country risk while $0 \leq \theta < 1$ indicates that the country of investment is characterized by political or fiscal budget risk that limit tax refunds. From $\hat{\lambda} = \theta\lambda$ and $\frac{d\sigma}{d\lambda} > 0$ (eq. (2)) we can easily conclude for the effect of loss offset restrictions (λ) and country risk ($\theta < 1$) on optimal risk-taking ($\hat{\sigma}$)

¹² Ljungqvist et al. (2017) show that state budget deficit/surplus and bond rating downgrades (in year t-1) are correlated with changes in tax rate and loss offset rules. However, the results are somewhat inconclusive. The study finds a significant correlation between state budget deficits and the magnitude of tax increases but no significant correlation for changes in loss offset rules. Furthermore, the study does not indicate a significant correlation between state budget surplus and changes in tax rules.

¹³ Kaminsky and Schmukler (2002) find that debt ratings affect financial markets in emerging economies and that this effect is stronger during economic downturns.

¹⁴ We use the percentage of government debt to GDP and credit rating of a country to proxy for *fiscal budget risk*.

$$\frac{d\hat{\sigma}}{d\hat{\lambda}} = \frac{(1-p) \cdot t \cdot f'_b(\hat{\sigma}) \cdot [U'[\pi_b] + U''[\pi_b] \cdot \pi_b]}{\widehat{SOC}} < \frac{(1-p) \cdot t \cdot f'_b(\sigma) \cdot [U'[\pi_b] + U''[\pi_b] \cdot \pi_b]}{SOC} = \frac{d\sigma}{d\lambda} \quad (4)$$

with $\frac{d\hat{\sigma}}{d\hat{\lambda}} > 0$, $\widehat{SOC} < 0$ and $\widehat{SOC} < SOC$. As country risk only changes the level of effective loss offset ($\hat{\lambda} < \lambda$ if $\theta < 1$) the direction of the effect, again, is uniform and positive. Lower effective loss offset, i.e., lower expected tax refunds due to country risk, reduce risk-taking as loss offset restrictions do in general. Focusing on the effect of country risk, we find correspondingly

$$\frac{d\hat{\sigma}}{d\theta} = \frac{(1-p) \cdot \lambda \cdot t \cdot f'_b(\hat{\sigma}) \cdot [U'[\pi_b] + U''[\pi_b] \cdot \pi_b]}{\widehat{SOC}} > 0. \quad (5)$$

Country risk uniformly reduces risk-taking. Furthermore, we can easily see that $\frac{d\hat{\sigma}}{d\theta}$ increases in t .

In summary, in this model country risk generates three effects on risk-taking (eqs. (4) and (5)).

Firstly, the impact of loss offset provisions in the face of country risk is lower than in the absence of country risk-induced limits to tax refunds (ineq. (4); illustrated in Figure 3 as effect 1). Secondly, country risk reduces the effectiveness of the tax incentive from loss offset provisions making it more likely that a tax rate increase discourages risk-taking (eq. (5); Figure 3, effect 2). Third, this impact of country risk on risk-taking is scaled by the tax rate (eq. (5); Figure 3, effect 3).

<Insert Figure 3 about here>

Figure 3 exemplifies all three effects for a common risk-averse attitude, i.e., for a logarithmic risk utility function (constant relative risk aversion). We find a critical tax rate (circle) that exactly neutralizes the risk sharing mechanism. As a consequence of country risk (dashed lines), this critical tax rate is much lower than in the absence of country risk (solid lines).

2.3 Hypotheses

Motivated by these theoretical predictions, we expect that for a critical level of country risk the positive association between loss offset provisions and firm risk-taking is fully

attenuated. We predict that increased country risk shifts the portion of risk-sharing between the company and the government to a point where company A in country A bears additional risk compared to a comparable company B in country B with lower country risk. Consequently, a similar change in tax rates and/or loss offset rules of country A (high country risk) leads to a smaller change in corporate risk-taking or even a reverse effect. Such a result suggests that the findings of prior literature are not generalizable to countries with high levels of country risk.

First, prior literature indicates that governments of countries with higher political risk are more inclined to tax companies' profits but are reluctant to share in losses, leading to a negative effect on corporate risk-taking (Dharmapala and Hines 2009). This is illustrated in Figure 3 as effect 1. Specifically, the figure illustrates that for each and every combination of tax rate (t) and level of loss offset provision (λ) country risk decreases the optimal level of risk-taking. This country risk effect (effect 1 in Figure 3) is reflected in a downward shift of all dashed lines (in comparison to the respective solid lines in the same color). Based on this rationale, we conjecture the following:

H1a: Political risk of a country attenuates the positive association between loss offset provisions and corporate risk-taking.

Correspondingly, we investigate the effect of fiscal budget risk on risk-taking. As anecdotal evidence and prior research indicate, governments can mitigate budget constraints by stretching the duration to provide cash tax refunds to taxpayers (Dwenger 2008; Dobridge 2016). This negatively affects corporate risk-taking because firms face losses and only delayed (cash) refunds for carrybacks or decrease their expectations future availability of carryforwards. Recent research supports this prediction and provides evidence that governments actively use tax policy

tools to balance public spending in economic downturns and upturns (Goncharov and Jacob 2014; Vegh and Vuletin 2015; Dobridge 2016).¹⁵ Consequently, we predict the following:

H1b: Fiscal budget risk of a country attenuates the positive association between loss offset provisions and corporate risk-taking.

Second, we demonstrate in equation (5) of the model that for a given corporate tax rate increase, country risk attenuates the positive association between loss offset provisions and corporate risk-taking. As illustrated in Figure 3 (effect 2), country risk shifts the critical tax rate to the left, making it more likely that a tax rate increase affects risk-taking negatively. Hence, we predict the following:

H2: A tax rate increase is more likely to discourage risk-taking if country risk is high.

Third, we demonstrate in our theoretical model (eq. 5) that the moderating effect of country risk on the tax loss offset provision increases in the underlying corporate tax rate. This relationship is also illustrated as effect 3 in Figure 3. The distance between the solid and dashed lines increases in the tax rate leading to a more pronounced effect of country risk for high tax rates. Therefore, in our third hypothesis, we conjecture:¹⁶

H3: The negative impact of country risk on corporate risk-taking increases in the country's tax rate.

3. Empirics and data

3.1 Cross-country panel and empirical identification strategy

¹⁵ Governments, however, are limited by budget laws. Costello, Petacchi, and Weber (2017) find evidence that stricter budget laws may result in spending cuts and tax increases in times of fiscal deficits.

¹⁶ Consistent with H2, we expect that an increase in the tax rate is more likely to discourage risk-taking in countries with pronounced country risk. Although we do not explicitly state this prediction, we use additional tests to further corroborate our results.

We examine the hypotheses above using a sample of 64 countries over the period 1992 to 2012. We collect the country tax level data from Coopers & Lybrand International Tax Summaries, Ernst & Young (EY) and PwC tax yearbooks. We select 1992 as a starting point because Eastern European and other emerging markets started their transition to the market system and capital market liberalizations are clustered around this year (Bekaert and Harvey 2002). A cross-country study allows us to investigate the effectiveness of loss offset rules dependent on the country characteristics as it offers a setting with greater variation in tax rate changes, loss offset rules, political, and fiscal budget risk across countries. Further, political and budget risk are more exogenous across than within countries (Djankov et al. 2010; Vegh and Vuletin 2015). Importantly, our sample comprises a substantial portion of the world including developed and developing countries. We cover 33 OECD countries and countries that are developing rapidly during our sample period (especially Asian countries as well as Eastern European countries). However, we face limited data availability for some regions and are not able to include many African and Middle Eastern countries. Figure 4 provides an overview of our sample countries.

<Insert Figure 4 about here>

While many country risk factors are relatively time-invariant or changing slowly, several shocks in our sample period allow us to exploit changes in political, and fiscal budget risk as well as tax policy changes.¹⁷ The covered sample period includes several economic shocks, such as the Asian crisis in 1997/98, the dot-com bubble in 2000/2001, and the financial crisis in 2008.

¹⁷ In line with prior literature (John et al. 2008; Langenmayr and Lester 2017), we use consolidated financial data of firms. This includes firms that operate mainly domestically but also multinational firms that are exposed to tax and country risk environments of several jurisdictions. We address this varying exposure in section 4.1 and document a stronger association for domestic firms.

Our sample ends in 2012 because we require data for two subsequent years (2013 and 2014) to calculate the 3-year risk measures.

We exploit changes in corporate tax rates and loss offset rules. Our sample consists of 1,058 country-year observations that include 51 increases and 183 decreases in corporate tax rates in 28 and 50 countries, respectively.¹⁸ The mean of the average tax rate increases is 2.4 percentage points and the mean of the decreases is 3.3 percentage points. Hence, the magnitude of tax rate changes in our study is substantially higher than in the Ljungqvist et al. (2017) study and provides further insights about the generalizability of their findings.¹⁹ Our sample includes 36 changes in loss carryforward rules and 13 changes in carryback rules. This comprises of 32 increases of the length of carryforward rules and four decreases of the LCF periods. Moreover, our sample includes eight enactments of loss carryback rules and five abolishments of LCB rules.

3.2 Relation between changes in tax rules and corporate risk-taking

3.2.1 OLS panel specifications to test the effects of loss offset rules changes

In a first step, we validate the results documented by Langenmayr and Lester (2018) using a larger sample that includes more heterogeneous countries. We follow Langenmayr and Lester (2018) and investigate the effect of tax rate changes and loss offset rules on corporate risk-taking without accounting for potential interactive effects of country risk factors. Therefore, we include *Political Risk* and *Fiscal Budget Risk* only as control variables.

$$\text{Firm Risk-Taking}_{i,t} = \alpha_0 + \beta_1 LC_{j,t} + \beta_2 CTRStd_{j,t} + \beta_3 LC*CTRStd_{j,t} + \beta_n C_{i,j,t} + \alpha_{k,t} + \varepsilon_{i,j,t} \quad (6)$$

¹⁸ This includes 41 increases and 175 decreases in corporate tax rates that are one percentage point or higher.

¹⁹ The setting of Ljungqvist et al. (2017, p.676) allows the authors to investigate the effects of relatively small magnitudes of tax rate changes. The average (median) treated firm in their sample “experiences a tax increase of 136 (106) basis points and a tax cut of 53 (44) basis points.” By contrast, our sample allows us to investigate effects of tax policy on corporate risk-taking by studying both a) different magnitudes of changes in corporate tax rates and loss offset rules, b) investigating the effects of these changes across countries with heterogeneous country risk.

The dependent variable *Firm Risk-Taking_{i,t}* is a measure of the riskiness of firm *i*'s investment in year *t*. We define *Firm Risk-Taking_{i,t}* as the standard deviation over three years of a firm's *ROA*'s (*EBIT/Total Assets*) deviation from the industry-country specific average *ROA* for the respective year (John et al. 2008; Faccio, Marachia, and Mura 2011; Langenmayr and Lester 2018). Importantly, this measure proxies for firms' operating risk and removes the influence of home country and industry-specific economic cycles. Firm management cannot alter this cycle, and thus our measure directly reflects the riskiness of corporate investment decisions.²⁰

Our main independent variables capture tax system determinants of the home country. Our main variable of interest, *LC_{j,t}*, captures the length of the statutory loss carryback period and the existence of a loss carryforward in firm *i*'s home country *j* in year *t*.²¹ We use the period of the length of the loss carryforward period in years. For unlimited loss carryforward periods, we use 20 years (maximum for limited LCF periods).²² For loss carrybacks, we use an indicator variable that equals one if the country offers a loss carryback and zero if the country does not (Bethmann et al. 2018).

The coefficient β_l represents the effect of the loss rules on risk-taking, given the average corporate tax rate in the sample. Consistent with findings of Langenmayr and Lester (2018), we expect a positive effect of loss carryforwards and carrybacks on corporate risk-taking ($\beta_l > 0$). Although of similar sign, we predict a stronger effect if a loss carryback is in place (Bethmann et al. 2018; Langenmayr and Lester 2018). Second, *CTRStd_{j,t}* captures the standardized corporate tax rate of country *j* in year *t*.²³ We use the top bracket corporate tax rate of country standardize

²⁰ To accommodate for potentially differing planning horizons, we also re-estimate all regressions with a 5-year industry-adjusted measure of *Firm Risk-Taking* and results remain substantially unchanged.

²¹ We define home country as the jurisdiction in which the country is headquartered.

²² We also use 100 years to account for unlimited loss carryforward and find comparable effects.

²³ We standardize tax rate *CTRStd_{j,t}* across the sample so that the tax rate has a mean of 0 and a standard deviation of 1 across the sample (Langenmayr and Lester 2018). This allows us to interpret the coefficient on β_l as the effect of loss offset rules on risk-taking given the average corporate tax rate in the sample.

tax rate $CTRStd_{j,t}$ across the sample and expect a negative coefficient ($\beta_2 < 0$). Third, $LC*CTRStd_{j,t}$ captures the interaction of the loss offset rules and the standardized statutory tax rate. We predict a significant positive coefficient β_3 because higher tax rates increase the benefit of loss offsets.

We include several firm- and country-level control variables in our regression analysis to ensure that our results are not driven by other factors. $C_{i,j,t}$ is the vector of time-varying country- and firm-level control variables. We use *Size* (the natural logarithm of total assets) because prior literature suggests that firm size is associated with lower operating risk since large firms can diversify their risk (John et al. 2008). Next, we control for *Leverage* (ratio of total liabilities to total assets) to mitigate concerns that additional risk-taking is associated with increased financial distress (de Jong et al. 2008; John et al. 2008; Kesternich and Schnitzer 2010). *ROA* captures the firm's ability to recover losses and invest in risky projects (John et al. 2008; Langenmayr and Lester 2018). Moreover, we control for *Sales Growth* (defined as the year-to-year percentage change in revenues) and *MB* (market-to-book-ratio, defined as the ratio of market capitalization to common equity) to account for investment opportunities (Rajgopal and Shevlin 2002).

We use *GDP Growth* and *Inflation* as country-level control variables to ensure that our results are not driven by economic conditions that directly or indirectly influence tax policy (John et al. 2008; Djankov et al. 2010; Vegh and Vuletin 2015). We obtain data on *GDP Growth* (annual percentage growth rate of GDP in constant 2010 U.S. dollars) from the World Bank Database. We define *Inflation* as the rate of price change in a country measured by the annual growth rate of the GDP implicit deflator (World Bank Database).

Importantly, we include *Political Risk* and *Fiscal Budget Risk* as control variables. Based on prior literature, we construct proxies for the respective country risk factors to account for

differences. First, we use the Worldwide Governance Indicators (WGI) developed by Kaufmann et al. (2011) to proxy for political risk. These measures provide cross-country indicators of governance and are used to proxy for political stability (de Jong et al. 2008; Dharmapala and Hines 2009). The WGI consists of three different categories: selection and monitoring of governments, the capacity of governments to implement policies, and the quality of institutions that govern these policies (e.g., enforcement of tax payment). Details of the WGI components are described in Appendix D.²⁴ Following Dharmapala and Hines (2009), we use the *yearly mean* of the combined indicators to proxy for political risk of a country (*Political Risk*). A high value for a variable reflects an increased risk for firms due to the political/institutional environment. We standardize the variable to have a mean of zero and a standard deviation of one across the sample.

Second, we use two measures to proxy for *Fiscal Budget Risk* of a country: percentage of government debt to GDP and credit rating of countries. Prior research suggests that countries use tax policy strategically to manage public spending and that the relative debt, as well as credit ratings, constrain governments' cash outflows (Goncharov and Jacob 2014). We obtain data about our primary measure, government debt, from the OECD and IMF Public Debt Database²⁵ and credit ratings of countries from the Worldscope Database (Oxford Economic Outlook) as credit ratings reflect governments' abilities to refinance and, ultimately, their cash outflows.²⁶ Again, we standardize both variables across the sample.

²⁴ The WGI Index data start in 1996 and are until 2002 only bi-annually available. For the years before 1996 we use the 1996 values and for the period from 1996 to 2002, we use the mean of the respective biannual values.

²⁵ See, IMF Public Debt Database <https://www.imf.org/external/pubs/cat/longres.aspx?sk=24332.0>.

²⁶ Although we do not tabulate results for regressions using credit ratings as *Country Risk Factor*, inferences remain the same across all specifications.

This approach paired with our extensive country sample over 21 years allows us to exploit variation from the economic development of a country. We include industry-by-year fixed effects $\alpha_{k,t}$ to account for overall macroeconomic effects in year t .²⁷ We cluster standard errors by country-year and by firm to account for within-firm and within country-year correlation in our sample (Petersen 2009).²⁸ For details about the variable definition, see Appendix D.

3.2.2 Effect of country risk factors on corporate risk-taking

In the second test, we modify the specification used in (1) and explicitly account for the interactive effect of country risk factors and changes in corporate tax rates and loss offset rules on corporate risk-taking:

$$\begin{aligned} \text{Firm Risk-Taking}_{i,t} = & \alpha_0 + \beta_1 LC_{j,t} + \beta_2 CTRStd_{j,t} + \beta_3 LC*CTRStd_{j,t} + \beta_4 CountryRiskFactor_{j,t} + \\ & \beta_5 LC*CountryRiskFactor_{j,t} + \beta_6 CTRStd_{j,t}*CountryRiskFactor_{j,t} + \\ & \beta_7 LC*CTRStd_{j,t}*CountryRiskFactor + \beta_n C_{i,j,t} + \alpha_{k,t} + \varepsilon_{i,j,t} \end{aligned} \quad (7)$$

where the dependent variable $\text{Firm Risk-Taking}_{i,t}$ is a measure of the riskiness of firm i 's investment in year t . As in equation (6), the independent variables capture tax system determinants of the home country. We expect similar signs and magnitudes of the coefficients β_1 to β_3 (capturing the effect of tax system changes for countries with low country risk). We expect firms located in low country risk jurisdictions to increase their risk-taking when either loss carryforwards or carrybacks are available and this effect increases in higher tax rates ($\beta_3 > 0$). Consistent with prior literature, we expect more pronounced effects for loss carrybacks than for forwards because carrybacks deliver an immediate cash refund and are not conditional on future

²⁷ We use the Fama-French 48 classification to account for industry fixed effects. Our results hold when we use Fama-French 12 classification or SIC classification.

²⁸ In section 4.4 and Table 10 we use different specifications of clustering and fixed effects. Our inferences do not change.

profitability and potential changes in carryforward rules (Langenmayr and Lester 2018; Bethmann et al. 2018).

For our analysis of H1a and H1b, we use two specifications of *CountryRiskFactor*: an indicator variable equal to one if country j 's value for the *Political Risk* or *Fiscal Budget Risk* is a) above the median in year t , and b) in the fourth quartile of the country-year t . Otherwise, we set *CountryRiskFactor* equal to zero. Consistent with H1a and H1b, we predict a negative effect of *CountryRiskFactor* ($\beta_4 < 0$) and a negative coefficient on β_7 that offsets the positive effect of β_3 . We estimate equation (7) separately for both country risk factors.

We include the vector $C_{i,j,t}$ to control for time-varying firm-level and country-level variables. Importantly, we include *Fiscal Budget Risk* as a control when estimating the effects of *Political Risk* and vice versa. $\alpha_{k,t}$ captures industry-by-year fixed effects to control for time-varying heterogeneity across industries. We cluster standard errors by firm and country-year to account for within-firm and within-country-year correlation in our sample (Petersen 2009).

3.2.3 Effectiveness of loss offset provisions in face of tax rate increases and scaling effect of tax rate

To test H2, we restrict our sample to observations three years before and after a tax rate increase ($t-3$ to $t+2$). This approach allows us to investigate the impact of a tax rate increase on corporate risk-taking depending on its level of country risk. We use specification (7) to test whether a tax rate increase discourages corporate risk-taking in environments with high country risk. Specifically, we compare the sum of the coefficients on β_6 and β_7 is equal (or smaller than) zero. A sum of these coefficients equal to (smaller than) zero indicates an attenuating (reversing) effect of country risk on corporate risk-taking.

Finally, we test H3 to investigate whether tax rates scale the negative impact of country risk. We split our sample at the median according to firm-year observations that are located in countries with low and high corporate tax rates.²⁹ We define high and low tax rates depending on the median corporate tax rate in our sample (33%). Based on H3, we predict that the negative effect of country risk on increases in the underlying corporate tax rate. Therefore, we expect a higher coefficient for β_7 for countries with statutory tax rates above the median and a lower coefficient for countries with statutory tax rates below the median. In a second step, we corroborate our results and restrict (as for our H2 tests) our sample to observations three years before and after a tax rate increase and re-estimate specification (7). We expect a more pronounced effect of country risk for this sub-sample.

3.3 Sample selection and descriptive statistics

We use a large dataset of publicly listed firms in 64 countries obtained from the Thomson Reuters' Worldscope Database. Importantly, we take a different approach compared to Langenmayr and Lester (2018) who focus on major Western European countries and the United States. We include countries that differ in their institutional and political characteristics. Hence, we include OECD countries and countries classified by the IMF as emerging economies. Previous studies indicate that the findings of developed countries are not necessarily transferable to developed countries and may result in a different effect of tax policy (Djankov et al. 2010; Vegh and Vuletin 2015). Our initial sample period spans from 1992 to 2014. To accommodate 3-year risk-taking measures, we limit the data to 1992 to 2012.³⁰ Our sample period covers major

²⁹ We use the median of our sample because it provides a first estimate of the critical point. In untabulated tests, we use 39% (third quartile) as a cut-off point and inferences remain unchanged.

³⁰ In contrast to Langenmayr and Lester (2018) we cover a wider range of countries with different events that affect economic, political, and fiscal budget risk. We replicate the authors' sample and find similar distributions of the variables in the sample period used.

economic and political events and crises that allow us to exploit variation in these measures. To mitigate concerns that firms do not only operate in one jurisdiction and hence the exposure to country-specific risk and its tax system varies, we construct a dummy variable, *Domestic*, equal to one if the respective firm has less than 10 percent of its yearly income, sales, and assets reported as foreign (Creal et al. 2014; Langenmayr and Lester 2018). We expect a stronger effect of corporate tax system changes on corporate risk-taking for domestic firms.

From the initial sample of 552,462 firm-years, we drop 5,643 firm-year observations of cross-listed firms. We eliminate observations from firms in the financial or utilities sector (99,396 firm-years) because they are subject to different regulations that likely affect risk-taking behavior. Moreover, we drop observations due to missing risk-taking measures (106,941 firm-years) and control and country-level variables for final sample (100,710 firm-years). This procedure results in an ultimate sample of 239,772 firm-year observations located in 64 countries. Table 1 presents the sample selection. Table 2 presents an overview of the number of firm-year observations in the respective countries. About 17.2 percent of the total observations are from the United States, followed by Japan (15.9 percent), China (8.1 percent), and India (5.7 percent).

<Insert Table 1 about here>

<Insert Table 2 about here>

Table 3 presents the descriptive statistics for our sample. Panel A summarizes the firm-level variables. We winsorize all firm-level and country-level variables (except for corporate tax rate) at the 1 percent and 99 percent levels.³¹ The mean (median) for *Risk* is 0.087 (0.031) which

³¹ We adjust the data for inflation using each country's Consumer Price Index in 2010 and convert them into U.S. dollars.

is lower than in the study of Langenmayr and Lester (2018) but consistent with John et al. (2008) that uses a sample that is comparable to our study.³² The average (median) of *Size* is 12.0 (12.0), of *Leverage* 0.52 (0.50), and of *Sales Growth* 0.20 (0.07). The mean (median) market-to-book-ratio is 2.1 (1.4). Importantly, the mean *ROA* is around zero which is due to the inclusion of loss years in our sample, the median of *ROA* is 0.06.

Panel B provides an overview of country-level variables. The mean (median) of *LCF* is 12.8 (10) years and approximately 45 percent of the firm-year observations are from countries that have a *LCB* in place. The average (median) corporate tax rate is 32.9 (33.0) percent. The average (median) for *Inflation* are 2.7 (2.1) percent, *Political Risk* (mean of WGI index) 5.13 (7.18), and *Fiscal Budget Risk* (government debt to GDP ratio 73.9 (63.6)) percent.

<Insert Table 3 about here>

Table 4 presents a summary of the distribution of each of the three country risk factors for the 64 countries in the sample. Consistent with prior literature (Kaufmann et al. 2011), we document a relatively low *Political Risk* for OECD countries and a relatively high *Political Risk* for *Emerging Markets*. *Fiscal Budget Risk*, however, is less concentrated in either of the two groups.

<Insert Table 4 about here>

Table 5 presents the descriptive statistics for our sample. The descriptive statistics are consistent prior literature. Our *Firm Risk-Taking* proxy is negatively correlated with *Size* and *ROA*. Further, *Firm Risk-Taking* is positively correlated with both loss offset variables providing first evidence of a positive effect of these provisions on corporate risk-taking. Turning to our macroeconomic

³² One explanation is our extended sample period that covers relatively less crises.

and country risk variables, the correlation between *Inflation* and *Firm Risk-Taking* is negative.³³ Further, *Government Debt* is negatively correlated with *Firm Risk-Taking* providing first evidence for our hypotheses. Importantly, *Political Risk* and *Government Debt* are negatively correlated supporting our hypotheses to consider these two country risk factors separately.

<Insert Table 5 about here>

4. Empirical results

4.1 Effects of tax rates and loss offset rules on corporate risk-taking

Table 6 presents our baseline results using equation (6). We regress *Firm Risk-Taking*_{*i,t*} on the length of the loss carryforward and loss carryback periods in the country in which the firm is headquartered (Columns 1 and 2). The coefficient for *LCF* is 0.005 and 0.003, respectively. Translated in economic magnitudes, for the average firm in the sample, a one year longer *LCF* is associated with 5.7 and 3.5 percent higher risk-taking, respectively.³⁴ Further, the estimate for the introduction of a loss carryback indicates a significant increase in corporate risk-taking of 14.9 percent (coefficient of 0.013) for the average firm in the sample.³⁵ Our coefficients are comparable to the findings of Langenmayr and Lester (2018), but of smaller magnitude. Consistent with the notion that loss carrybacks provide an immediate and certain cash flow, the coefficient for the *LCB* is higher. Control variables in Column (2) take the expected signs. *Size* and *ROA* negatively correlated with *Firm Risk-Taking*.³⁶ Coefficients on *Leverage*, *Sales*

³³ We acknowledge high correlations among Inflation, GDP Growth, and our country risk factors. We address this concern in our robustness tests in Section 4.4.

³⁴ To calculate the effect of a one year loss offset by dividing the estimated coefficient by the mean *Risk*. Following this, we derive estimates of 5.74 percent (=0.005/0.087) for a one year longer LCF period. The magnitude of the estimate is somewhat greater than in the Langenmayr and Lester (2018) study.

³⁵ As for the LCF effect, we calculate the effect of 14.9 percent (=0.013/0.087) by dividing the coefficient by the mean of *Firm Risk-Taking*. The magnitude is smaller than in the Langenmayr and Lester (2018) study, but may be due to fact that we just consider whether an LCB is in place or a first indication of a negative impact of country risk.

³⁶ We note that the magnitude of the coefficient for *ROA* is huge. However, this relation is mechanic because *Firm Risk-Taking* is constructed based on *ROA*. Regressions specifications of prior studies (John et al. 2008; Langenmayr and Lester 2018) indicate similar magnitudes of coefficients on *ROA*.

Growth, *MB*, and *GDP Growth* are positive coefficients and are consistent with results found in prior literature (John et al. 2008, Langenmayr and Lester 2018; Ljungqvist et al. 2017). Taken together, our results initially support the findings of Langenmayr and Lester (2018) for a sample of more heterogeneous countries.

Next, we add the interaction of loss offsets and the standardized corporate tax rates and estimate equation (6). In Column (3), coefficients for *LCF* and *LCB* are of similar magnitude as in specifications (1) and (2). The coefficient of the interaction between *LCF* and *CTRStd* in Column (3) is significant (coefficient 0.001) which translates into 1.2 percent increase in risk-taking for a one year increase in LCF. The interaction of *LCB* and *CTRStd* is also statistically and economically significant (9.2 percent for the adoption of a *LCB*, coefficient of 0.008). In Column (4), we include *Inflation* and country risk factors (*Political Risk* and *Fiscal Budget Risk*) in our model and run equation (6). Our variables of interests are of similar magnitude and both country risk factors are negative. To further corroborate findings of prior literature, we estimate equation (6) using domestic firms. Column (5) presents the results for domestic firms.³⁷ Consistent with prior literature, we document slightly more pronounced effects for domestic firms. Combined, our initial results confirm prior literature that stresses the importance of loss carryback and carryforward rules to foster corporate risk-taking and that the effect of loss offset rules increases in the tax rate (Langenmayr and Lester 2018; Ljungqvist et al. 2017).

<Insert Table 6 about here>

4.2 Effects of country risk factors on corporate risk-taking

We use equation (7) to examine our main predictions that country risk negatively affects the relation between loss offset rules and corporate risk-taking. To test H1a and H1b, we

³⁷ The results are of similar magnitude for domestic firms (firms that report less than 10 percent of income, sales, and assets as foreign).

estimate equation (7) separately using *Political Risk* and *Fiscal Budget Risk* as the *Country Risk Factor*.³⁸ We proxy for *Country Risk Factor* in two ways. First, we define *Country Risk Factor* as an indicator variable equal to one if firm *i* is located in a country whose country risk proxy is *above the yearly median* of the proxy (Table 7, Panel A), meaning higher country risk. Second, we estimate equation (7) using an indicator variable equal to one if firm *i* is located in a country whose value is in the fourth quartile in year *t* and zero otherwise (table 7, Panel B). These specifications allow us to compare the economic magnitude of the effect of the tax system in low (coefficient β_3 , $LCF/LCB*CTRStd$) vs. high country risk countries (β_7 , $LCF/LCB*CTRStd*Country Risk Factor$). We expect a more negative impact of country risk in the latter specification.

Table 7, Column (1) presents the results for our specification using *Political Risk* as *Country Risk Factor* in the interaction term. In Panel A, we find no negative effect of country risk factors on the interaction of *LCF* and *CTRStd*. The coefficient β_3 (I) that estimates the effect of *LCF* and *CTRStd* is positive (0.001), whereas the coefficient β_7 (II) is 0.000. Results from an F-Test indicate that the sum of the coefficients (I + II) is not significantly different from zero at conventional levels ($P > F = 0.143$). This finding is inconsistent with our prediction.

Turning to carrybacks, we estimate a significant coefficient β_3 for the interaction of *LCB* and *CTRStd* in countries whose *Political Risk* is below the yearly median of the proxy. This is the baseline effect for countries with low *Political Risk*. The corresponding coefficient of $LCB*CTRStd$ is of similar magnitude (0.012) as documented in 4.1, translating into an increase of 13.8 percent in risk-taking after the enactment of a loss carryback.³⁹ Consistent with our

³⁸ We include *Fiscal Budget Risk* as a control variable when we use *Political Risk* as a *Country Risk Factor* for our estimation and vice versa.

³⁹ We calculate the effect of 13.8 percent ($=0.012/0.087$) by dividing the coefficient by the sample mean of *Firm Risk-Taking*.

theoretical predictions, we estimate a negative coefficient (-0.011) on β_7 providing initial evidence of a negative impact of *Political Risk* on corporate risk-taking. Importantly, the magnitude of the coefficient suggests that this negative effect reverses the positive effect estimated for countries with low *Political Risk*. Results from an F-test indicate that the sum of the coefficients (III + IV) is not different from zero indicating an offsetting effect of *Political Risk*.⁴⁰ The estimated effects are economically significant: the adoption of a loss carryback regime in countries with *Political Risk* below the median (e.g., Spain) is associated with a 13.8 percent increase in corporate risk-taking while a carryback rule adoption in countries above the median (e.g., Mexico) is associated with no increase in corporate risk-taking.⁴¹

Taken together, our results provide support for H1a for loss carrybacks but not for loss carryforwards. This result is consistent with the immediate cash flow effect of a loss carryback exerting an especially strong impact on risk-taking. By contrast, loss carryforwards only generate tax refunds if future profits are generated and country risk is low. If the tax refund is threatened by high country risk, it considerably reduces the tax incentive.⁴²

To test H1b, we investigate the effect of *Fiscal Budget Risk* on corporate risk-taking. Results are presented in Column (2) of Table 7. Inconsistent with our predictions, we do not find a negative impact of country risk for loss carryforwards (sum of the coefficients (*I* + *II*) of 0.000 and 0.002, respectively). However, we find a negative effect of *Fiscal Budget Risk* on risk-taking for loss carrybacks. Specifically, we estimate a positive effect of *LCB* for countries with *Fiscal Budget Risk* below the median (coefficient 0.011). Consistent with our predictions, we estimate a

⁴⁰ We test whether the sum of the coefficients (III + IV = 0.001) equals zero and do not reject the null (p-value = 0.922).

⁴¹ In untabulated tests, we also include an index aggregating creditor rights (La Porta et al. 1998; Acharya et al. 2011). Our results remain essentially unchanged.

⁴² This finding may be surprising but is in line with inconclusive results documented in prior literature: Langenmayr and Lester (2018) also estimate a significant negative effect of the interaction of LCF and tax rate (p. 251). We attribute this inconclusive finding to the low variation of the *LCF* measure.

negative coefficient (-0.012) for β_7 indicating that *Fiscal Budget Risk* reverses the positive effect of loss carrybacks. We test this attenuating effect of *Fiscal Budget Risk* using an F-test and do not reject the null hypothesis that the sum of the two coefficients (III + IV) equals zero (p-value = 0.729). Similar to our results for H1a, we find support for H1b for loss carrybacks but not for loss carryforwards. Moreover, the economic magnitude of *Fiscal Budget Risk* is similar to our estimates for *Political Risk* and is substantial.

In Panel B, we re-estimate equation (7) using an indicator variable equal to one if the *Country Risk Factor* is in the fourth quartile and zero otherwise. Compared to Panel A, we find more pronounced effects using this definition, corroborating our initial findings. While our results again indicate a *positive* effect of country risk for loss carryforwards, we find more pronounced effects especially for *Political Risk* (sum of coefficients (III + IV) equal to -0.035) compared to *Fiscal Budget Risk* (sum of coefficients (III + IV) equal to -0.008).⁴³ However, the negative sums of the coefficients (III + IV) indicate that high country risk environments can lead to negative impacts on corporate risk-taking if carrybacks are in place.⁴⁴ Overall, we find strong and consistent support for H1a and H1b with respect to loss carrybacks but not carryforwards.

<Insert Table 7 about here>

4.3 Effectiveness of loss offset provisions under tax rate increases and scaling effect of tax rate

In H2, we predict that a tax rate increase is more likely to discourage risk-taking if country risk is high. To investigate the effect of tax rate increases given an existing loss offset

⁴³ This is in line with prior literature that documents a significant effect of *Political Risk* (John et al. 2008; Djankov et al. 2010; Vegh and Vuletin 2015), especially for countries with a low level of governance and low quality of political institutions.

⁴⁴ In untabulated tests, we re-estimate equation (7) using continuous values of *Country Risk Factor*. The coefficients on $LCF/LCB*CTRS_{it}*Country Risk Factor$ provide the same inferences.

rule, we restrict our sub-sample to observations three years prior to and after tax rate increases, resulting in a sub-sample of 23,255 firm-year observations. We present our results in Table 8, Panel A (Panel B) for median splits (fourth quartile) of the respective *Country Risk Factor*. Our results are inconclusive for carryforwards. For carrybacks, our results indicate a more pronounced effect of *Fiscal Budget Risk* in both panels (sums of III+IV: 0.006/-0.061 vs. 0.016/-0.029). Again, the negative impact of country risk is more pronounced for the fourth quartile of country risk. These results are consistent with our findings in H1 and provide additional support for our theoretical model.

<Insert Table 8 about here>

H3 predicts that the negative impact of country risk increases in the underlying corporate tax rate. To test this conjecture, we split our sample at the median of corporate tax rates resulting in firm-year observations of countries with low (< 33%, Columns 1 and 3) and high (> 33%, Columns 2 and 4) corporate tax rates. We present our results in Table 9, Panel A, bifurcated between low and high corporate tax rates consisting of 108,886 and 130,862 firm-year observations, respectively.

For carryforwards, we find inconclusive results indicating positive sums of coefficients (I+II) in three out of four cases, suggesting a *positive* effect of country risk. For carrybacks, the results in columns (1) and (2) indicate a negative but insignificant effect of *Political Risk* for firms located in countries with high tax rates. The sum of coefficients (III + IV equal to 0.015) in Column (1) indicates a less pronounced negative effect of *Political Risk* for low corporate tax rates than for high corporate tax rates (Column 2, III + IV equal to -0.005). Our results in Columns (3) and (4) provide the same inference for *Fiscal Budget Risk*, providing initial support for H3.

To further corroborate our results, we re-estimate equation (7) limiting our sample only to observations three years before and after a tax rate increase (as in our tests of H2). Panel B presents the results for the two sub-samples consisting of 14,138 and 9,057 firm-year observations for low and high corporate tax rates, respectively. Consistent with our predictions of H2 and H3, we find the most pronounced effects of country risk for high corporate tax rates. Taken together, the findings in Panel A and B provide support for H3.

<Insert Table 9 about here>

4.4 Robustness tests

One major concern raised in prior literature is that tax policy reacts to the underlying economic changes and is not exogenously determined. This implies that firms in countries with changes in loss offset rules/tax rates are not comparable with firms in countries without these changes (Romer and Romer 2010; Vegh and Vuletin 2015; Ljungqvist and Smolyansky 2016).⁴⁵ To mitigate this concern, we use group-fixed effects to narrow the counterfactuals to firms in countries with similar macroeconomic conditions. Using this approach, we can further isolate the effect of tax rates changes. We use the same research designs as in equation (7) and apply Industry-Year Fixed Effects for countries with a similar GDP growth pattern and economic development level. Table 10 presents the results of these tests. Columns (1) and (2) show the results for country groups that are in the same quartile with respect to their GDP growth and hence comparable level of macroeconomic conditions (GDP-Growth-Quartile-Industry-Year fixed effects). This approach limits our counterfactuals to firms located in countries with comparable economic conditions and development levels (Vegh and Vuletin 2015). Inferences

⁴⁵ As Vegh and Vuletin (2015, p. 334) point out, tax policy is more volatile in developing countries than in industrial economies, resulting in larger changes of tax rates. The authors suggest that volatility of tax policy in developing economies is about 35 to 100 percent higher than in industrial countries. Furthermore, the authors find that tax policy is acyclical in industrial countries and procyclical in developing countries.

from both, loss carryforwards and carrybacks, and country risk factors remain the same but are somewhat less pronounced. In Columns (3) and (4), we restrict counterfactuals to countries with similar macroeconomic level and growth conditions (GDP-Growth-Quartile-Ln(GDP)-Industry-Year fixed effects) (Bethmann et al. 2018; Jacob, Michaely, and Müller 2018). Implications from our results remain unchanged. In Columns (5) to (6), we re-estimate our baseline regression using firm fixed effects. We add GDP-Growth-Quartile-Ln(GDP)-Industry-Year fixed effects in Columns (7) and (8). All specifications indicate a moderating effect of our country risk factors on the risk-taking mechanism. Overall, our results indicate a higher moderating effect of fiscal budget risk.

Further, we use a changes model that compares changes in $LCF/LCB*CTRStd$ and $LCF/LCB*CTRStd*Country\ Risk\ Factor$ that allows to remove confounding effects from time-invariant country-level conditions or policies (Ljungqvist et al. 2017). Untabulated tests confirm our inferences derived from our tests in 4.2. and 4.3.

<Insert Table 10 about here>

Next, we conduct several robustness tests to ensure that our results are not driven by our risk measure or certain countries. First, we use a modified measure of *Firm Risk-Taking* that is based on a five-year forward looking horizon. Second, we re-estimate equations (6) and (7) using the firm-level standard deviation of returns. Untabulated tests indicate similar results. Third, we remove all observations from countries with a) less than 50 and b) less than 200 observations. Again, inferences remain unchanged. Finally, we exclude the countries with the largest number of observations from our sample (USA, Japan, China, and India) to mitigate concerns about our sample selection procedure and potential effects driven by one country. In untabulated tests, we obtain similar results.

5. Conclusion

This paper investigates the effect of country risk factors on corporate risk-taking. Using a cross-country panel with 234 corporate tax rate changes and 49 changes in loss offset rules, we initially provide evidence that changes in tax loss offsets and corporate tax rates affect firm risk-taking. We then show that this effect is fully attenuated by country risk. Specifically, we document that in environments with high political risk, changes in loss offset rules and corporate tax rates are not associated with firms' propensity to take risk. Our results indicate an attenuating effect for two country risk factors, *Fiscal Budget Risk*, and *Political Risk*. Results from the second set of our tests indicate that country risk not only offsets the positive effects of loss carrybacks but reverses this effect when countries increase their corporate tax rates. Lastly, we find that the negative impact of country risk is more pronounced for firms located in countries with *high* statutory tax rates.

We add to the literature on the risk-sharing mechanism between government and companies (Langenmayr and Lester 2018; Ljungqvist et al. 2017) by the risk-sharing mechanism documented in prior literature does not hold in countries with high political risk and fiscal budget risk. We also add to the literature on the interaction between country risk and tax system characteristics (Cummins, Hasset, and Hubbard 1996; Djankov et al. 2010; Romer and Romer 2010; Vegh and Vuletin 2015; UNCTAD 2016). Moreover, our study identifies factors that explain cross-country variation in responses to tax rate changes and loss offset changes. This adds to the understanding of how corporate tax systems can be designed to incentivize corporate investment and risk-taking (IMF 2017). Overall, our findings suggest that country risk is an important determinant of corporate risk-taking that deserves consideration before implementing tax policies that aim to foster risk-taking.

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Appendix A: Effect of risk aversion on risk-taking

The effect of a higher tax rate on the disutility is illustrated in Figure 5.

<Insert Figure 5 about here>

Red color indicates a low tax rate ($t = 0.25$), while black indicates a high tax rate ($t = 0.5$).

Solid lines depict pre-tax values, dotted lines and dashed lines post-tax values (loss offset restriction with $\lambda = 0.5$ is dotted, full loss offset, i.e., $\lambda = 1$, is dashed). The direction of the overall tax effect ($A \gtrless B$) depends on the tax rate, risk aversion, and loss offset provisions.

An increase in the tax rate reduces after-tax profits decreasing the utility of expected after-tax profits (B). Simultaneously, this tax-induced cut in after-tax profits increases the marginal utility of the additional profit due to the changed level of risk aversion (curvature of the utility function).

The tax refund on incurred losses arises only if loss offset provisions are granted ($\lambda > 0$). Then, an increase in the tax rate increases the government's share and thus the firm's utility (A).

However, there are more forces at work in the domain of losses. First, loss offset restrictions reduce the utility gain from loss offset ($\Delta U_1, \Delta U_2$). This increase in disutility is scaled by the tax rate and thus increases in t . This effect is illustrated in Figure 5 by $\Delta U_1 > \Delta U_2$.

Second, also, the level of risk-aversion determines the size of A . The more pronounced risk aversion the more utility the investor assigns to the tax refund. As depicted in Figure 5, higher taxes induce higher tax refunds and thus lower post-tax losses. The resulting lower level of risk aversion mitigates the aforementioned first effect. This second effect is illustrated by the difference $\Delta U_3 > \Delta U_1$. As for lower post-tax losses risk aversion is less pronounced (curvature of the utility function), higher tax rates reduce risk aversion in the domain of losses. Weaker risk aversion due to higher taxes reduces the utility gain from the tax refund. This mechanism is

illustrated above. We see that the effect of a tax rate of 25% on the change in utility is stronger than the effect of an increase in the tax rate by further 25% (summing up to a tax rate of 50%).

Appendix B: Effect of loss offset provisions on risk-taking

Building on Domar and Musgrave 1944, we assume a firm that aims to invest a fixed amount I has to choose the level of risk (σ) involved. If the firm decides to increase the riskiness of investment (σ), the variance of the risky return increases, too. With probability p the invested amount I generates a profit given by the function $f_g(\sigma)$ with $f_g(\sigma) > 0$ (good state of nature), with probability $(1 - p)$ a loss of $f_b(\sigma) < 0$ is incurred (bad state of nature).

Consistent with Sandmo (1971), Appelbaum and Katz (1986), Asplund (2002), Janssen and Karamychev (2007) and Langenmayr and Lester (2018) we assume the firm maximizes its continuously differentiable and concave risk-utility function with $f'_g(\sigma) > 0$, $f'_b(\sigma) < 0$, $f''_g(\sigma) < 0$, $f''_b(\sigma) < 0$. Consistent with this literature, we assume firm level risk-aversion which can be interpreted as the manager's utility from firm returns. We introduce a corporate tax at rate t and a loss offset coefficient λ with $\lambda = 1$ describing a full loss offset and $\lambda = 0$ the absence of loss offset provisions. If $\lambda < 1$ then loss offset is restricted. The expected risk-utility from the risky investment is

$$E[U] = p \cdot U[(1 - t) \cdot (f_g(\sigma) - I)] + (1 - p) \cdot U[(1 - \lambda t) \cdot (f_b(\sigma) - I)], \quad (8)$$

with the net of taxes utilities $U[(1 - t)(f_g(\sigma) - I)] = U[(f_g(\sigma) - I)] - B$, where B denotes the tax payment on the profit in the good state of nature, and $U[(1 - t)(f_b(\sigma) - I)] = U[(f_b(\sigma) - I)] + A$, where A denotes the tax refund from loss offset in the bad state of nature (Langenmayr and Lester 2017). Due to risk-aversion, the utility gain from a full tax refund is larger than a corresponding expected utility loss from taxes on profits ($A > B$) (Domar and Musgrave 1944, Atkinson and Stiglitz 1980, Langenmayr and Lester 2017).

Consistent with the Domar-Musgrave framework, the firm decides on the optimal riskiness of the investment according to the first order condition (*FOC*):

$$\frac{\partial E[U(\pi)]}{\partial \sigma} = p \cdot U'[\pi_g] \cdot (1-t) \cdot f'_g(\sigma) + (1-p) \cdot U'[\pi_b] \cdot (1-\lambda t) \cdot f'_b(\sigma) = 0, \quad (9)$$

where $\pi_g = (1-t) \cdot (f_g(\sigma) - I) > 0$ and $\pi_b = (1-t) \cdot (f_b(\sigma) - I) < 0$ denote the after-tax profit and loss in either state of the world. Finally we obtain

$$\frac{d\sigma}{d\lambda} = \frac{\overbrace{\overbrace{(1-p) \cdot \tilde{t} \cdot f'_b(\sigma)}^{+} \cdot \overbrace{\left[\overbrace{U'[\pi_b]}^{+} + \overbrace{U''[\pi_b] \cdot \tilde{\pi}_b}^{-} \right]}^{<0}}^{-}}^{<0}}{\underbrace{\overbrace{p \cdot \overbrace{U''[\pi_g]}^{+} \cdot (1-t)^2 \cdot \underbrace{(f'_g(\sigma))^2}_{+}}^{+}}_{+} + \overbrace{p \cdot \overbrace{U'[\pi_g]}^{+} \cdot (1-t) \cdot \underbrace{f''_g(\sigma)}_{-}}^{+}}_{+} + \underbrace{\overbrace{(1-p) \cdot \overbrace{U''[\pi_b]}^{+} \cdot (1-\lambda t)^2 \cdot \underbrace{(f'_b(\sigma))^2}_{+}}^{+}}_{+} + \overbrace{(1-p) \cdot \overbrace{U'[\pi_b]}^{+} \cdot (1-\lambda t) \cdot \underbrace{f''_b(\sigma)}_{-}}^{+}}_{SOC < 0}} > 0 \quad (10)$$

with the second order condition, $SOC = p \cdot U''[\pi_g] \cdot (1-t)^2 \cdot (f'_g(\sigma))^2 + p \cdot U'[\pi_g] \cdot (1-t) \cdot f''_g(\sigma) + (1-p) \cdot U''[\pi_b] \cdot (1-\lambda t)^2 \cdot (f'_b(\sigma))^2 + (1-p) \cdot U'[\pi_b] \cdot (1-\lambda t) \cdot f''_b(\sigma) < 0$, in the denominator (Langenmayr and Lester 2017). The SOC is fulfilled as $f'_g(\sigma) > 0, f'_b(\sigma) < 0, f''_g(\sigma) < 0, f''_b(\sigma) < 0, U'[\pi_g] > 0, U'[\pi_b] > 0, U''[\pi_g] < 0$ and $U''[\pi_b] < 0$. Hence, we find a uniform positive effect of a marginal increase in loss offset provisions on risk-taking.

Appendix C: Effect of tax rate on risk-taking

By contrast, the effect of a tax rate increase is ambiguous.

$$\frac{d\sigma}{dt} = \frac{\overbrace{\begin{aligned} & \overbrace{p \cdot U''[\pi_g] \cdot \pi_g}^{+} \cdot \overbrace{f'_g(\sigma)}^{+} + \overbrace{p \cdot U'[\pi_g] \cdot f'_g(\sigma)}^{+} \\ & + \overbrace{(1-p) \cdot U''[\pi_b] \cdot \lambda \cdot \pi_b}^{+} \cdot \overbrace{f'_b(\sigma)}^{+} + \overbrace{(1-p) \cdot U'[\pi_b] \cdot \lambda \cdot f'_b(\sigma)}^{+} \end{aligned}}^{\geq 0}}{\underbrace{\begin{aligned} & \underbrace{p \cdot U''[\pi_g] \cdot (1-t)^2 \cdot (f'_g(\sigma))^2}_{+} + \underbrace{p \cdot U'[\pi_g] \cdot (1-t) \cdot f''_g(\sigma)}_{+} \\ & + \underbrace{(1-p) \cdot U''[\pi_b] \cdot (1-\lambda t)^2 \cdot (f'_b(\sigma))^2}_{+} + \underbrace{(1-p) \cdot U'[\pi_b] \cdot (1-\lambda t) \cdot f''_b(\sigma)}_{+} \end{aligned}}_{SOC < 0}} \geq 0. \quad (11)$$

Substituting for the Arrow-Pratt coefficient of relative risk aversion, $R_R(\pi) = -\frac{U''[\pi]}{U'[\pi]}|\pi|$, we

obtain, $\frac{d\sigma}{dt} = -\frac{p \cdot U'[\pi_g] \cdot f'_g(\sigma) \cdot [R_R(\pi) - 1] - \lambda \cdot (1-p) \cdot U'[\pi_b] \cdot f'_b(\sigma) \cdot [R_R(\pi) + 1]}{SOC} \geq 0$. The *SOC* is negative (see

Appendix B). Examining the numerator clarifies that risk-taking increases in the tax rate for

$$R_R > 0 \text{ if } p \cdot U'[\pi_g] \cdot f'_g(\sigma) \leq -(1-p) \cdot U'[\pi_b] \cdot (1-p) \cdot f'_b(\sigma) \text{ as } \left. \frac{d\sigma}{dt} \right|_{\lambda \rightarrow 1} > 0 \quad (12)$$

(Langenmayr and Lester 2017, p. 14). This equation illustrates that the level of risk aversion determines which one of the opposing effects in the numerator dominates.

Appendix D: Variable Definitions

Panel A: Firm-Level Variables Source: Thomson Reuters' Worldscope Database	
<i>Variable</i>	<i>Description and Source</i>
<i>Domestic</i>	Indicator variable for foreign operations. The variable is equal to one if a firm reports less than 10 percent of income, sales, and assets as foreign (Creal, Robinson, Rogers, and Zechman 2014; Langenmayr and Lester 2017). Source: Worldscope.
<i>Leverage</i>	Ratio of total liabilities (XWC 03351) to total assets (WC02999), winsorized at 1% and 99%. Source: Worldscope.
<i>MB</i>	Market-to-Book Ratio: Ratio of market capitalization (WC08001) to common equity (WC03501), winsorized at 1% and 99%. Source: Worldscope.
<i>Firm Risk-Taking</i>	Three-year firm risk-taking proxy: Three-year earnings volatility measure (John et al. 2008; Langenmayr and Lester 2017). It is defined as the standard deviation over three years of a firm's ROA's deviation from the industry-country specific average ROA. $RISK3y = \sqrt{\frac{1}{2} \sum_{t=1}^3 (E_{icjt} - \frac{1}{3} \sum_{t=1}^3 E_{icjt})^2}$, where $E_{icjt} = ROA_{icjt} - \frac{1}{N_{jct}} \sum_{k=1}^{N_{jct}} ROA_{k jct}$. <i>RISK3y</i> and <i>ROA</i> are winsorized at 1% and 99%. Source: Worldscope.
<i>ROA</i>	Return On Assets: Ratio of <i>EBIT</i> (WC18191) over assets (WC 02999), where <i>EBIT</i> is earnings before interest and taxes, winsorized at 1% and 99%. Source: Worldscope.
<i>Sales Growth</i>	Sales Growth: Year-to-year percentage change in revenues (WC01001), winsorized at 1% and 99%. Source: Worldscope.
<i>Size</i>	Firm Size: Natural logarithm of total assets in 1000 U.S. dollars (constant 2010 U.S. dollars) (WC02999), winsorized at 1% and 99%. Source: Worldscope.

Panel B: Country-Level Tax Variables

Source: Coopers & Lybrand International Tax Summaries;
Tax Handbooks published by Ernst & Young, PwC

<i>Variable</i>	<i>Description</i>
<i>CTR</i>	Country's statutory corporate tax rate. We compute this by including central and sub-central/local rates. In case that the tax system is progressive, we use the top marginal tax rate.
<i>CTRStd</i>	Standardized corporate tax rate (CTR) (over sample period). Mean is 0 and standard deviation is 1.
<i>LCB</i>	Loss carryback equals one if the country has a loss carryback in place and zero if the country does not.
<i>LCF</i>	Loss carryforward is the period for which losses can be carried forward, in years. If losses can be carried forward indefinitely, we set the value to 20 years.

Panel C: Country-Level Variables

Source: The World Bank (WGI) and IMF

<i>Variable</i>	<i>Description</i>
<i>Country Control Variables</i>	
<i>GDP Growth</i>	Annual percentage growth rate of GDP in constant 2010 U.S. dollars.
<i>Inflation</i>	Quartile rank of country's inflation rate in a sample year. Inflation is the rate of price change in a country measured by the annual growth rate of the GDP implicit deflator.
<i>Emerging markets</i>	The following countries are emerging markets: Argentina, Brazil, Bulgaria, Chile, China, Colombia, Hungary, India, Indonesia, Latvia, Lithuania, Malaysia, Mexico, Nigeria, Pakistan, Peru, Philippines, Poland, Romania, Russia, South Africa, Thailand, Turkey, Ukraine, and Venezuela. Source: IMF.
<i>Country Risk Variables</i>	
<i>Country Risk Factor</i>	Indicator variable equal to one if a firm is located in a country whose country risk indicator in year t is above the median (in the fourth quartile) of the sample year and zero otherwise.
<i>Fiscal Budget Risk</i>	
<i>Government Debt</i>	Country's percentage of gross debt of central government to country's GDP in a sample year, standardized over the sample period. Source: IMF Economic Outlook.
<i>Country Credit Rating</i>	Country's annual credit rating index in a respective year. A value

of 1 captures a “D” rating of a country. A value of 20 an “AAA” rating. We standardize the variable over the sample period. Source: Worldscope, Oxford Economic Outlook.

Political Risk

Political Risk

Composite governance index of a country’s (unweighted) mean of combined WGI measures (*Voice and Accountability, Political Stability, Government Effectiveness, Regulatory Quality, Rule of Law, Control of Corruption*) in a sample year (Dharmapala and Hines 2009). For ease of interpretation, we standardize the variable over the sample period and multiply it by -1 so that a higher value reflects higher political risk. Source: The World Bank (WGI).

Voice and Accountability

Yearly estimate of a country’s perceptions of the extent to which a country's citizens are able to participate in selecting their government, as well as freedom of expression, freedom of association, and a free media (WB).

Political Stability and Absence of Violence/Terrorism

Yearly estimate of perceptions of the likelihood that the government will be destabilized or overthrown by unconstitutional or violent means, including politically-motivated violence and terrorism (WB).

Government Effectiveness

Yearly estimate of perceptions of the quality of public services, the quality of the civil service and the degree of its independence from political pressures, the quality of policy formulation and implementation, and the credibility of the government's commitment to such policies (WB).

Regulatory Quality

Yearly estimate of perceptions of the ability of the government to formulate and implement sound policies and regulations that permit and promote private sector development (WB).

Rule of Law

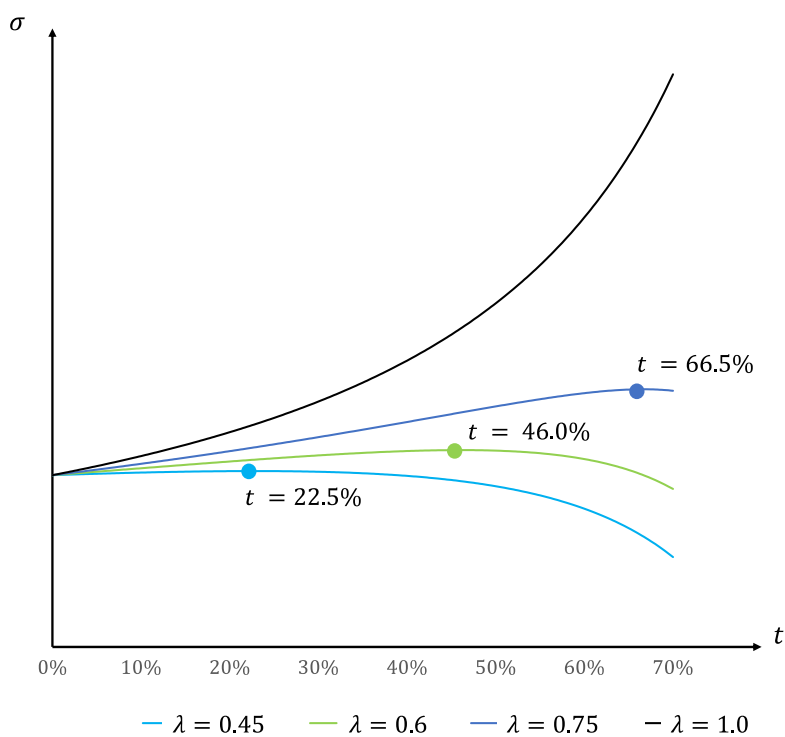
Yearly estimate of perceptions of the extent to which agents have confidence in and abide by the rules of society, and in particular the quality of contract enforcement, property rights, the police, and the courts, as well as the likelihood of crime and violence (WB).

Control of Corruption

Yearly estimate of perceptions of the extent to which public power is exercised for private gain, including both petty and grand forms of corruption, as well as "capture" of the state by elites and private interests (WB).

Figure 1: Optimal Risk-Taking σ as a Function of the Tax Rate t for various loss offset provisions λ

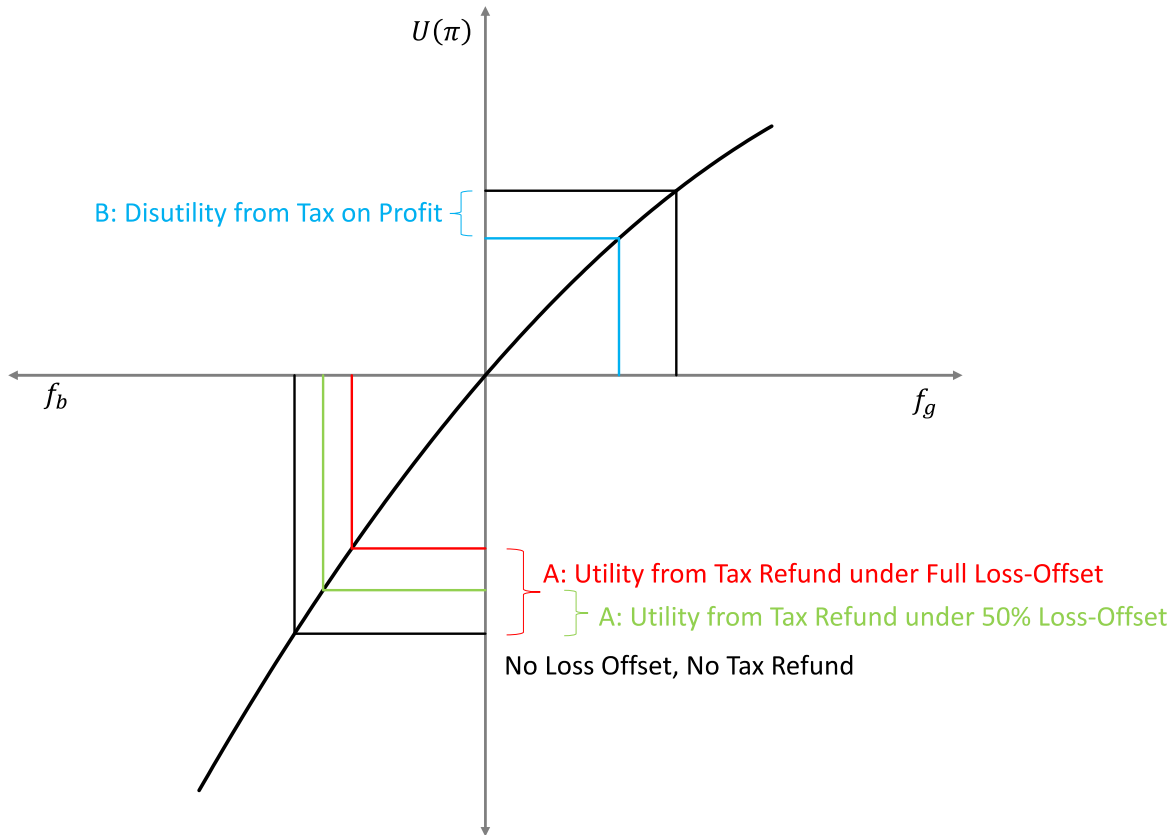
This figure illustrates optimal risk-taking under relative risk-aversion for different levels of loss-offset. E.g., for a logarithmic risk utility function risk-taking (σ) increases under a full loss offset ($\lambda = 1$) in the tax rate (t). Under more restrictive loss offset rules (e.g., $\lambda = 0.6$) the risk sharing mechanism induces increased risk-taking for tax rates that do not exceed a specific critical tax rate (e.g., for $\lambda = 0.6$ and $t = 46\%$), while risk-taking decreases in the tax rate for higher tax rates (e.g., for $\lambda = 0.6$ and $t \geq 46\%$). Obviously, depending on the level of loss offset provision, the tax incentive from loss offset provisions on risk-taking is neutralized by the income effect of higher tax rates at a critical tax rate and reverses for higher tax rates.



Source: own calculation.

Figure 2: Benefit from tax refund on a tax loss (A) in comparison to the disutility from taxes on profits (B)

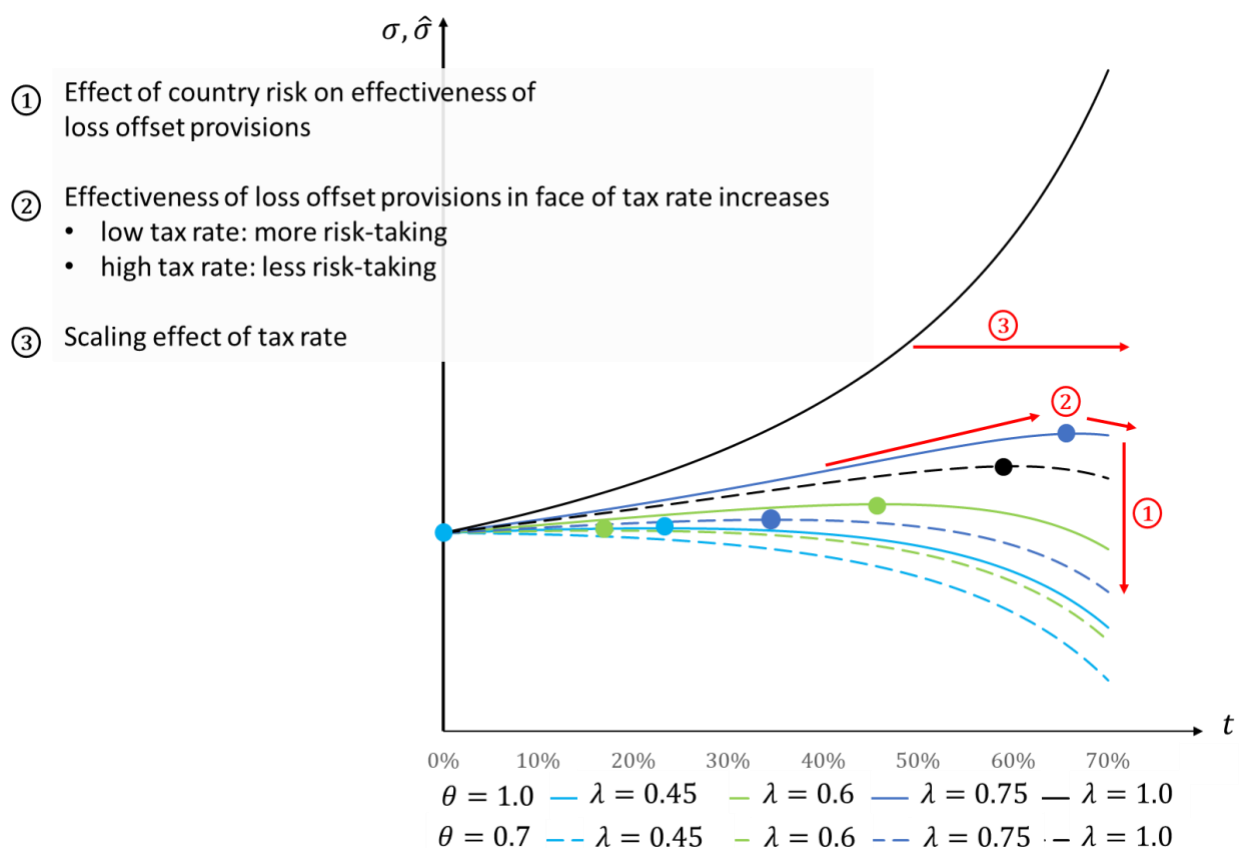
This figure illustrates the utility effects exemplified for a tax rate t of 30% under full loss offset ($\lambda = 1$), a loss offset of 50% ($\lambda = 0.5$) or no loss offset ($\lambda = 0$) for a risk-averse investor.



Source: modified from Langenmayr and Lester 2018, own calculations.

**Figure 3: Optimal Risk-Taking as a Function of the Tax Rate
for various loss offset provisions considering country risk**

This figure illustrates the effect of country risk (θ) on the reversal of the tax incentive from loss offset provisions on risk-taking in absence of country risk (σ) and with explicit country risk ($\hat{\sigma}$) as a function of the tax rate (t) for different levels of loss offset provisions (λ). Optimal risk-taking in absence of country risk is illustrated by solid lines while optimal risk-taking adjusted for country risk is plotted as dashed lines. Obviously, the optimal risk-taking decreases in face of country risk. Moreover, the critical tax rate (illustrated by circles, i.e., neutralization of tax incentive) also decreases in face of country risk (risk-taking maxima/circles of dashed lines in comparison to the risk-taking maxima/circles of solid lines).



Source: own calculation.

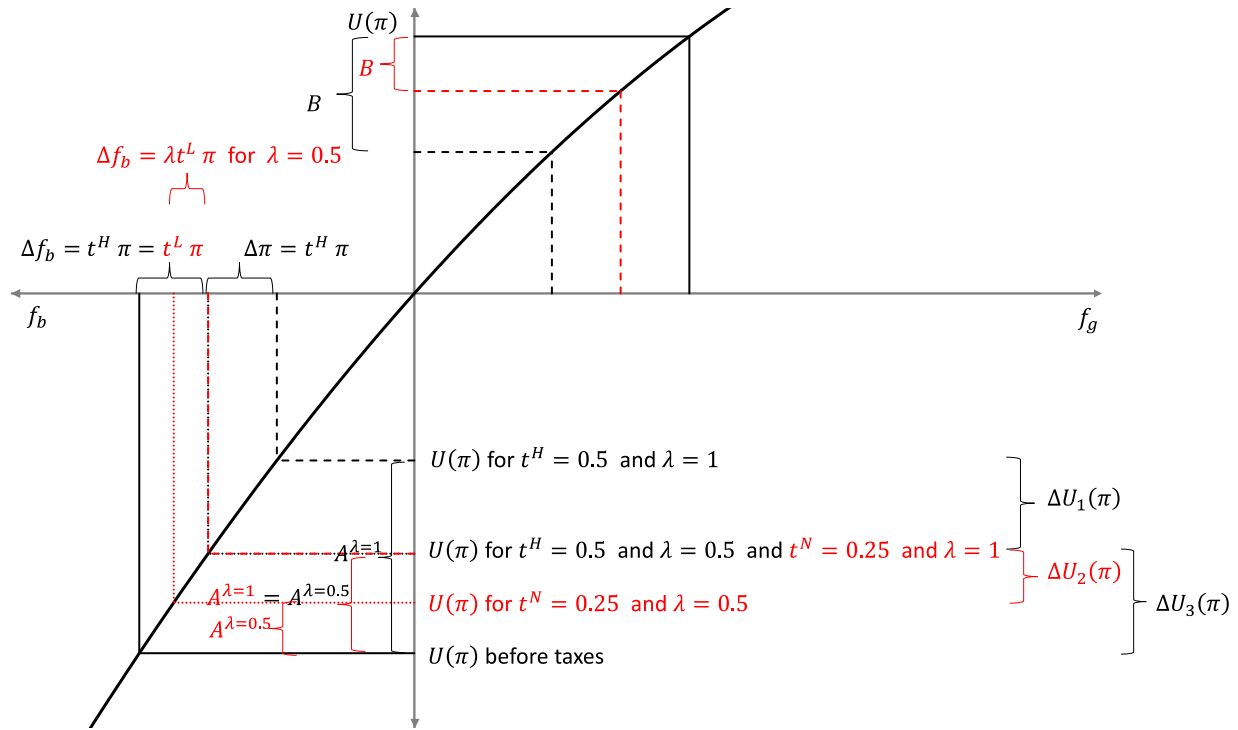
Figure 4: Countries Covered in Sample

This figure indicates those countries that are in our sample. Countries highlighted in black are in our sample and countries shaded in grey are not in our sample.



Figure 5: Decrease in utility due to loss offset restrictions for different tax rate levels

This figure illustrates the effect on risk aversion on the decrease in utility for different tax rate levels exemplified for a tax rate t of 25% and 50% under full loss offset ($\lambda = 1$) and a loss offset of 50% ($\lambda = 0.5$).



Source: own calculations.

Table 1: Sample Selection

This table describes the sample selection process for our sample over the period from 1992 to 2012

Step	Description	No. of observations dropped	No. of observations remaining
1	All firms listed in Thomson Reuters' Worldscope Database with non-missing data for total assets (1992-2014)		552,462
2	Less: observations of cross-listed firms	(5,643)	546,819
3	Less: observations of firms in the financial or utilities sector	(99,396)	447,423
4	Less: observations with missing risk-taking measures	(106,941)	340,482
5	Less: observations with missing control and country-level variables	(100,710)	239,772

Table 2: Sample Composition

This table summarizes the number of 239,772 observations per country in our sample over the period from 1992 to 2012.

Country	Obs.	Country	Obs.	Country	Obs.
Argentina	586	India	13,715	Philippines	1,372
Australia	9,898	Indonesia	3,586	Poland	2,232
Austria	736	Ireland	659	Portugal	580
Belgium	1,031	Israel	2,184	Romania	487
Brazil	2,013	Italy	1,964	Russia	1,023
Bulgaria	827	Japan	38,050	Singapore	4,961
Canada	7,503	Jordan	377	Slovak Rep.	58
Chile	1,555	Kazakhstan	7	South Africa	2,437
China	19,365	Kenya	166	Spain	1,329
Colombia	202	Korea	13,494	Sweden	3,000
Croatia	405	Latvia	56	Switzerland	2,315
Czech Rep.	44	Lithuania	138	Thailand	5,170
Denmark	1,453	Luxembourg	188	Tunisia	154
Egypt	516	Malaysia	8,628	Turkey	2,249
Finland	1,419	Mexico	1,179	Uganda	2
France	6,025	Morocco	214	Ukraine	102
Germany	6,400	Netherlands	1,398	United Kingdom	10,229
Ghana	59	New Zealand	775	United States	41,167
Greece	1,735	Nigeria	147	Venezuela	55
Hong Kong	8,683	Norway	1,195	Zimbabwe	2
Hungary	180	Pakistan	1,308		
Iceland	50	Peru	735		

Table 3: Descriptive Statistics

This table presents descriptive statistics of our main variables for 25,906 firms and 239,772 firm-year observations over the period from 1992 to 2012. Panel A presents summary statistics for firm-level variables. Panel B presents summary statistics for country-level variables. All continuous variables are winsorized at the 1 and 99 percent levels. Variables are defined in Appendix D.

Variable	N	Mean	Standard Deviation	Minimum	25th Percentile	Median	75th Percentile	Maximum
Panel A: Firm-Level Variables								
Firm Risk-Taking	239,772	0.087	0.183	0.000	0.012	0.031	0.081	1.352
Size	239,772	12.043	2.133	6.317	10.707	12.030	13.393	17.296
Leverage	239,772	0.527	0.354	0.024	0.321	0.501	0.661	2.744
Sales Growth	239,772	0.209	0.795	-0.884	-0.040	0.073	0.228	6.072
ROA	239,772	0.002	0.300	-2.049	0.010	0.057	0.108	0.378
MB	239,772	2.159	3.426	-8.429	0.712	1.361	2.564	22.362
Panel B: Country-Level Variables								
LCF	239,772	12.846	6.921	0.000	5.000	10.000	20.000	20.000
LCB	239,772	0.457	0.498	0.000	0.000	0.000	1.000	1.000
CTR	239,772	0.329	0.078	0.100	0.280	0.330	0.390	0.582
GDP Growth	239,772	0.073	0.098	-0.171	0.017	0.066	0.129	0.305
Inflation	239,772	0.027	0.036	-0.034	0.008	0.021	0.039	0.181
Political Risk	239,772	5.134	4.526	-4.865	1.962	7.184	8.606	11.004
Control of Corruption	239,772	0.973	0.962	-0.986	0.125	1.265	1.766	2.390
Government Effectiveness	239,772	1.148	0.721	-0.451	0.524	1.459	1.697	2.229
Political Stability	239,772	0.370	0.781	-1.678	-0.090	0.595	0.980	1.441
Regulatory Quality	239,772	0.982	0.737	-0.541	0.490	1.146	1.593	2.015
Rule of Law	239,772	0.993	0.783	-0.826	0.417	1.319	1.589	1.948
Voice and Accountability	239,772	0.667	0.880	-1.666	0.422	0.998	1.312	1.656
Government Debt	239,772	0.739	0.545	0.097	0.349	0.636	0.860	2.373
Country Debt Rating	239,772	16.700	3.849	0.001	14.250	18.333	19.889	20.000

Table 4: Distribution of Country Risk factors in Sample

This table presents the distribution of the quartiles of the respective country risk factors for the countries in the sample. The quartiles are based on the yearly rank of the country within the respective risk measure.

Country	Obs	Political Risk					Fiscal Budget Risk				
		Mean	SD	P25	P50	P75	Mean	SD	P25	P50	P75
Argentina	586	4.000	0.000	4.000	4.000	4.000	2.594	0.900	2.000	2.000	3.000
Australia	9,898	1.000	0.000	1.000	1.000	1.000	1.000	0.000	1.000	1.000	1.000
Austria	736	1.000	0.000	1.000	1.000	1.000	2.829	0.376	3.000	3.000	3.000
Belgium	1,031	1.929	0.257	2.000	2.000	2.000	3.933	0.250	4.000	4.000	4.000
Brazil	2,013	4.000	0.000	4.000	4.000	4.000	2.756	0.548	3.000	3.000	3.000
Bulgaria	827	4.000	0.000	4.000	4.000	4.000	1.000	0.000	1.000	1.000	1.000
Canada	7,503	1.000	0.000	1.000	1.000	1.000	3.200	0.400	3.000	3.000	3.000
Chile	1,555	2.729	0.477	2.000	3.000	3.000	1.000	0.000	1.000	1.000	1.000
China	19,365	4.000	0.000	4.000	4.000	4.000	1.000	0.000	1.000	1.000	1.000
Colombia	202	4.000	0.000	4.000	4.000	4.000	1.623	0.486	1.000	2.000	2.000
Croatia	405	3.000	0.000	3.000	3.000	3.000	1.696	0.461	1.000	2.000	2.000
Czech Rep.	44	3.000	0.000	3.000	3.000	3.000	1.186	0.394	1.000	1.000	1.000
Denmark	1,453	1.000	0.000	1.000	1.000	1.000	2.019	0.606	2.000	2.000	2.000
Egypt	516	4.000	0.000	4.000	4.000	4.000	3.222	0.416	3.000	3.000	3.000
Finland	1,419	1.000	0.000	1.000	1.000	1.000	1.933	0.250	2.000	2.000	2.000
France	6,025	2.351	0.477	2.000	2.000	3.000	2.664	0.601	2.000	3.000	3.000
Germany	6,400	1.122	0.328	1.000	1.000	1.000	2.628	0.483	2.000	3.000	3.000
Ghana	59	4.000	0.000	4.000	4.000	4.000	1.500	0.505	1.000	1.500	2.000
Greece	1,735	3.108	0.311	3.000	3.000	3.000	4.000	0.000	4.000	4.000	4.000
Hong Kong	8,683	1.527	0.589	1.000	1.000	2.000	1.096	0.295	1.000	1.000	1.000
Hungary	180	3.000	0.000	3.000	3.000	3.000	2.609	0.489	2.000	3.000	3.000
Iceland	50	1.000	0.000	1.000	1.000	1.000	2.900	1.344	1.000	4.000	4.000
India	13,715	4.000	0.000	4.000	4.000	4.000	3.000	0.000	3.000	3.000	3.000
Indonesia	3,586	4.000	0.000	4.000	4.000	4.000	1.815	0.923	1.000	2.000	2.000
Ireland	659	1.163	0.370	1.000	1.000	1.000	2.329	1.252	1.000	2.000	4.000
Israel	2,184	3.000	0.000	3.000	3.000	3.000	3.191	0.393	3.000	3.000	3.000
Italy	1,964	3.000	0.000	3.000	3.000	3.000	4.000	0.000	4.000	4.000	4.000
Japan	38,050	2.628	0.483	2.000	3.000	3.000	3.984	0.127	4.000	4.000	4.000
Jordan	377	4.000	0.000	4.000	4.000	4.000	2.784	0.412	3.000	3.000	3.000
Kazakhstan	7	4.000	0.000	4.000	4.000	4.000	1.000	0.000	1.000	1.000	1.000
Kenya	166	4.000	0.000	4.000	4.000	4.000	2.012	0.109	2.000	2.000	2.000
Korea	13,494	3.000	0.000	3.000	3.000	3.000	1.000	0.000	1.000	1.000	1.000
Latvia	56	3.000	0.000	3.000	3.000	3.000	1.382	0.490	1.000	1.000	2.000
Lithuania	138	3.000	0.000	3.000	3.000	3.000	1.452	0.500	1.000	1.000	2.000
Luxembourg	188	1.000	0.000	1.000	1.000	1.000	1.000	0.000	1.000	1.000	1.000
Malaysia	8,628	3.317	0.465	3.000	3.000	4.000	1.988	0.170	2.000	2.000	2.000
Mexico	1,179	4.000	0.000	4.000	4.000	4.000	1.954	0.209	2.000	2.000	2.000
Morocco	214	4.000	0.000	4.000	4.000	4.000	2.146	0.354	2.000	2.000	2.000
Netherlands	1,398	1.000	0.000	1.000	1.000	1.000	2.353	0.478	2.000	2.000	3.000
New Zealand	775	1.000	0.000	1.000	1.000	1.000	1.279	0.449	1.000	1.000	2.000

Country	Obs	Political Risk					Fiscal Budget Risk				
		Mean	SD	P25	P50	P75	Mean	SD	P25	P50	P75
Nigeria	147	4.000	0.000	4.000	4.000	4.000	1.020	0.142	1.000	1.000	1.000
Norway	1,195	1.000	0.000	1.000	1.000	1.000	1.585	0.493	1.000	2.000	2.000
Pakistan	1,308	4.000	0.000	4.000	4.000	4.000	2.417	0.493	2.000	2.000	3.000
Peru	735	4.000	0.000	4.000	4.000	4.000	1.414	0.493	1.000	1.000	2.000
Philippines	1,372	4.000	0.000	4.000	4.000	4.000	2.151	0.358	2.000	2.000	2.000
Poland	2,232	3.000	0.000	3.000	3.000	3.000	2.000	0.000	2.000	2.000	2.000
Portugal	580	2.633	0.497	2.000	3.000	3.000	2.686	0.796	2.000	2.000	3.000
Romania	487	4.000	0.000	4.000	4.000	4.000	1.112	0.316	1.000	1.000	1.000
Russia	1,023	4.000	0.000	4.000	4.000	4.000	1.031	0.219	1.000	1.000	1.000
Singapore	4,961	1.056	0.229	1.000	1.000	1.000	3.784	0.412	4.000	4.000	4.000
Slovak Rep.	58	3.000	0.000	3.000	3.000	3.000	1.750	0.437	1.500	2.000	2.000
South Africa	2,437	3.399	0.490	3.000	3.000	4.000	1.650	0.477	1.000	2.000	2.000
Spain	1,329	2.816	0.388	3.000	3.000	3.000	2.242	0.428	2.000	2.000	2.000
Sweden	3,000	1.000	0.000	1.000	1.000	1.000	2.132	0.339	2.000	2.000	2.000
Switzerland	2,315	1.000	0.000	1.000	1.000	1.000	2.211	0.408	2.000	2.000	2.000
Thailand	5,170	3.970	0.172	4.000	4.000	4.000	1.902	0.298	2.000	2.000	2.000
Tunisia	154	4.000	0.000	4.000	4.000	4.000	2.000	0.000	2.000	2.000	2.000
Turkey	2,249	4.000	0.000	4.000	4.000	4.000	2.144	0.390	2.000	2.000	2.000
Uganda	2	4.000	0.000	4.000	4.000	4.000	1.000	0.000	1.000	1.000	1.000
Ukraine	102	4.000	0.000	4.000	4.000	4.000	1.990	0.099	2.000	2.000	2.000
UK	10,229	1.422	0.494	1.000	1.000	2.000	2.347	0.650	2.000	2.000	3.000
United States	41,167	1.787	0.409	2.000	2.000	2.000	2.895	0.713	2.000	3.000	3.000
Venezuela	55	4.000	0.000	4.000	4.000	4.000	1.556	0.572	1.000	2.000	2.000
Zimbabwe	2	2.490	1.116	1.000	2.000	3.000	2.481	1.116	1.000	2.000	3.000

Table 5: Correlation Table

This table provides Pearson correlations for the sample. Bold letters denote statistical significance at the 1 percent level.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
(1) Firm Risk-Taking	1													
(2) Size	-0.341	1												
(3) Leverage	0.293	-0.057	1											
(4) Sales Growth	0.076	-0.076	-0.023	1										
(5) ROA	-0.634	0.395	-0.400	-0.045	1									
(6) MB	0.024	-0.003	-0.131	0.086	0.039	1								
(7) LCF	0.243	-0.105	0.011	0.064	-0.167	0.06	1							
(8) LCB	0.131	0.057	0.071	-0.020	-0.11	0.018	0.357	1						
(9) CTR	-0.001	0.114	0.118	-0.039	-0.027	0.015	-0.102	0.288	1					
(10) GDP Growth	-0.022	-0.043	-0.053	0.063	0.047	0.050	-0.101	-0.211	-0.212	1				
(11) Inflation	-0.016	-0.097	-0.011	0.082	0.062	0.038	-0.070	-0.283	-0.259	0.419	1			
(12) Political Risk	-0.170	-0.001	-0.013	-0.006	0.152	-0.005	-0.554	-0.497	-0.193	0.338	0.564	1		
(13) Government Debt	-0.104	0.147	0.052	-0.098	0.030	-0.097	-0.241	0.134	0.536	-0.275	-0.482	-0.259	1	
(14) Country Debt Rating	0.156	0.072	0.036	0.004	-0.153	0.065	0.366	0.447	0.365	-0.241	-0.536	-0.736	0.180	1

Table 6: Effect of Tax Rates and Loss Offset Rules on Corporate Risk-Taking

This table presents regression results on firm risk-taking over the 1992 to 2012 period. The variable *Firm Risk-Taking* is defined as the standard deviation over three years of a firm's *ROA*'s deviation from the industry-country specific average *ROA*. In columns (1) and (2), we estimate equation (6) without the interactions of loss offset rules and standardized corporate tax rates using the full sample. In columns 3 (4), we estimate equation [6] using the full sample without (with) *Inflation* and country risk controls. In column (5), we estimate equation (6) for domestic firms (*Domestic* = 1), i.e. firms that have more than 10% of their business operations not in the country in which they are headquartered. All specifications include industry-by-year fixed effects. We report robust standard errors clustered by firm and by country-year in parentheses. *, **, and *** denote significance at the 10%, 5%, and 1% level, respectively. Independent variables are described in Appendix D.

	<i>Dependent Variable: Firm Risk-Taking</i>				
	(1)	(2)	(3)	(4)	(5)
LCF	0.005*** (0.000)	0.003*** (0.000)	0.003*** (0.000)	0.002*** (0.000)	0.002*** (0.000)
LCB	0.019*** (0.005)	0.013*** (0.003)	0.011*** (0.003)	0.008*** (0.003)	0.010*** (0.003)
CTRStd	0.003 (0.003)	-0.001 (0.002)	-0.016*** (0.002)	-0.004 (0.003)	-0.003 (0.003)
LCF*CTRStd			0.001*** (0.000)	0.001** (0.000)	0.001* (0.000)
LCB*CTRStd			0.008*** (0.003)	0.007*** (0.003)	0.008*** (0.003)
Size		-0.009*** (0.001)	-0.009*** (0.001)	-0.009*** (0.001)	-0.011*** (0.001)
Leverage		0.047*** (0.004)	0.046*** (0.004)	0.047*** (0.004)	0.051*** (0.004)
Sales Growth		0.005*** (0.001)	0.005*** (0.001)	0.004*** (0.001)	0.004*** (0.001)
ROA		-0.312*** (0.006)	-0.311*** (0.006)	-0.310*** (0.006)	-0.305*** (0.007)
MB		0.002*** (0.000)	0.002*** (0.000)	0.002*** (0.000)	0.001*** (0.000)
GDP Growth		0.035** (0.015)	0.022 (0.013)	0.015 (0.014)	0.009 (0.014)
Inflation				-0.009*** (0.002)	-0.006*** (0.002)
Political Risk				-0.011*** (0.002)	-0.011*** (0.002)
Fiscal Budget Risk				0.002 (0.002)	0.001 (0.002)
Industry-by-Year FE	Yes	Yes	Yes	Yes	Yes
Observations	239,772	239,772	239,772	239,772	184,570
Adjusted R-squared	0.114	0.453	0.455	0.456	0.475

Table 7: Interactive Effect of Tax System Changes and Country Risk Factors

This table presents regression results on firm risk-taking over the 1992 to 2012 period. The variable *Firm Risk-Taking* is defined as the standard deviation over three years of a firm's *ROA*'s deviation from the industry-country specific average *ROA*. In Panel A (B), we define *Country Risk Factor* as an indicator variable equal to one if the firm is located in a country whose country risk proxy in year *t* is above the yearly median of the proxy (in the fourth quartile) and zero otherwise. In column (1), we present results from estimates of equation (7) using *Political Risk* as *Country Risk Factor*, in column (2) from estimates of equation (7) using *Fiscal Budget Risk* as *Country Risk Factor*. The main effects specified in equation (7) are included in the model but are not reported in this table. We include industry-by-year fixed effects. We report robust standard errors clustered by firm and by country-year in parentheses. *, **, and *** denote significance at the 10%, 5%, and 1% level, respectively. Independent variables are described in Appendix D.

Panel A: Median split of <i>Country Risk Factor</i>		
	<i>Dependent Variable: Firm Risk-Taking</i>	
	Political Risk	Fiscal Budget Risk
	(1)	(2)
(I) LCF*CTRStd	0.001*** (0.000)	0.002*** (0.000)
(II) LCF*CTRStd*Country Risk Factor	0.000 (0.001)	0.000 (0.000)
Sum of Coefficients (I + II)	0.001	0.002***
P > F (I + II = 0)	[0.143]	[0.002]
(III) LCB*CTRStd	0.012*** (0.004)	0.011** (0.005)
(IV) LCB*CTRStd*Country Risk Factor	-0.011** (0.005)	-0.012** (0.006)
Sum of Coefficients (III + IV)	0.001	-0.001
P > F (III + IV = 0)	[0.922]	[0.729]
<i>Country Risk Factor</i> interactions & Firm- and Country-level controls & Industry-by-Year fixed effects included		
Observations	239,772	239,772
Adjusted R-squared	0.458	0.458
Panel B: Indicator variable equal to one if <i>Country Risk Factor</i> is in the fourth Quartile		
	(1)	(2)
(I) LCF*CTRStd	0.000** (0.000)	-0.000 (0.000)
(II) LCF*CTRStd*Country Risk Factor	0.001*** (0.000)	0.002*** (0.000)
Sum of Coefficients (I + II)	0.001***	0.002***
P > F (I + II = 0)	[0.000]	[0.000]
(III) LCB*CTRStd	0.008*** (0.003)	0.016*** (0.004)
(IV) LCB*CTRStd*Country Risk Factor	-0.043*** (0.013)	-0.024*** (0.005)
Sum of Coefficients (III + IV)	-0.035***	-0.008**
P > F (III + IV = 0)	[0.008]	[0.024]
<i>Country Risk Factor</i> interactions & Firm- and Country-level controls & Industry-by-Year fixed effects included		
Observations	239,772	239,772
Adjusted R-squared	0.456	0.457

Table 8: Effectiveness of Loss Offset Provisions in face of Tax Rate Increases

This table presents regression results on firm risk-taking over the 1992 to 2012 period. We restrict our sub-sample to observations three years prior and post to tax rate increases. The variable *Firm Risk-Taking* is defined as the standard deviation over three years of a firm's *ROA*'s deviation from the industry-country specific average *ROA*. In Panel A (B), we define *Country Risk Factor* as an indicator variable equal to one if the firm is located in a country whose country risk proxy in year *t* is above the yearly median of the proxy (in the fourth quartile) and zero otherwise. In column (1), we present results from estimates of equation (7) using *Political Risk* as *Country Risk Factor*, in column (2) from estimates of equation (7) using *Fiscal Budget Risk* as *Country Risk Factor*. The main effects specified in equation (7) are included in the model but are not reported in this table. We include industry-by-year fixed effects. We report robust standard errors clustered by firm and by country-year in parentheses. *, **, and *** denote significance at the 10%, 5%, and 1% level, respectively. Independent variables are described in Appendix D.

Panel A: Median split of Country Risk Factor		
	<i>Dependent Variable: Firm Risk-Taking</i>	
	Political Risk	Fiscal Budget Risk
	(1)	(2)
(I) LCF*CTRStd	-0.002*** (0.001)	-0.000 (0.000)
(II) LCF*CTRStd*Country Risk Factor	0.003*** (0.001)	0.000 (0.001)
Sum of Coefficients (I + II)	0.001***	0.000
P > F (I + II = 0)	[0.001]	[0.9102]
(III) LCB*CTRStd	0.020*** (0.005)	0.016*** (0.004)
(IV) LCB*CTRStd*Country Risk Factor	-0.004 (0.007)	-0.010 (0.006)
Sum of Coefficients (III + IV)	0.016***	0.006
P > F (III + IV = 0)	[0.001]	[0.266]
<i>Country Risk Factor interactions & Firm- and Country-level controls & Industry-by-Year fixed effects included</i>		
Observations	23,255	23,255
Adjusted R-squared	0.412	0.408
Panel B: Indicator variable equal to one if Country Risk Factor is in the fourth Quartile		
(I) LCF*CTRStd	0.000 (0.000)	0.000 (0.000)
(II) LCF*CTRStd*Country Risk Factor	-0.001 (0.001)	0.002 (0.001)
Sum of Coefficients (I + II)	-0.001	0.002*
P > F (I + II = 0)	[0.342]	[0.054]
(III) LCB*CTRStd	0.015*** (0.003)	0.012*** (0.004)
(IV) LCB*CTRStd*Country Risk Factor	-0.044*** (0.013)	-0.073*** (0.013)
Sum of Coefficients (III + IV)	-0.029**	-0.061***
P > F (III + IV = 0)	[0.023]	[0.006]
<i>Country Risk Factor interactions & Firm- and Country-level controls & Industry-by-Year fixed effects included</i>		
Observations	23,255	23,255
Adjusted R-squared	0.407	0.412

Table 9: Effect of Country Risk in Countries with Low vs. High Corporate Tax Rates

This table presents regression results on firm risk-taking over the 1992 to 2012 period. The variable *Firm Risk-Taking* is defined as the standard deviation over three years of a firm's ROA's deviation from the industry-country specific average ROA. In Panel A, we estimate equation (7) including all observations. In Panel B, we restrict our sub-sample to observations three years prior and post to tax rate increases. We define *Country Risk Factor* as an indicator variable equal to one if the firm is located in a country whose country risk proxy is above the yearly median of the proxy. In columns (1) and (2), we estimate equation (7) using *Political Risk*, in column (3) and (4) using *Fiscal Budget Risk* as *Country Risk Factor*. Columns (1) and (3) present results for firms in countries with statutory corporate tax rates below the median (33%). Columns (2) and (4) present results for firms in countries with statutory corporate tax rates above the median (33%). The main effects specified in equation (7) are included in the model but are not reported in this table. We include industry-by-year fixed effects. We report robust standard errors clustered by firm and by country-year in parentheses. *, **, and *** denote significance at the 10%, 5%, and 1% level, respectively. Independent variables are described in Appendix D.

Panel A: All observations

	<i>Dependent Variable: Firm Risk-Taking</i>			
	<i>Political Risk</i>		<i>Fiscal Budget Risk</i>	
	Low Tax Rate	High Tax Rate	Low Tax Rate	High Tax Rate
	(1)	(2)	(3)	(4)
(I) LCF*CTRStd	-0.000 (0.001)	0.000 (0.001)	-0.000 (0.000)	0.001 (0.001)
(II) LCF*CTRStd*Country Risk Factor	0.000 (0.001)	0.002 (0.001)	0.001** (0.000)	0.004*** (0.001)
Sum of Coefficients (I + II)	0.000	0.002*	0.001*	0.004***
P > F (I + II = 0)	[0.401]	[0.0757]	[0.0946]	[0.000]
(III) LCB*CTRStd	0.017** (0.007)	0.008 (0.015)	0.026*** (0.006)	-0.009 (0.015)
(IV) LCB*CTRStd*Country Risk Factor	-0.002 (0.009)	-0.013 (0.016)	-0.022* (0.012)	-0.000 (0.015)
Sum of Coefficients (III + IV)	0.015**	-0.005	0.004	-0.009
P > F (III + IV = 0)	[0.021]	[0.456]	[0.699]	[0.198]
Observations	108,886	130,862	108,886	130,862
Adjusted R-squared	0.403	0.507	0.404	0.509

Country Risk Factor interactions & Firm- and Country-level controls & Industry-by-Year fixed effects included

Panel B: Tax rate increases

	Low Tax Rate	High Tax Rate	Low Tax Rate	High Tax Rate
	(1)	(2)	(3)	(4)
(I) LCF*CTRStd	0.001 (0.001)	0.003 (0.003)	0.004** (0.001)	-0.003*** (0.001)
(II) LCF*CTRStd*Country Risk Factor	0.000 (0.001)	0.000 (0.001)	0.002 (0.002)	0.004 (0.003)
Sum of Coefficients (I + II)	0.001	0.003*	0.006	0.001
P > F (I + II = 0)	[0.139]	[0.067]	[0.116]	[0.801]
(III) LCB*CTRStd	0.022*** (0.006)	0.046*** (0.014)	0.031 (0.019)	-0.000 (0.023)
(IV) LCB*CTRStd*Country Risk Factor	-0.013 (0.009)	-0.095*** (0.030)	-0.018 (0.029)	-0.069 (0.051)
Sum of Coefficients (III + IV)	0.009	-0.049	0.013	-0.069*
P > F (III + IV = 0)	[0.399]	[0.146]	[0.778]	[0.073]
Observations	14,138	9,057	14,138	9,057
Adjusted R-squared	0.409	0.475	0.410	0.469

Country Risk Factor interactions & Firm- and Country-level controls & Industry-by-Year fixed effects included

Table 10: Robustness Tests – Country-Group and Firm-Level Analyses

This table presents regression results on firm risk-taking over the 1992 to 2012 period. The variable *Firm Risk-Taking* is defined as the standard deviation over three years of a firm's *ROA*'s deviation from the industry-country specific average *ROA*. In columns (1), (3), (5), and (7), we estimate equation (7) using *Political Risk*, in column (2), (4), (6), and (8) using *Fiscal Budget Risk* as *Country Risk Factor*. The main effects specified in equation (7) are included in the model but are not reported in this table. In Panel A (B), we define *Country Risk Factor* as an indicator variable equal to one if the firm is located in a country whose country risk proxy in year *t* is above the yearly median of the proxy (in the fourth quartile) and zero otherwise. In Columns (1) and (2), we calculate quartiles of GDP growth in each year and then include GDP–Growth–Industry–Year fixed effects. In Columns (3) and (4), we calculate quartiles of GDP growth and quartiles of GDP in the current year in each year and then include GDP–Growth–Level–Industry–Year fixed effects. In Columns (5) and (6), we include firm fixed effects, and in Columns (7) and (8) we include firm fixed and GDP–Growth–Level–Industry–Year fixed effects. We report robust standard errors clustered by firm and by country-year in parentheses for Columns (1) to (4) and by country in Columns (5) to (8). *, **, and *** denote significance at the 10%, 5%, and 1% level, respectively. Independent variables are described in Appendix D.

Median split of Country Risk Factor			<i>Dependent Variable: Firm Risk-Taking</i>					
	Political	Fiscal	Political	Fiscal	Political	Fiscal	Political	Fiscal
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
<i>(I)</i> LCF*CTRStd	0.000 (0.000)	-0.000 (0.000)	0.001** (0.000)	0.000 (0.000)	0.002*** (0.000)	0.001*** (0.000)	0.001*** (0.000)	-0.000 (0.000)
<i>(II)</i> LCF*CTRStd*Country Risk Factor	0.000 (0.001)	0.001** (0.000)	-0.002*** (0.001)	-0.000* (0.000)	-0.001 (0.001)	0.001*** (0.000)	-0.001** (0.000)	0.000 (0.000)
Sum of Coefficients (I + II)	0.000	0.001***	-0.001**	0.000	0.001	0.002***	0.000	0.000
P > F (I + II = 0)	[0.205]	[0.001]	[0.041]	[0.861]	[0.175]	[0.000]	[0.997]	[0.692]
<i>(III)</i> LCB*CTRStd	0.007 (0.005)	0.007* (0.004)	0.014*** (0.004)	0.012*** (0.004)	0.007* (0.004)	0.021*** (0.005)	0.009* (0.005)	0.010** (0.004)
<i>(IV)</i> LCB*CTRStd*Country Risk Factor	-0.001 (0.005)	-0.007 (0.005)	-0.008 (0.005)	-0.006 (0.006)	0.003 (0.004)	-0.016*** (0.006)	-0.002 (0.004)	-0.007 (0.004)
Sum of Coefficients (III + IV)	0.006***	0.000	0.006**	0.006	0.010**	0.005	0.007**	0.003
P > F (III + IV = 0)	[0.017]	[0.926]	[0.036]	[0.141]	[0.068]	[0.285]	[0.032]	[0.410]
Observations	239,617	239,617	238,905	238,905	238,130	238,130	237,252	237,252
Adjusted R-squared	0.471	0.470	0.494	0.494	0.582	0.583	0.614	0.614
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE	No	No	No	No	Yes	Yes	Yes	Yes
GDP-Growth- Quartile-Industry-Year FE	Yes	Yes	No	No	No	No	No	No
GDP-Growth-Quartile-Ln(GDP)-Ind-Year FE	No	No	Yes	Yes	No	No	Yes	Yes
Cluster	Country-Year	Country-Year	Country-Year	Country-Year	Country	Country	Country	Country

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