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FACULDADE DE ECONOMIA
UNIVERSIDADE DO PORTO

CORPORATE SOCIAL RESPONSIBILITY AND OPTIMAL CAPITAL STRUCTURE: A DYNAMIC ANALYSIS

André Miguel da Silva Ferreira

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Filipe Macedo Pinto Grilo

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Abstract

Corporate Social Responsibility (CSR) practices are increasingly recognized as strategic tools that may impact various aspects of a firm, including its financial strategy. In this context, CSR policies may influence the definition of a dynamic and proactive financing policy. Thus, this dissertation aims to study the dynamic relationship between CSR and the Optimal Capital Structure (OCS). Specifically, the goal of this dissertation is twofold. First, I assess the dynamic impact of OCS determinants on the debt ratio and test if this impact depends on the CSR level. Second, I analyse the dynamic impact of CSR investments on the OCS and test if this impact depends on specific firm characteristics.

To this end, I employ the P-VAR and IP-VAR methodologies. These models allow for a dynamic representation of the OCS decision-making process by admitting bidirectional causality between multiple determinants, CSR, and the debt ratio. The IP-VAR further allows including a set of interactions between the CSR score and each determinant. Incorporating these interactions is critical to assess if the impact of CSR on the debt ratio depends on firm characteristics and if the impact of a determinant on the OCS depends on the CSR level.

The results indicate that CSR investments lead to a gradual increase in the debt ratio over time, with the magnitude of this increase being greater for larger firms in the long-term. Moreover, CSR weakens the positive influence of profitability and tax shields on the long-term OCS, but strengthens the positive impact of firm size. Therefore, these findings emphasize that a one-size-fits-all approach to long-term debt management may not be appropriate. Firms should tailor their debt levels, considering their unique characteristics and the intensity of their CSR policies.

JEL codes: D25, G32, M14

Keywords: Corporate Social Responsibility; Optimal Capital Structure; Panel VAR

Resumo

As práticas de Responsabilidade Social Corporativa (RSC) são cada vez mais reconhecidas como instrumentos estratégicos que podem impactar vários aspetos de uma empresa, incluindo a estratégia financeira. Neste contexto, as políticas de RSC podem influenciar a definição da política de financiamento dinâmica e proactiva. Assim, esta dissertação tem como objetivo estudar a relação dinâmica entre a RSC e a Estrutura Ótima de Capital (EOC). Especificamente, o objetivo desta dissertação é duplo. Primeiro, avalio o impacto dos determinantes da EOC no *debt ratio* e testo se esse impacto depende do nível de RSC. Segundo, analiso o impacto dinâmico dos investimentos em RSC na EOC e testo se esse impacto depende das características da empresa.

Para o efeito, utilizo as metodologias P-VAR e IP-VAR. Estes modelos permitem uma representação dinâmica do processo de definição da EOC, admitindo causalidade bidirecional entre os múltiplos determinantes, RSC e *debt ratio*. O IP-VAR permite incluir um conjunto de interações entre o *score* da RSC e cada um dos determinantes. A incorporação destas interações é fundamental para avaliar se o impacto da RSC no *debt ratio* depende das características das empresas e se o impacto de um determinante na EOC depende do nível de RSC.

Os resultados sugerem que o investimento em RSC promove um aumento gradual do rácio da dívida ao longo do tempo, sendo a magnitude deste aumento superior para as empresas de maior dimensão, no longo prazo. Além disso, a RSC enfraquece a influência positiva da rendibilidade e dos *tax shileds* na EOC, a longo prazo, mas reforça o impacto positivo da dimensão da empresa. Portanto, estas conclusões sublinham que uma abordagem *one-size-fits-all* na gestão da dívida de longo prazo pode não ser adequada. As empresas devem adaptar os seus níveis de endividamento, considerando as suas características e a intensidade das políticas de RSC

Códigos JEL: D25, G32, M14

Palavras-chave: Responsabilidade Social Corporativa; Estrutura Ótima de Capitais; VAR em Painel

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Abbreviations

BTM: Book-to-Market

CSR: Corporate Social Responsibility

ESG: Environmental, Social, and Governance

IP-VAR: Interacted Panel Vector Autoregression

KPI: Key Performance Indicator

LTDEIR: Long-term debt or equity issuances or repurchases

NFCND: Neither financially constrained nor distressed

NPV: Net Present Value

OCS: Optimal Capital Structure

P-VAR: Panel Vector Autoregression

US: United States

1. Introduction

The firm's financing structure is a strategic decision that affects its value. In this context, Optimal Capital Structure (OCS) theories suggest that there is an optimal debt level for each firm that depends on its characteristics (also known as determinants of OCS), such as size, profitability, and asset structure (e.g., Frank & Goyal, 2009). Moreover, the firm external environment (e.g., the environment's capacity to support sustained growth) tends to condition the relationship between the firm characteristics and the OCS (e.g., Kayo & Kimura, 2011). Consequently, the firm external environment may thus strengthen or weaken the relevance of some determinants, conditioning the OCS. As such, in today's dynamic world, one may argue that the constant change in firm characteristics and environment implies a constant refinement in the optimal debt level. Hence, firms ought to undertake proactive and forward-looking debt management.

In other words, any event that influences the firm characteristics and environment also contributes to the change in the debt ratio. Among these events, I highlight the adoption of Corporate Social Responsibility (CSR) policies. These policies have gained relevance in the business world in recent years, with companies looking to CSR programs as strategic tools that impact multiple business dimensions. Namely, these policies may influence, over time, some OCS determinants, such as profitability, size, or asset structure (e.g., Lins et al., 2017). Therefore, CSR policies may dynamically affect the firm's optimal debt level. Thus, this dissertation seeks to answer the following research question: How can CSR dynamically affect the OCS definition?

So far, the literature tested if there is a significant relationship between CSR and observed capital structure (e.g., Sharfman & Fernando, 2008). In this sense, these studies seek to explain the current debt ratio based on the current firm's features and based on the actual CSR level. Despite the lack of consensus in the literature, these studies have the merit of assessing CSR's direct and static impact on observed capital structure. However, to the best of my knowledge, four issues in the relationship between CSR and OCS remain unexplored.

First, these studies have performed a *static* analysis, and thus have limited capacity to study how the investment in CSR practices may *dynamically* affect the evolution of the debt ratio. Second, these studies only analyse the *direct* effects of CSR on the debt ratio, potentially neglecting the *indirect* effects of CSR on the debt ratio, i.e., CSR effects on other variables that mediate the relationship with the debt ratio. Third, none of these studies targets the study of OCS. These studies only focus on observed capital structure, as they do not apply the lessons from the empirical OCS literature by not considering only the contexts in which financing decisions may be optimal (e.g., Van Binsbergen et al., 2010). Fourth, these studies are not addressing how the level of CSR - as a factor that may affect the firm's environment - may condition the magnitude of the time variation in the debt ratio, resulting from an increase in a determinant of OCS.

Therefore, this dissertation seeks to fill the gap in the literature by meeting four goals. First, I test whether the OCS setting is a dynamic process in which intertemporal causality relationships exist among the determinants. Thus, I explore the dynamic impact of determinants on the OCS, i.e., how the change in one determinant affects the other determinants and, ultimately, the debt ratio over time. Second, I explore how CSR investment impacts the various determinants and, ultimately, the optimal debt ratio over time. In other words, I explore the dynamic impact of CSR policies on the OCS. Third, I assess whether the dynamic impact of CSR on the OCS depends on firms' characteristics. Finally, I assess whether the dynamic impact of determinants on the OCS depends on the CSR level. To do so, I depart from the literature in four ways.

First, to analyse the dynamic impact of determinants on OCS, I apply the Panel Vector Autoregression (P-VAR) model, assuming all variables to be endogenous. This assumption allows the establishment of intertemporal causality relationships among the various OCS determinants and between the determinants and the optimal debt ratio. Moreover, in line with Van Binsbergen et al. (2010), I only consider observations for firms that can perform optimal decisions, i.e., firms that do not face financial constraints. These options allow me to create an empirical model that best represents the rational decision-making process of firms, thus allowing the study of OCS. The use of the P-VAR, besides enabling the identification of the direct impacts of each determinant on the debt ratio (in line with the OCS literature), also allows the identification of the indirect effects of each determinant on the debt ratio, i.e., the effect that the determinant has on other determinants, which in this way influence the OCS. Hence, the remaining determinants act as mediator variables of the relationship.

Second, to identify the dynamic impact of CSR on OCS, I allow my empirical model to consider the existence of potential bidirectional causal relations between CSR, the determinants, and the debt ratio. Such methodological decisions, besides allowing the identification of the direct impacts of CSR on the debt ratio (in line with the literature), also enables the identify the indirect effects of CSR on the debt ratio, i.e., the effects that CSR policies have on the OCS determinants, which mediate the relationship with the optimal debt ratio. Additionally, applying a type of the P-VAR model allows me to see the temporal profile of CSR effects, dividing this impact into three temporal dimensions: short-term, medium-term, and long-term.

Third, I introduce in the empirical model the possibility of non-linear relationships between CSR and the optimal debt ratio, allowing the dynamic impact of CSR to depend on firm characteristics. The estimation of non-linear relationships is possible in the context of the Interacted Panel Vector Autoregression (IP-VAR) methodology through the introduction of interaction terms between the CSR score and each determinant. To this end, the IP-VAR allows constructing and comparing two IRFs at different percentiles of the distribution of the variables belonging to the interaction. For example, for a shock in CSR, I compute an average IRF for the larger firms and compute another average IRF for the smaller firms. If the difference between the two IRFs is systematic, then the size affects the impact of CSR on a given endogenous variable. Therefore, the introduction of interactions permits me to explore how firm characteristics may condition the magnitude and direction of direct and indirect effects of CSR on the debt ratio over time.

Fourth, I allow for the possibility of non-linear relationships between the determinants and the debt ratio, enabling the dynamic impact of each determinant on the debt ratio to depend on the firms' CSR level. It is feasible by including the interactions between CSR and determinants in the IP-VAR. This methodology allows building two IRFs at different percentiles of the CSR score variable. Namely, for a shock on a given determinant, I compute the mean IRFs for firms with higher CSR and lower CSR. By analysing whether the difference between the IRFs is systematic, one can perceive whether the magnitude and direction of the direct and indirect effects of determinants on the OCS depend on the level of CSR.

The main findings are as follows. First, I find causal relationships among the OCS determinants. This result suggests that determinants impact OCS dynamically through direct and indirect effects. Hence, ignoring indirect effects may compromise the full assessment of the long-term impacts on debt generated by the variation in the value of determinants. Second, in the long-term, an increase in CSR leads to an increase in the firm's growth potential and a reshaping of the firm's asset structure in favour of intangibles. These two effects lead to an increase in the optimal debt ratio over time. Third, firm size is the only firm characteristic that affects the magnitude of the long-term effects of CSR on OCS. The larger the company, the higher the increase in debt ratio following an investment in CSR. Fourth, the CSR level may change the magnitude of the long-term impact of determinants on OCS. For more responsible firms - compared to less responsible ones - an increase in size leads to a higher increase in debt, while increased profitability and tax shields yield a lower increase in the debt ratio.

These findings have implications for corporate policies, especially for the definition of a dynamic financing strategy. Mainly, the results imply that long-term debt management is not a one-size-fits-all policy. Thus, firms should adjust their debt levels, from short- to long-term, considering firm characteristics and CSR policy intensity. Moreover, the findings may help firms to forecast which determinants gain and lose relevance in the long-term, allowing them to manage proactively their debt, with more efficiency.

The dissertation is organized as follows. The next section reviews the literature on CSR and OCS. Section 3 presents the variables and empirical methodology. In section 4, I describe the data. Section 5 presents and discusses the empirical findings on the impacts of CSR practices on the OCS definition process. Finally, section 6 concludes.

2. Literature review

This section has four subsections. While Subsection 2.1 presents the key concepts of this dissertation, the other three subsections review the three strands of literature related to this dissertation. The first branch of literature explores the theories and determinants of OCS, while the second assesses the impact of CSR on a set of relevant financial variables to this study. These two strands of literature are related in a sequential logic because the second one explores the impact of CSR on financial variables that may correspond to determinants of the OCS, identified by the first literature (e.g., profitability). Hence, from the coupling of the two branches, one can identify potential indirect effects through which CSR affects the OCS.[1] The third branch seeks to assess if CSR impacts the observed capital structure.

2.1. Concepts: CSR and OCS

This dissertation has two key concepts: CSR and OCS. First, according to the Commission of the European Communities (2001), CSR is a set of practices in which companies voluntarily incorporate social and environmental objectives in their operations and relationships with stakeholders. At the genesis of these practices, the idea is to create shared value, reconciling economic value with social value via the response to social problems and needs (Porter & Kramer, 2011).

Second, OCS corresponds to the mix of debt and equity that maximises the firm's value. If initially maximising the value of the firm meant minimising the cost of capital (e.g., Modigliani & Miller, 1963), at a later stage the Trade-off-theory (TOT) went beyond the cost of capital by identifying several costs and benefits of debt, such as greater financial flexibility or a disciplining effect on management (e.g., Jensen, 1986). According to this theory, OCS is achieved when debt's marginal costs and benefits equalize.

2.2. OCS: Theories and determinants

The literature on OCS is extensive and generally focuses on two complementary subjects. First, several studies have explained the OCS by identifying the costs and benefits of debt, such as tax shields and bankruptcy costs, among others (e.g., Goldstein et al., 2001; Jensen, 1986; Modigliani & Miller, 1963). Second, other studies have examined variables that may influence the costs and benefits of debt, i.e., the determinants of OCS (e.g., Degryse et al.,

[1] In Appendix A, I present a systematic scheme of the multiple indirect effects by which CSR may operate.

2012; Frank & Goyal, 2009). In this section, I first review the benefits and costs of debt and, afterwards, the main determinants of OCS.

Starting with the benefits of debt, the literature has highlighted two key benefits. First, debt offers the possibility of a tax shield, as argued by Modigliani and Miller (1963). The increase in debt raises the amount of interest paid, reducing taxable income and, consequently, the tax payment. Therefore, the generation of tax shields reduces the cost of debt and creates incentives to increase debt. Second, debt tends to discipline the manager (Jensen, 1986). The separation between ownership and control generates agency costs between managers and shareholders since the former tend to act in their interest in the absence of control over managers (Jensen & Meckling, 1976). In this sense, since debt raises the risk of bankruptcy, the manager is interested in being efficient, aligning his interests with the shareholders' interests (Harris & Raviv, 1990). Hence, debt yields efficiency, increasing the firm's value.

Turning to the costs of debt, the literature has highlighted three key costs. First, increasing debt raises the likelihood of bankruptcy and, consequently, bankruptcy costs (Miller, 1988). As a result, there is an incentive to reduce debt to minimise the costs of bankruptcy. Second, debt increases agency costs between shareholders and lenders (Fama & French, 2002; Jensen & Meckling, 1976). These costs arise because while lenders prefer safe investments, shareholders prefer profitability, which tends to increase with risk, creating moral hazard problems. In the face of moral hazard, lenders seek to monitor and apply covenants to control firms' opportunistic behaviour. Such actions by lenders tend to translate into higher interest rates and the loss of financial flexibility of firms, making debt less attractive (Arnold, 2008; Jensen & Meckling, 1976). Third, flexibility loss costs arise when projects with positive NPVs are lost due to a lack of financing. In this sense, these costs increase as debt increases (borrowing capacity is reduced). Thus, the greater the opportunities (and flexibility loss costs), the more incentives there are to reduce debt (Goldstein et al., 2001).

I now turn to the main determinants of OCS, i.e., the variables that may influence the benefits and costs of debt and, consequently, OCS. The empirical literature, based on the arguments of the theoretical OCS studies, has proposed a myriad of determinants, from which I highlight six of the most referred ones: size, asset structure, risk, profitability, marginal tax rate and growth opportunities.[2]

[2] The literature also suggests other determinants such as arbitrage opportunities, shareholder structure, type of industry, or macroeconomic factors such as inflation.

First, firm size plays a crucial role in influencing debt costs and benefits. Larger firms enjoy certain advantages such as increased diversification, resulting in a lower risk of bankruptcy (Titman & Wessels, 1988). Moreover, the firm size influences the extent of two categories of agency costs. On the other hand, larger firms are better equipped to address information asymmetry issues, leading to lower agency costs between *shareholders* and *lenders* (Cassar & Holmes, 2003) and, thus, better financing conditions. On the other hand, the complexity of management structures in larger firms can hinder control over managers' behaviour, giving rise to agency costs between *shareholders* and *managers* (Singh & Davidson, 2003). Consequently, firms have an incentive to employ higher levels of debt to discipline management. Therefore, all these arguments point to lower debt costs and higher debt benefits and, thus, higher optimal debt levels. In agreement, empirical research generally finds a positive relationship between firm size and leverage (e.g., Balios et al., 2016; Kayo & Kimura, 2011; Sheikh & Wang, 2011).

Second, several studies have highlighted asset structure (e.g., the weight of tangible and intangible assets) as an important determinant. For tangible assets, there are two opposing perspectives. On the one hand, tangible assets may be used as collateral, reducing the risk for lenders, thus reducing agency costs and mitigating the problem of asymmetric information (Degryse et al., 2012). Hence, the decrease in debt costs increases the attractiveness of debt. In line with this view, the generality of the empirical literature tends to support a positive relationship between debt and collateral assets (e.g., Degryse et al., 2012; Frank & Goyal, 2009; Kayo & Kimura, 2011). On the other hand, Titman and Wessels (1998) argue that, in firms with less collatable assets, the monitoring of capital outlays is more complex. This means less control over managers, increasing the risk of their opportunistic behaviour (e.g., consuming more than the optimal level of perquisites). To avoid managers consuming excessive perquisites, firms with fewer collaterals tend to increase debt to discipline management. This negative relationship between collatable assets and leverage is evidenced by Sheikh and Wang (2011) and Booth et al. (2001).

Regarding intangible assets, Larkin (2013) argues that more intangibles (i.e., higher brand perception) promote a reduction in the company's risk and the consequent reduction in bankruptcy costs, which incentives the use of debt. In the same vein, empirical studies have found that intangible assets are also positively related to leverage (Lim et al., 2020; Van Binsbergen et al., 2010)

Third, risk (i.e., greater profit volatility) can affect OCS through two effects. On the one hand, the increased risk is directly associated with bankruptcy costs (Bradley et al., 1984), and thus, in response to increased risk, firms should reduce debt since leverage increases risk and bankruptcy costs (Miller, 1988). On the other hand, a higher firm's risk translates into higher risk for shareholders, who demand a higher rate of return, making equity less attractive compared to debt. Despite these two contrary effects, Bradley et al. (1984) state that the relationship between debt and risk is negative unless bankruptcy costs are negligible. The empirical literature has overwhelmingly supported such a view (e.g., Frank & Goyal, 2009; Sheikh & Wang, 2011)

Fourth, firms with higher profitability can meet long-term obligations. This idea suggests fewer financial difficulties and bankruptcy costs, meaning higher profitability is synonymous with higher debt (Alipour et al., 2015). Empirically, the evidence between profitability and debt is mixed. Some studies find that higher debt levels are related to higher profitability (e.g., Danis et al., 2014). Contrarily, Frank and Goyal (2009), Fama and French (2002) and Sheikh and Wang (2011) find a negative relationship with profits. Alipour et al. (2015) justify these opposite results by stating that firms with these features have more internal resources, thus not requiring debt. This argument is consistent with Pecking Order Theory (POT) premises.

Fifth, the next determinant is the marginal tax rate (MTR), which represents the present value of the tax benefit for a dollar of interest deduction (Graham, 1996). The TOT postulates that the higher the MTR, the higher the debt tax shields, increasing debt incentives. In fact, several studies suggest a positive relationship between MTR and debt level (e.g., Graham, 1996; MacKie-Mason, 1990). Despite that, some firms still have low or zero debt levels, despite having low bankruptcy costs and high MTR (Strebulaev & Yang, 2013).

Finally, growth opportunities can directly affect two costs/benefits of debt. On the one hand, in the presence of growth opportunities, higher debt increases flexibility loss costs because it may financially restrict the firm from taking advantage of all opportunities. Therefore, when faced with opportunities, firms should keep their debt low to avoid missing projects with positive NPV. On the other hand, Jensen (1986) postulates that, in the absence of growth opportunities and the presence of large cash flows, the risk of opportunistic behaviour by the manager is greater and therefore debt has a greater disciplining effect. While both arguments suggest that opportunities and debt are inversely related, the evidence is mixed depending on the variables used to represent these opportunities. Using measures of historical growth opportunities (e.g., sales growth), Chen (2004) and Cassar and Holmes (2003) find that past opportunities and debt have a positive relationship. This last finding is justified by POT arguments, since growth opportunities exhausted intern funds, which require recur to the extern funds with a lower level of information asymmetry, i.e., short-term debt. In this sense, the debt will be temporarily taken to respond to financing needs (DeAngelo, 2022). Using variables representing future investment opportunities (e.g., book-to-market ratio), several studies verify that future opportunities and debt have an inverse relationship (e.g., Barclay et al., 2006). However, it is also relevant to point out that the book-to-market ratio (BTM) can also be seen as a proxy of financial distress risk since distressed firms tend to present a higher ratio (Fama & French, 1995). By this view, if BTM is higher, then the cost of debt is raised, leading to a decrease in debt.

So far, I have presented the branch of empirical and theoretical literature that reports a multiplicity of direct and unidirectional links from determinants to the optimal debt ratio. However, when one takes a broader view of the dynamics surrounding the OCS definition, one can see that assuming that the relationship between determinants and OCS is direct and unidirectional may be too restrictive for two reasons. First, there may be bidirectional causal relationships between debt and multiple determinants. The empirical literature recognises this bidirectional relationship, as the related research uses debt ratio as explanatory variables of several determinants of OCS, such as profitability or MTR (e.g., Lins et al., 2017; Van Binsbergen et al., 2010), for example. Taking such relationships into account allows for exploring possible looping effects between variables, making it possible to identify possible multiplier effects. Second, there may be causal relationships among the various determinants. To illustrate, it is common to point to size, risk and growth opportunities as determinants of firms' profitability (e.g., Asimakopoulos et al., 2009; Lins et al., 2017), while profitability can be referred to as a driver of growth opportunities (Nunes et al., 2013). By disregarding these links between determinants, one is ignoring the indirect effects that a determinant has on the OCS, i.e., the effect of the determinant on the other determinants that mediate the relationship with the debt ratio.

To the best of my knowledge, the existing literature tends to overlook such types of causal relationships. Here arises room for improvement in the literature since considering such relationships allows for exploring all the dynamics underlying the definition of the OCS. Namely, it allows identifying the indirect impacts of a determinant on OCS.

2.3. The Impact of CSR on determinants of OCS

So far, the literature on CSR has assessed if this strategic tool has impacted several financial variables (e.g., Albuquerque et al., 2018; Cheung, 2016; Mishra & Modi, 2013). Although studies are not directly concerned with determinants, some variables they explore correspond to OCS determinants. Additionally, to better understand the relationship between CSR and the OCS determinants, I take a step back by exploring what the literature says about the costs and benefits of CSR.

On the cost side, CSR policies entail the consumption of resources such as cash (valued by its opportunity cost) and employee time, leading to productivity losses and the consequent need to hire more (Sprinkle & Maines, 2010).

On the benefit side, CSR policies promote enhanced reputation and transparency. I argue that these two benefits may exert influence on the costs/benefits of debt in different ways. On the one hand, the increase in transparency promotes the reduction of lenders' information asymmetry, generating a reduction in agency costs (Cui et al., 2018). Additionally, the greater disclosure and transparency of the firm's activity provokes a higher discipline effect on managers' decisions (Kanodia & Lee, 1998). Thus, I argue that there is a direct relationship between transparency and debt costs/benefits. On the other hand, I advocate that increasing reputation exerts an indirect effect on the costs/benefits of debt since reputation has a direct impact on the determinants of OCS, which then affect the costs/benefits of debt. This increase in reputation is felt in the relationship with three key stakeholders (e.g., Hsu, 2012; Pérez, 2015).

First, Cui et al. (2018) find that CSR decreases agency costs with lenders, suggesting that the firm's reputation with lenders is strengthened. Such a reduction in agency costs is in line with the empirical findings that CSR increases credit ratings (e.g., Attig et al., 2013; Jiraporn et al., 2014) and reduces debt costs (e.g., Raimo et al., 2021). Despite these results, Goss and Roberts (2011) find that CSR only decreases the interest rate when borrowers are of low quality (with significant agency problems); CSR does not impact the interest level when these are of high quality. Second, Porter and Kramer (2006) state that firms that develop CSR practices have relationships with stakeholders strengthened, which allows for increasing the company's reputation in the face of society (Harjoto & Salas, 2017; Melo & Galan, 2011).

Third, CSR may also generate improved reputation/trustworthiness amongst customers (Park & Kim, 2019), exerting effects at two levels: increasing earnings and reducing earnings volatility. The empirical literature generally supports the premise that CSR promotes increased sales and earnings (e.g., Lins et al., 2017). These results may occur because CSR is seen as a product differentiation strategy (Flammer, 2015), promoting increased consumer loyalty (Luo & Bhattacharya, 2009). In this context, Albuquerque et al. (2018) argue that increased consumer loyalty makes demand less *price-elastic*, allowing to practice higher profit margins and prices. This trend is reflected in increased profits and the absolute value of sales. Regarding the level of earnings volatility, the literature tends to identify a negative relationship between CSR and sales volatility. At this level, Albuquerque et al. (2018) argue that CSR, by generating more loyalty, promotes a lower *elasticity of profits* to aggregate shocks in the economy and, thus, lower earnings volatility. Such view is confirmed by Lins et al. (2017) and Bae et al. (2021) who find that firms with higher CSR levels exhibited higher stock returns during the financial crisis and the Covid-19 pandemic, respectively.

So far, I have reviewed the costs and benefits triggered by CSR policies. From here on, I make my interpretation of the literature, which allows me to create links between different branches of the literature. Hence, I establish hypothetical linkages that give a more structured view of how these CSR costs and benefits may influence each of the six determinants of OCS discussed above.[3] First and second, I advocate that the impact of CSR on size and growth opportunities may be positive, considering two main motivations: (*i*) Sales growth driven by CSR (e.g., Lins et al., 2017) generates future investment needs and opportunities; (*ii*) The reduction in interest rates and greater access to credit makes financing more attractive, which may increase the number of projects with positive NPVs being taken up.

Third, the asset structure may be altered by CSR. In particular, I argue that CSR can increase the weight of intangibles in the asset structure, since CSR, by promoting an increase in reputation in the face of society, leads to an increase in intangible assets associated with brand value (Melo & Galan, 2011).

Fourth, most empirical studies highlight that CSR and risk have an inverse relationship. This relationship may be verified at two levels: CSR reduces systematic risk, making results less correlated with the business cycle (e.g., Albuquerque et al., 2018); and CSR reduces idiosyncratic risk (e.g., Mishra & Modi, 2013). Conversely, Jo and Harjoto (2014), in light of the CSR overinvestment theory, hypothesize CSR investment may lead to increased risk.

[3] In Appendix A, I present a systematic scheme of the links between CSR and the various determinants of OCS. I support these linkages based on the costs and benefits of CSR.

According to them, excessive investment in CSR may represent a factor for increased corporate risk as the firm misallocates its scarce resources.

Fifth, regarding profitability, the empirical literature overwhelmingly supports a positive relationship with CSR (e.g., Lins et al., 2017). I advocate that this positive relationship may occur due to the increase in profit margins driven by CSR (Albuquerque et al., 2018) and the decrease in interest payments. However, evidence also presents a negative relationship between CSR and profitability. Harjoto and Jo (2011) find that increases in CSR can lead to reduced profitability in firms with high managerial entrenchment. Such findings are justified based on CSR overinvestment theory, according to which managers tend to overinvest in CSR programs (harming shareholders) because by making such investments they obtain private benefits in the form of enhancing their reputation as good global citizens (Barnea & Rubin, 2010).

Finally, I propose that CSR practices can influence the MTR variable in three main ways: (*i*) it may decrease the interest rate, reducing interest expenses; (*ii*) it may increase future earnings, because of increased sales and profit margins; (*iii*) it may decrease present earnings because of the investment made in CSR. While the first two reasons promote an increase in MTR, the third promotes a decline, so the impact on MTR is unclear. To the best of my knowledge, no study has yet systematically analysed the impact of CSR on the MTR.

From this literature, I can extract unidirectional relationships from CSR to the determinants, thus I can infer potential indirect effects of CSR on the OCS, mediated through the OCS determinants. However, assuming that the relationships between CSR and determinants are direct and unidirectional may be too restrictive since empirical literature supports the existence of bidirectional relationships. For example, there is a wide range of papers that point to CSR being positively affected by size (Aras et al., 2010; Kansal et al., 2014; Othman et al., 2011) and profitability (Othman et al., 2011) and being negatively influenced by risk (Albuquerque et al., 2018) and growth opportunities (Li & Zhang, 2010). These findings suggest that CSR practices are both a cause and a consequence of OCS determinants. As such, I argue that there may be looping effects between some determinants and CSR. Namely, if size drives CSR and vice-versa, then size and CSR feed off each other leading to the initial effect of CSR investment being multiplied.

To the best of my knowledge, no study assesses the impacts of CSR on OCS considering the temporal dynamics arising from the looping effects between determinants and CSR and considering the various indirect effects by which CSR can influence OCS.

2.4. CSR and Observed capital structure

The link between CSR and observed capital structure is a relevant topic from the standpoint of strategic corporate management.[4] However, such a theme has received little attention within the scientific community. According to the few available studies, the range of findings is wide and may depend on sample characteristics. Using a 6-year panel of French firms, Hamrouni et al. (2019) evidence a positive relationship between CSR and the debt ratio. In the same line of thought, Sharfman and Fernando (2008), in a sample of 2002 US firms, show that the implementation of environmental risk management (a CSR dimension) promotes a debt increase. However, the empirical findings concerning the US economy are far from consistent as, Harjoto (2017) and Sheikh (2019), using large panels, find that CSR promotes debt reduction.

Similarly, the lack of consensus occurs also within studies that use Chinese firms. While Yang et al. (2018) find a positive relationship, Ho et al. (2022) find the opposite relationship. Despite the temporal proximity, these studies present distinct samples, with the former having, on average, firms with a higher level of financial leverage. It may be the case that sample characteristics have an impact on the sign of the relationship between CSR and OCS.

In line with this idea, Sheikh (2019) finds that the effect of CSR on the observed capital structure is negative in firms facing intense competition and neutral otherwise, suggesting that the sign of the relationship depends on firms' characteristics. Given this line of reasoning, it may be the case that the lack of consensus in the literature may result from differences in the characteristics of firms in the samples of each study. This argument motivates the need in literature to broaden the scope of these studies, to explore how the characteristics of firms may influence the impact of CSR on debt ratio.

[4] It is common practice to assume that CSR and debt ratio have a reverse causality relationship (e.g., Ho et al., 2022; Yang et al., 2018). A possible justification for the reverse causality is that higher indebtedness leads to higher pressure from lenders, which may lead firms to adopt CSR practices to access more credit (Cheng et al., 2014). Therefore, CSR is both a cause and a consequence of the variation in the debt ratio.

3. Methodology

This section has three subsections. In subsection 3.1, I present and define the variables that I use in the study. Subsection 3.2.1 justifies the methodological choice and discusses the empirical design of the two models used: Panel Vector Autoregression (P-VAR) and Interacted Panel Vector Autoregression (IP-VAR). Finally, in subsection 3.2.2., I report the adopted methodological options.

3.1. Variables

This subsection presents and justifies the selection of variables used in the empirical models. I consider all variables to be endogenous to properly depict the existence of bidirectional causal relationships between OCS, CSR, and OCS determinants.

The vector of endogenous variables has three groups of variables:

$$Y_{it} = [CSR_{it};\ DR_{it};\ D_{it}] \tag{1}$$

Where CSR_{it} is the metric that quantifies CSR practices, D_{it} is a vector of variables that includes the determinants of OCS, while DR_{it} represents the debt ratio, as a metric of debt intensity.

The determinants of OCS employed correspond to those covered in the literature review and are the most universally accepted. In this way, I choose the following determinants and associated metrics, in parentheses: size (LTA), asset structure (COL and INTANG), risk/earnings volatility (RISK), profitability (CF), tax shields (MTR) and future growth opportunities (BTM). Therefore, the vector of the determinants of OCS includes the following endogenous variables:

$$D_{it} = [LTA_{it};\ COL_{it};\ INTANG_{it};\ RISK_{it};\ CF_{it};\ MTR_{it};\ BTM_{it}] \tag{2}$$

In Table 1, I define the key variables used to quantify CSR activities, debt intensity, and multiple OCS determinants.

Table 1: Definition of key variables

Variable	Definition	Reference
CSR Score (CSR)	Index (between 0 and 100) that measures the firm's performance in matters of corporate and social responsibility	
Debt Ratio (DR)	Short-term and long-term debt divided by total book assets	Fama and French (2002), Frank and Goyal (2009)
Total assets (LTA)	Natural logarithm of total book assets at constant prices	Frank and Goyal (2009), Van Binsbergen et al. (2010)
Collateral assets (COL)	The sum of Inventories and Net Plant, property, and Equipment divided by total book assets	
Intangible assets (INTANG)	Intangibles divided by total book assets	
Earnings volatility (RISK)	Standard deviation of the ratio between EBITDA and total book assets, for the last 3 years period	Alipour et al. (2015)
Profitability (CF)	EBITDA divided by total book assets	Frank and Goyal (2009), Van Binsbergen et al. (2010)
Marginal Tax Rate (MTR)	Present value of the tax benefit for a dollar of interest deduction (Graham, 1996)	
Book-to-market (BTM)	Total common equity divided by market capitalization	

This table presents and defines each of the OCS determinants.

3.2. Empirical design

3.2.1. Model Specification

The OCS definition process is a complex system that must consider multiple relationships. As such, the choice of methodology is strongly conditioned by the need to respect these relationships, to depict three main issues. First, the empirical model should be able to identify, without bias, the impact of CSR on the OCS determinants and the impact of the determinants on the debt ratio. Second, the model should recognise the existence of unidirectional or bidirectional causal relationships between the various OCS determinants to represent dynamic effects on OCS. Third, the model should be non-recursive, to recognise the loop effects between CSR and determinants, between determinants, or even in the direct relationship between OCS and CSR. This recognition is fundamental to solving potential endogeneity problems among variables. In sum, the three conditions require that CSR, OCS, and their determinants are considered endogenous variables within the empirical model.

Furthermore, the dissertation aims to assess how (*i*) firms' features affect the impact of a CSR shock on OCS and (*ii*) how such practices affect the dynamic impact of a determinants shock on OCS. Therefore, the empirical model aiming for these goals should also allow the introduction of interaction terms between the various determinants and CSR.

Consequently, I adopt two models: P-VAR and IP-VAR. These models fulfil the conditions imposed and allow me to explore the intertemporal dynamics caused by the shock on CSR or OCS determinants by assuming that the impact of a shock is not exhausted in the period itself. First, the P-VAR is an extension of the VAR model that allows the combining of the temporal and cross-section dimension in one model. Such an extension is necessary given the nature of panel data and the reduced time dimension that is a feature of entrepreneurial data. Second, the IP-VAR, initially developed by Towbin and Weber (2013) and Sá et al. (2014) adds to P-VAR the potentiality of exploring the existence of non-linear relations among endogenous variables, through the inclusion of interactions among variables.

At an early stage, I use a P-VAR, where I do not include the CSR variables or the interactions. Its purpose is just to briefly analyse the endogenous relationships between the various OCS determinants and their relationship with the debt ratio. This model is specified as.

$$Y_{i,t} = \sum_{i=1}^{N} F_i C_{i,j} + \sum_{k=1}^{L} A_k Y_{i,t-k} + \mu_{i,t} \tag{3}$$

Where, $t = 1, \dots, T$ represents the period; $i = 1, \dots, N$ identifies the firm; and $k = 1, \dots, L$ express the lag structure; In addiction, $Y_{i,t}$ is a vector of endogenous variables, F_i is the firm-specific intercept of firm i, A_k is the matrix of autoregressive coefficients for lag k, common to all firms, and $C_{i,j}$ is an indicator variable for each firm (equal to 1 if $i = j$, and 0 otherwise).

Lastly, $\mu_{i,t}$ is a vector of normally distributed errors with mean zero and covariance matrix $\sum_i$.

For my main objective, I use an Interacted Panel Vector Autoregressive (IP-VAR) framework to evaluate the CSR impact on the debt ratio. In this framework, I already include the CSR as well as the interactions of the CSR with the OCS determinants. The model is specified as:

$$Y_{i,t} = \sum_{i=1}^{N} F_i C_{i,j} + \sum_{k=1}^{L} A_k Y_{i,t-k} + \sum_{k=1}^{L} \sum_{d \in D} B_{k,d} CSR_{i,t-k} \times d_{i,t-k} + \mu_{i,t} \quad (4)$$

where, t, i, an k are defined as previously ; $d \in D$ denote the OCS determinant included in vector D. Whereas D is a vector that includes all the OCS determinants. Besides, $Y_{i,t}$ is a vector of endogenous variables; $CSR_{i,t-k} \times d_{i,t-k}$ is the interaction term between CSR and the OCS determinant d, for lag k; F_i is the firm-specific intercept of firm i; A_k is the matrix of autoregressive coefficients associated to the endogenous variables with lag k, common to all firm; $B_{k,d}$ is the matrix of autoregressive coefficients for lag k and for interaction of CSR with OCS determinant d; and $C_{i,j}$ is an indicator variable for each firm (equal to 1 if $i = j$, and 0 otherwise). Lastly, $\mu_{i,t}$ is a vector of normally distributed errors with mean zero and covariance matrix $\sum_i$.

I estimate models (3) and (4) using Ordinary Least Squares and allowing for the existence of firm fixed effects, but assuming that the coefficients (from matrix A_k) are identical across sectional units. Pesaran and Smith (1995) argue that if there is heterogeneity in the coefficients across firms, then defining a common coefficient leads to biased estimates. However, by including the interaction terms, I am allowing the impact of a lagged variable on a dependent variable to depend on other characteristics of the firm. In other words, these interactions may explain some of the firm heterogeneity, attenuating the bias (Towbin & Weber, 2013).

The introduction of interactions is the key element that permits testing whether the relationship between the shock variable and the response variable depends on the value of a set of *factors* (e.g., profitability, size, CSR). In this context, the introduction of interactions allows for achieving two goals. First, it allows answering what happens to the debt ratio when CSR suffers a shock and how this impact differs across firm characteristics (i.e., depending on the OCS determinants). Second, the interactions provide the intuition to explain what happens to the debt ratio when one determinant of the OCS suffers a shock and how its impact varies depending on whether the firm has high or low CSR.

These two questions can be answered by building and comparing the IRFs at different percentiles of the distribution of the variables belonging to the interaction. For example, to test whether the response of a given endogenous variable to the CSR shock depends on profitability, I compute an average IRF of the observations with high profitability and compute another average IRF of the observations with low profitability. If the difference between the two IRFs is systematic, then the level of profitability affects the impact of CSR on that endogenous variable.

But this benefit comes at a cost. Indeed, in an IP-VAR involving multiple interaction terms and correlated variables within those interactions, the difference between the IRFs may not effectively isolate the effects of a single *factor*, i.e., IP-VAR fails to isolate the impact that one factor (e.g., profitability) has on the relationship between the response variable and the shock variable. For example, if there are two positively correlated determinants (i.e., factors), selecting the higher percentiles of one determinant may also pick the higher percentiles of the other determinant. Thus, what is being interpreted is the sum of the effect of the two factors. To address this issue, I need two groups of observations (each one associated with a different IRF), which must meet two conditions to isolate that impact. First, the mean of the determinant under analysis must be statistically different between the two groups. Second, the remaining endogenous variables that are part of at least one interaction cannot have a statistically different mean between the two groups. In other words, the two groups must be balanced. Hence, I create balanced groups using the Entropy Balancing technique to mitigate the IP-VAR limitations.

3.2.2. Inference and estimation

To construct the IRFs, I use the following options: I set the lag to one period; the confidence intervals were constructed based on a Monte Carlo simulation with 1000 draws and using Bayesian inference, following Sá et al. (2014) and Koop et al. (1996); I use generalized impulse response function, as defined by Pesaran and Shin (1998), and, hence, the order of the variables in the VAR is irrelevant.[5]

[5] Alternatively, I also consider the bootstrapping technique of Runkle (1987) to construct the confidence interval, in line with Towbin and Weber (2013). The results are not choice sensitive.

As previously discussed, to isolate the effect of each interaction, I recur to the Entropy Balancing technique. This approach is traditionally applied in settings in which there is a treatment group and a control group (Hainmueller, 2012). This procedure aims to achieve covariate balance, that is, to create two groups with similar characteristics in all covariates, except in the treatment variable. To guarantee the balancing of the groups, this technique assigns weights to each observation so that some moments of each covariate in the two groups are identical. The weightings should be such as to guarantee that, for instance, the mean and variance of variable X are the same in both groups.

To better understand how Entropy Balancing is incorporated within the IP-VAR framework, assume that $X = [X_1\ X_2 \dots X_n]$ is a vector of variables that are used to construct the interaction terms. Additionally, assume that the shock is on variable X_j and that one wants to find out if the impact of that shock depends on variable X_i. To implement Entropy Balancing I follow the following four steps. Firstly, I create the treatment variable that identifies the control and treatment groups. This variable takes the value 1 for the values above the 67th percentile of variable X_i and takes the value 0 for the values below the 33rd percentile. The remaining observations are not part of either group. Secondly, I create the treatment and control groups based on the treatment variable. Thirdly, I apply the Entropy balancing algorithm, with the restriction that the remaining variables of X different from X_i have the same mean in both groups. Finally, I extract the weights associated with each observation.

Once the weights are calculated, I apply these weights to the IRFs, following three additional steps:

1) Through Bayesian inference, I obtain new estimates for IP-VAR betas and calculate the IRF for each observation.
2) I calculate the average IRF of the observations, for each group, through a weighted average and using the weighting provided by entropy balancing.
3) I implement the Monte Carlo simulation, repeating steps 1) and 2) 1000 times.

4. Data

This section has three subsections. Subsection 4.1 presents the criteria used to select data from firms able to make optimal financing decisions. Subsection 4.3 displays the main time trends concerning the CSR metric. Finally, subsection 4.3 reports the descriptive statistics.

4.1. Data Selection

All variables are obtained from corporate financial and non-financial statement data in the Refinitiv database.[6] This data only includes public US companies that have disclosed CSR information and span from 2002 to 2017, which totals 12,791 firm-year observations. The sample starts in 2002, since no CSR data is available before this year; and the sample ends in 2017 since in 2018 the US tax rate is reduced, yielding a structural break in the MTR variable.[7]

From the initial sample, I select the firm-year observations that respect four conditions. First, I keep firm-year observations with no missing values in all variables needed to compute the endogenous variables of the IP-VAR model. Next, I eliminate firms in the financial, insurance and public administration sectors, in line with Van Binsbergen et al. (2010) since these sectors tend to be severely regulated. Third, I eliminate observations in which firms, in the given year, were involved in substantial M&A activities (i.e., the acquisition amount exceeds 15% of assets). Finally, I eliminate observations with a null or negative value in sales, equity, or assets. The application of the above restrictions reduces the sample size to a total of 9,898 firm-year observations. Moreover, to remove outliers, I perform winsorization at 1st and 99th percentiles for the variables debt ratio (DR), book-to-market (BTM) and profitability (CF).

To study Optimal Capital Structure, I follow Van Binsbergen et al. (2010) and select the observations in which firms are neither financially constrained nor financially distressed. According to the authors, if both conditions are met, firms make optimal decisions and are not subject to high adjustment costs. Thus, I use the Altman Z-score to measure financial distress, and I use the metric of long-term debt or equity issuances or repurchases (LTDEIR) to measure financial constraints. These metrics are expressed below.

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[6] The one exception is MTR since this variable is constructed following the proposals of Graham (2000) and Blouin et al. (2010). For more details about MTR construction, see annexes.

[7] The reduction of the tax rate leads to the change of the MTR upper limit from 35% to 21%, which may generate noise in the estimation and violate the stationarity assumption (the mean would not be independent of time), given that the overwhelming percentage of observations lie close to the upper bound.

$$ZSCORE = \frac{3.3EBIT + Sales + 1.4Retained\ Earnings + 1.2Working\ Capital}{Book\ Assets} + \frac{0.6Captitalization}{Liabilities} \tag{5}$$

$$LTDEIR = \begin{cases} 1\ if\ \dfrac{Long - term\ debt\ issuance}{Total\ Assets} \geq 50^{th}\ percentile \\ or\ \dfrac{Long - term\ debt\ reduction}{Total\ Assets} \geq 50^{th}\ percentile \\ or\ \dfrac{Equity\ issuance}{Total\ Assets} \geq 50^{th}\ percentile \\ or\ \dfrac{Equity\ reduction}{Total\ Assets} \geq 50^{th}\ percentile \\ 0\ otherwise \end{cases} \tag{6}$$

To select the final sample, I followed two criteria: First, I keep firm-year observations with the Z-score above the median and LTDEIR equal to one. Second, I keep observations that are included in a sequence of at least seven consecutive observations, without any gap in the data.[8] These restrictions generate a sample of 1702 observations, with an average of 10.1 observations per firm.

4.2. Corporate Social Responsibility

The choice of the variable representing CSR practices is critical. Existing studies use metrics from different ESG databases and, generally, either use the ESG indicator as a proxy for CSR activities or select ESG dimensions to construct the CSR indicator (e.g., Albuquerque et al., 2018; Lins et al., 2017).

Cheng et al. (2014) and Ioannou and Serafeim (2012) use the Thomas Reuters Asset4 ESG database (the database that preceded the Refinitiv database), computing CSR based on the environmental, governmental and social pillars and excluding the economic dimension, because they consider it irrelevant given the definition of CSR. In other words, one can say that the indicator used by these papers is similar to Refinitiv's ESG calculation, which includes exactly the three dimensions pointed out by the authors. Hence, I follow Cheng et al. (2014) and use Refinitiv's ESG indicator as a proxy for CSR practices.

[8] The restriction is applied to allow for performing stationarity tests on the data. I used the Im-Pesaran-Shin test for panel data which requires two conditions: (*i*) no gaps in the time sequence; (*ii*) a minimum number of observations per firm. I set the minimum number to seven to perform the test up to four lags. The test results point to stationarity in all variables and are available upon request.

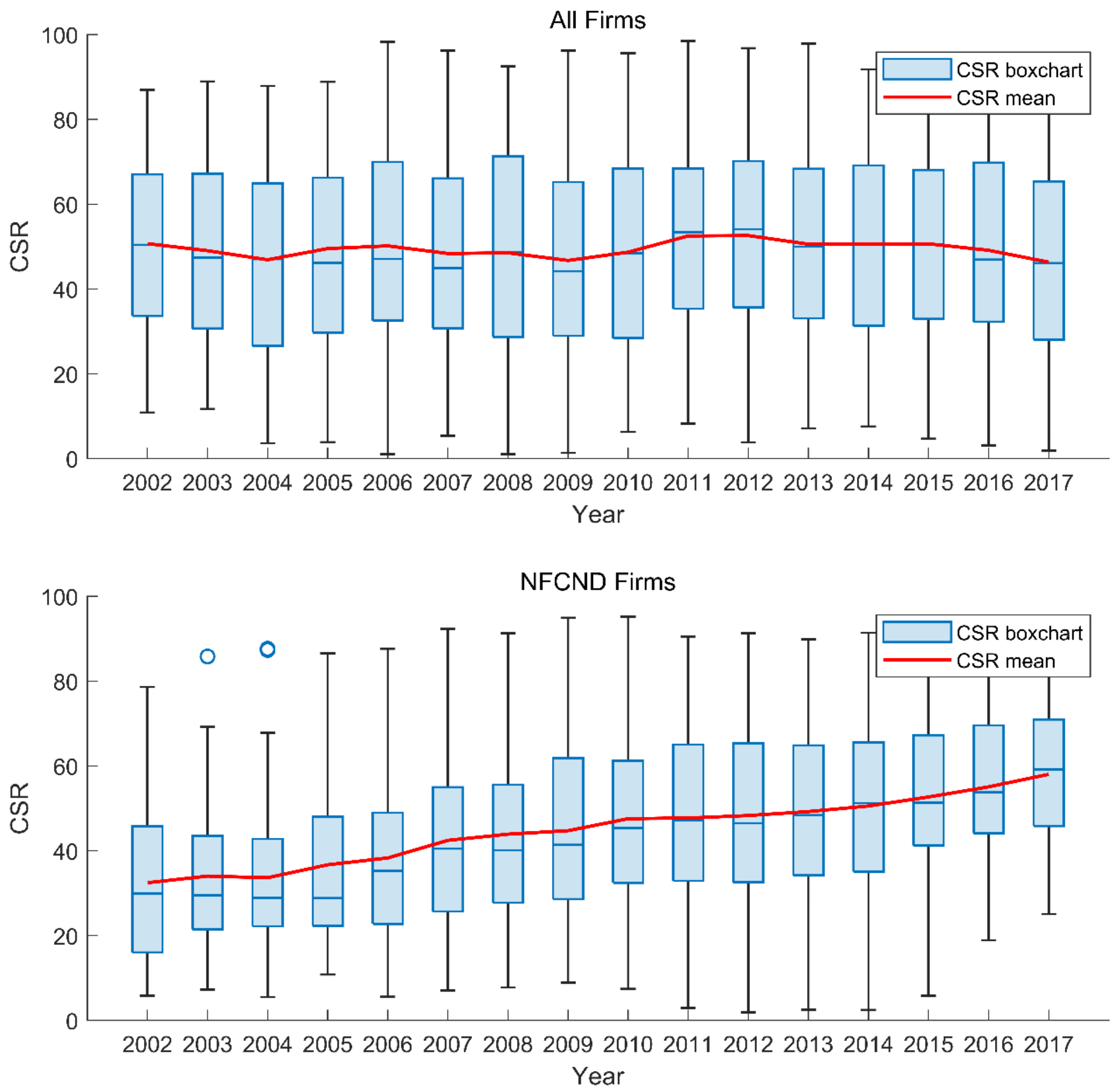
The ESG indicator is a relative indicator: each company's score is attributed as a function of performance against other companies, i.e., whether a company is better or worse than the others in each key performance indicator (KPI). Thus, an improvement in the score does not necessarily represent an increase in CSR practices but merely signals a more favourable evolution compared to other companies. By the same reasoning, a given level of CSR practices generates a lower score in 2017 than in 2002 because there has been a greater concern with social objectives, leading to a deterioration in relative performance in 2017.

Figure 1 shows (in the upper graph) the evolution and dispersion of CSR scores between 2002 and 2017 for all non-financial and non-governmental firms with CSR data available to date. The same figure (in the bottom graph) shows this same evolution but only for firms that are neither financially constrained nor distressed (NFCND). For the group of all firms, on average, there is no clear trend in the evolution of CSR and the dispersion of scores between firms does not seem to undergo major changes over time. This outcome was expected given that the indicator is relative, meaning that, if some firms improve, the score of the other firms reduces, keeping the average relatively constant. However, the scenario changes considerably when analysed for NFCND firms, for which the evolution of CSR scores has been more favourable than the average for all firms. This finding suggests that NFCND companies have conditions for CSR to evolve more favourably over time, which seems to support the slack hypothesis. According to this hypothesis, unconstrained and non-distressed firms are more likely to invest in CSR than those facing constraints because the former have more resources to do so (Waddock & Graves, 1997).

I also find that the dispersion of CSR scores across firms tends to be lower for NFCND firms than for the set of all firms, which is more evident in recent years. This outcome also supports the slack hypothesis, because if NFCND firms are not constrained, then all of them may be capable of investing in CSR, which helps to explain a smaller dispersion of behaviour. Such dispersion of behaviours is more likely to occur in the sample that includes the full range of firms, given the greater dispersion of financial contexts of these companies.

By supporting the Slack hypothesis, these results suggest that NFCND firms exhibit greater flexibility in the decision-making process. Thus, the financing decisions of NFCND firms may tend to be more flexible, which allows firms to make optimal decisions. This rationale suggests that the constraints applied to identify optimal choices are playing their role.

Figure 1: CSR evolution



The figure represents the evolution of CSR practices between 2002 and 2017 for NFCND firms and the set of all firms. The red line signals the average CSR score of firms for each specific year.

4.3. Summary Statistics

Table 2 reports summary statistics for the CSR, debt ratio, and OCS determinants. A set of four patterns characterising the sample can be discerned. First, the average debt ratio is 17.56%, but there is some volatility between companies, given that the standard deviation is 13.02%. Second, I am using data belonging to very large firms, which simultaneously present future growth opportunities as shown by the low average BTM (0.3108) and very high average LTA (22.652). In addition, there is little volatility in these two variables. Third, there is a strong heterogeneity among firms regarding asset structure, as demonstrated by the high standard deviations of COL and INTANG in comparison to their averages. I also verified that intangibles, on average, represent a relevant component of the assets (21.11%). Fourth, the sample firms have an average CF of 0.1946 (and an average MTR very close to the maximum), which means that these firms are, on average, profitable. Moreover, the firms show low volatility of profitability, as suggested by the low mean RISK (0.025).

Table 2: Summary Statistics

	NFCND Firms						All Firms		
	N	Mean	SD	25th perc.	50th perc.	75th perc.	N	Mean	SD
CSR	1702	46.379	19.775	30.531	44.758	61.519	9898	39.297	19.657
COL	1702	0.3703	0.2399	0.2013	0.3421	0.4906	9898	0.4162	0.2800
INTANG	1702	0.2111	0.1690	0.0726	0.1831	0.3182	9898	0.2062	0.2163
LTA	1072	22.652	1.2521	21.704	22.434	23.442	9898	22.368	1.5960
BTM	1702	0.3108	0.2070	0.1765	0.2644	0.3800	9898	0.4330	0.3028
RISK	1702	0.0250	0.0410	0.0074	0.0147	0.0263	9898	0.0289	0.0608
CF	1702	0.1946	0.0768	0.1466	0.1857	0.2319	9898	0.1260	0.1119
MTR	1702	0.3456	0.0238	0.3500	0.3500	0.3500	9898	0.3150	0.0753
DR	1702	0.1756	0.1302	0.0714	0.1680	0.2576	9898	0.2624	0.1765

This table shows the descriptive statistics of all variables, as defined above. The sample ranges from 2002 to 2017 with unbalanced data. The designations of each variable are presented in Table 1.

The restrictions applied to identify NFCND firms seem to be playing their role, given that such restrictions promote an increase in the mean of CF and MTR and a reduction in the mean of BTM and RISK. Such behaviours are associated with lower financial distress risk and fewer financial constraints.

Additionally, the average CSR score is also higher in NFCND firms than for the set of all firms. This statistic suggests that NFCND firms are more financially endowed to invest in CSR activities, so they invest more in such activities, as suggested by the slack hypothesis (Waddock & Graves, 1997).

5. Results

This section is divided into four subsections. In subsection 5.1, I identify the direct and indirect effects of each determinant on the debt ratio. Subsection 5.2 presents the impacts of a CSR shock on the debt ratio, exploring the adjacent direct and indirect paths. Subsection 5.3 presents and discusses how different firms' characteristics can influence the effects of a CSR shock on the debt ratio. Finally, subsection 5.4 presents and discusses how the dynamic impact of each determinant shock on the debt ratio is affected by the CSR level.

5.1. The impact of determinants on the optimal debt ratio

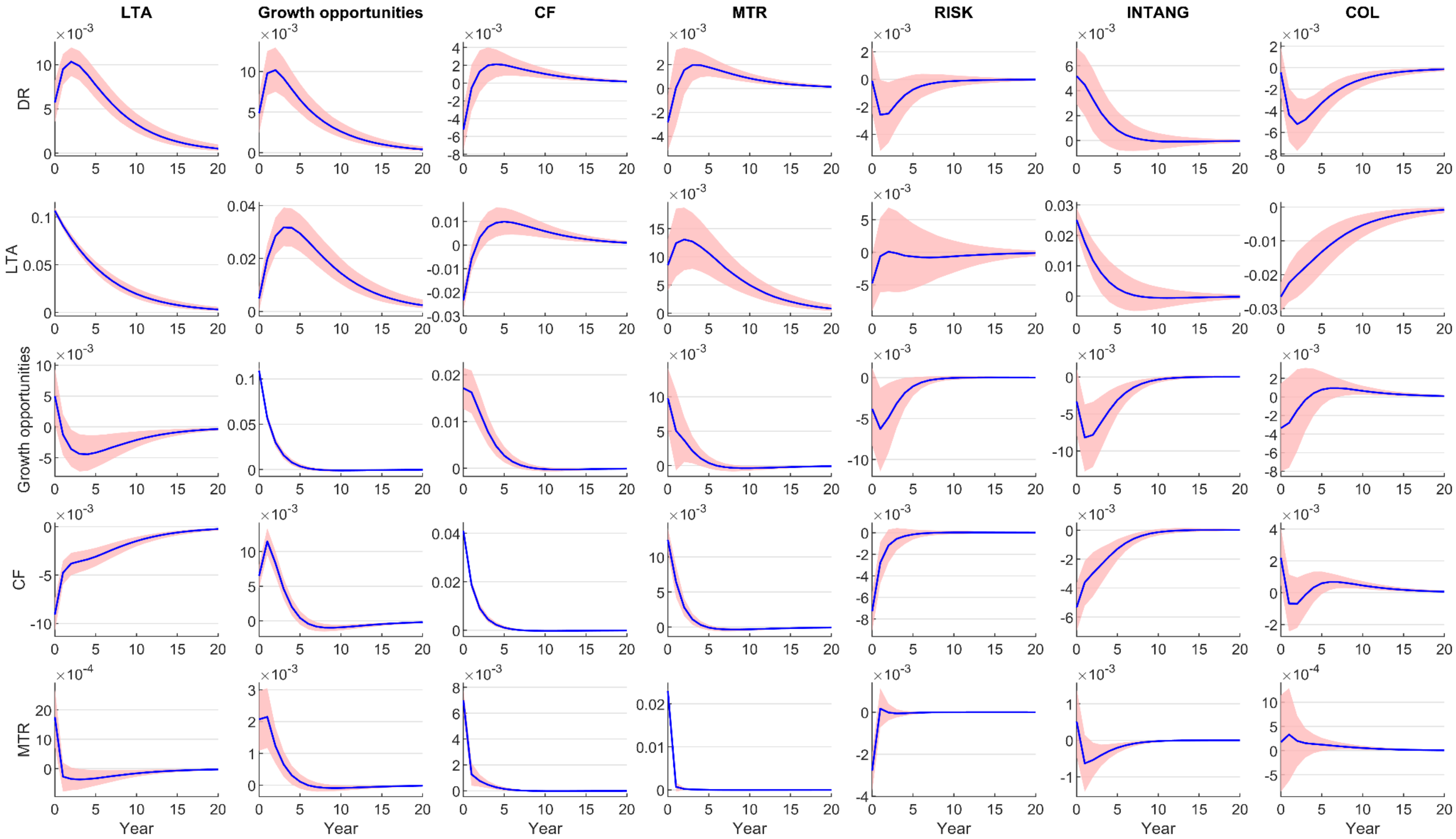
Figure 2 plots the IRFs for the endogenous variables, generated from the estimation of the model represented in Equation (3) in Subsection 3.2.1. In each plot, the blue line represents the median response, while the red shaded area plots the 90% confidence interval. Figure 2 is organized as follows: each column represents a shock in a specific variable, while each row represents a specific endogenous variable affected by the shock.

Overall, the results in Figure 2 suggest numerous bidirectional or unidirectional relationships between OCS determinants. For example, a positive profitability shock promotes an expansion of growth opportunities and vice-versa.[9] From this finding, I may suggest that the increase in profitability may exert, for example, indirect effects on the debt ratio through the impact it has on growth opportunities because this subsequent expansion of opportunities will ultimately affect the debt ratio. This outcome suggests that ignoring such relationships may compromise the correct assessment of the determinant impact since the possible indirect effects of variables are neglected. Thus, these results motivate the need to account for this issue, breaking the paradigm of empirical studies on OCS.

Focusing on the first column of Figure 2, I may suggest that several determinants provoke significant impacts on the debt ratio. However, these results should be read carefully, as they represent the sum of direct and indirect effects. Therefore, the analysis of the remaining rows allows identifying potential indirect effects since they depict the effect of one determinant on others. Thus, I look at the impact of each of the seven determinants on the OCS, analysing it column by column.

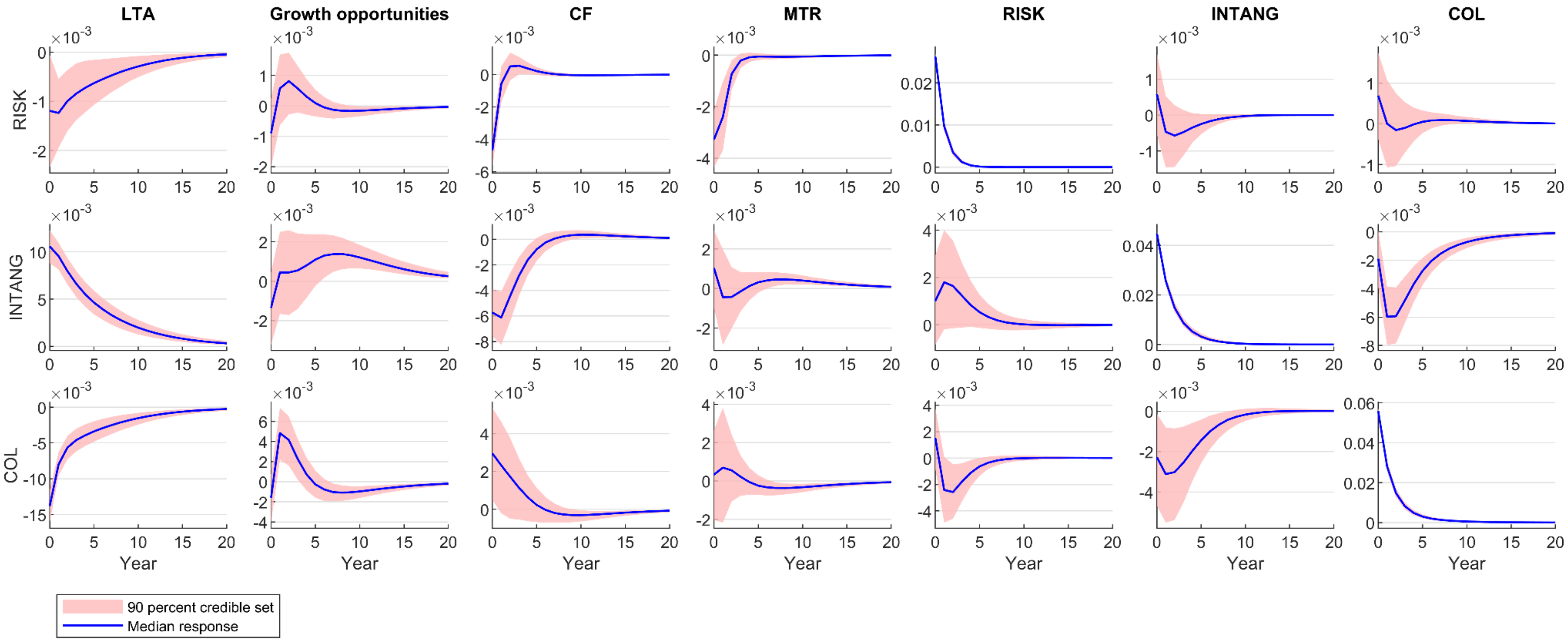
[9] These results may be seen in matrix positions: column (2) and row (4); and column (3) and row (3).

Figure 2: Impulse Response Function resulting from a shock on OCS determinants



(continued)

Figure 2: Impulse Response Function resulting from a shock on OCS determinants (continued).



This figure plots the IRFs. Each column represents a shock in a different variable, while each row represents a different endogenous variable affected by the shock. The shock in each variable is equal to its standard deviation. The blue line represents the median response, while the shaded area represents the 90% confidence interval.
Note: Growth opportunities correspond to the opposite of BTM.

Starting with column (1), the IRF shows that increasing size leads to higher levels of debt, over time. The existence of a positive effect in the shock year and year 1 suggests an immediate and direct effect on the debt ratio, which is in line with the empirical literature (e.g., Balios et al., 2016; Sheikh & Wang, 2011). This finding is consistent with the POT since larger firms may have lower agency costs vis-à-vis shareholders and lenders (Cassar & Holmes, 2003), which leads to a preference for debt. It also supports the TOT since larger firms may have lower bankruptcy costs (Titman & Wessels, 1988) and, thus, may have a greater incentive to increase debt. In addition, column (1) shows that the size increase triggers a wide variety of indirect impacts on OCS, via other determinants such as: (*i*) intangibles (collaterals) gain (lose) weight in the asset structure, which can be justified with the valuation of the brand associated with the growth/gain in market share; (*ii*) a risk reduction, as larger companies tend to be more diversified (Titman & Wessels, 1988); (*iii*) a reduction in growth opportunities from year 2 onwards, which may imply that the firm's current growth has exhausted growth opportunities; (*iv*) a reduction in profitability.

Second, column (2) suggests that an expansion of growth opportunities (i.e., the BTM reduction) encourages an increase in the debt ratio over time. This effect is significant in the shock year and in the first year, suggesting that the direct effect exists and is positive. The conclusion is consistent with the premise of the POT theory, which states that the existence of opportunities will require the firm to issue temporary debt to finance itself (DeAngelo, 2022). Moreover, the increase in opportunities can exert an indirect impact on OCS by reducing the weight of intangibles (from year 6 onwards) and by increasing the weight of tangibles (until year 3), MTR and profitability (until year 4). Lastly, expanding opportunities may also promote an increase in firm size, over the 20 years, as more opportunities give firms room to grow. Based on the findings in column (1), this impact on size intensifies the process of increasing debt. As such, it may be the case that the temporary increase in debt becomes permanent.

Third, the increased profitability promotes an increase in the debt ratio, from year 3 onwards (column 3). However, Figure 2 suggests that profitability has no significant direct impact on OCS in period 1, but there is an immediate downward effect on the debt ratio in the year of the shock. This finding seems to support the POT theory given that higher profitability allows for more domestic reserves, which substitute for debt, as Alipour et al. (2015) argue. Thus, the long-term evolution of the debt ratio may be justified through two key opposing indirect impacts. On the one hand, Column (3) indicates that the increase in profitability promotes more growth opportunities, year after year, for about 7 years. This behaviour seems to indicate that the increase in profitability is a sign that the sector is growing, which generates new opportunities. In turn, as concluded above, these new opportunities are an incentive to increase debt intensity and company size. On the other hand, column (3) shows that higher profitability contributes to reductions in the proportion of intangibles in assets, which may lead to less debt and a contraction in the firm size.[10] Despite the opposing effects, the net impact on debt ratio and size is positive (from year 3 onwards), which suggests that the indirect impact by the BTM path is more intense. Finally, as the net effect on size is positive, this impact also increases debt intensity.

Fourth, column (4) suggests that the impacts of increasing MTR are similar to those of raising profitability, generating a negative effect in the year of the shock, and generating an increase in the debt ratio from year 3 onwards, but without any direct impact in the first year after the shock. Therefore, the increase in MTR may only promote the increase in the debt ratio through indirect effects caused by the increase in profitability, the increase in size, and the reduction in the BTM.

Fifth, from column (5), I find that the increased risk contributes to the reduction of the debt ratio for two consecutive periods after the shock. This finding also suggests that there is a direct and negative impact of risk on debt intensity, in line with most empirical literature (e.g., Frank & Goyal, 2009; Sheikh & Wang, 2011) and with the POT and TOT premise. Despite this, the indirect effects appear to be brief in time and this briefness may occur because of two opposing forces. On the one hand, the increase in risk contributes indirectly to the preference for debt through the effect that risk has on the decrease in profitability and growth opportunities up to 2 years after the shock. On the other hand, contributing to a decrease in collateral weight induces a preference for equity, as will be shown later.

Sixth, an increase in the proportion of intangibles in the asset structure leads to a significant increase in the debt ratio in the year of the shock and the following two years (column 6). This finding indicates that the direct effect exists and is positive, agreeing with the empirical literature (e.g., Lim et al., 2020; Van Binsbergen et al., 2010). Moreover, there are indirect effects, although they often cancel each other out. On the one hand, the increase in INTANG leads to an increase in size and a reduction in collateral weights. Based on the results of the

[10] These results may be seen in column (6) of Figure 2 and will be discussed shortly.

first row of columns (1) and (7), it is remarkable that such indirect impacts contribute to an increase in debt. On the other hand, the increase in INTANG yields a reduction in growth opportunities and profitability. Using the results in columns (2) and (3), I suggest that these indirect effects contribute to debt reduction. Therefore, there are multiple indirect effects, but they tend to cancel each other out.

Finally, an increase in the proportion of tangible assets in the asset structure promotes a reduction in debt over several years (column 7). I also find that the direct effect is negative in year 1, contradicting the expected sign of the relationship. However, these results are compatible with the implications of the agency theory, insofar as in firms with more collaterals, there is a greater tendency for managers to consume more perks than the optimal (Titman & Wessels, 1988). Therefore, debt is increased to discipline management and make bankruptcy risk effective. Regarding indirect effects, as observed in the last column, the increase in COL contributes to the reduction in the size and weight of intangibles. Given the conclusions previously drawn from columns (1) and (6), both reductions generate less debt intensity, intensifying the initial direct effect.

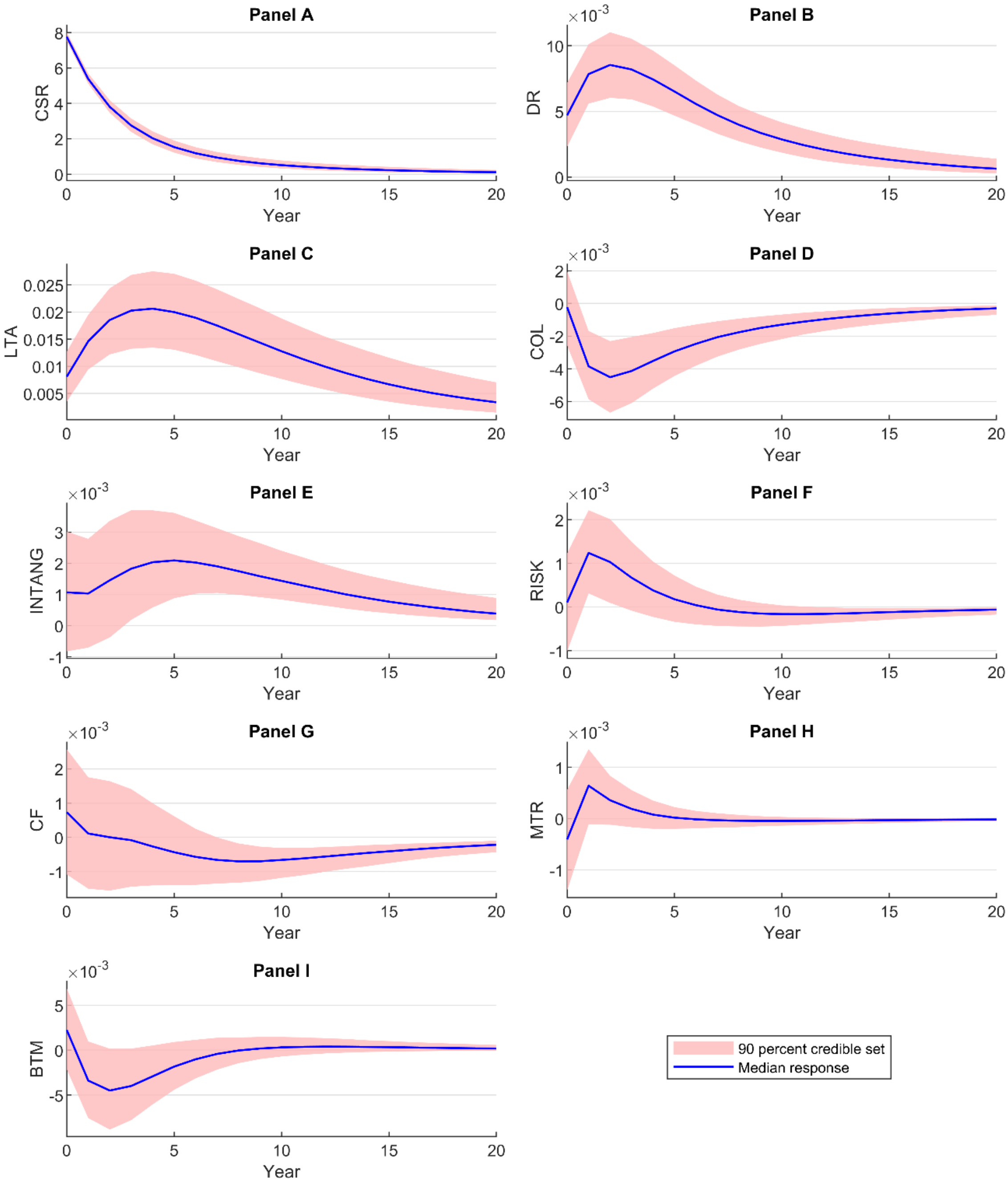
The results of this subsection show that the OCS definition is a dynamic process since the shock on a determinant generates effects on the other determinants and ultimately a variation in the optimal debt ratio over time. Hence, any event that influences the OCS determinants will contribute to the debt ratio adjusting over time. Thus, I raise the hypothesis that recent events/tendencies of CSR policy adoption may generate intertemporal impacts on the OCS.

5.2. The impact of CSR on the optimal debt ratio

Figure 3 presents the IRFs generated from the estimation of the model represented in Equation (4) in Subsection 3.2.1. This figure has nine panels (Panels A to I), which plot the IRFs for the vector of endogenous variables in the model (CSR, the debt ratio, and the determinants of OCS) following an unexpected shock to the CSR score. In each panel, the blue line represents the median response, while the red area signals the 90% confidence interval for the IRF. From Panel A, I find that a CSR shock is positively correlated over time, meaning that there is a tendency to continue to invest in CSR, albeit at decreasing rates.

Panel B of Figure 3 represents the impact of CSR score increase on the debt ratio, showing two main patterns. First, the increase in responsible practices generates an increase in the debt ratio in the year of the shock. This increase may be a direct consequence of the increased transparency of firms, which is obtained by increasing and disclosing CSR practices. Increased transparency mitigates agency costs between shareholders and lenders (Cui et al., 2018), thus ensuring more favourable financing conditions. Therefore, debt increases. Second, the yearly impact of the CSR shock on the debt ratio is always positive, over time, although this annual increase tends to converge to zero.

Figure 3: Impulse Responses Functions to a CSR Shock



This figure plots the IRFs to a CSR shock. The CSR shock is equal to its standard deviation. The blue line represents the median response, while the shaded area represents the 90% confidence interval.

Exploring the remaining panels, I identify the effects that CSR exerts on the determinants, and, hence, indirectly affecting the OCS. In this context, CSR policies impact the level of several determinants, among which I highlight five cases.[11] First, the positive shock on CSR activity leads to an increase in the firm size, year after year (Panel C). This trend may suggest that CSR, as a product differentiation strategy, may generate greater loyalty from consumers, allowing firms to reach new market segments and expand market share. In turn, this differentiation may be converted into an increase in sales and company size. Therefore, CSR can be a growth strategy that allows firms to extend their growth potential.

Second, a boost in CSR contributes to a continuous reduction in the share of collaterals in the asset structure (Panel D). This decline may be explained by two main reasons. First, intangible assets may gain relative importance because of the impact that CSR has on increasing the value of the firm's brand and intangible assets (Melo & Galan, 2011). Second, cash holdings gain weight in the asset structure (e.g., Arouri & Pijourlet, 2017). According to the agency theory, cash holdings should be minimised because high cash holdings induce opportunistic behaviour by managers (Jensen, 1986). However, CSR may mitigate this relationship, as the disclosure of CSR practices exposes more managers' options, making control over them more effective. Thus, CSR reduces the propensity for opportunistic behaviour, allowing firms to maintain higher levels of cash holdings.[12]

Third, an impulse in CSR also contributes to the increase in the intangibles' weight from year 2 onwards (Panel E), in line with what has been reported in other studies (e.g., Melo & Galan, 2011). There may be opposite forces justifying this evolution. On the one hand, a boost in CSR may increase intangibles (by enhancing brand identity) due to the firm's improved reputation among stakeholders and customers. On the other hand, CSR can also promote an increase in cash holdings, preventing intangibles' relative weight from growing. These two effects seem to cancel each other out in year 1, but from year 2 onwards the percentage increase of intangibles will be higher. This higher increase (from the second year onwards) may be due to the impact of increased size on the valuation of intangible assets. An increase in the firm size allows for further expansion and recognition of the brand, consolidating it (seen in Figure 2).

[11] A shock to CSR does not influence the determinants of MTR and growth opportunities (Panel H and I). However, the IRFs represent only the median response of firms, so I cannot rule out the hypothesis that, depending on firms' characteristics, these determinants may be influenced by the CSR shock.

[12] In the annexes, I show the IRF for the weight of the other assets (which include cash holdings and exclude collateral and intangible assets) in the asset structure due to a CSR shock.

Fourth, I find an increase in firms' risk in the first two years after the CSR shock (Panel F). This finding contradicts most of the empirical literature (e.g., Albuquerque et al., 2018), but it may confirm the CSR overinvestment theory (e.g., Jo & Harjoto, 2014). This view states that, in high managerial entrenchment firms, managers may invest excessively in CSR programs to obtain private benefits. But, the materialisation of these programmes makes the corporate risk higher.

Finally, the increase in responsible activities contributes to a decrease in profitability from year 8 onwards (Panel G), contrary to what the empirical literature supports (e.g., Lins et al., 2017).[13] This result can be justified by the relationship between size and profitability because CSR generates an increase in size, which then promotes a reduction in profitability. Although this relationship is not the most common, such relation is justifiable given the characteristics of the sample. Since the sample is constituted of firms of huge size, then it is reasonable to assume that the increase in size may promote some diseconomies of scale, justifying the negative relation. Therefore, in firms where the relationship between profitability and size is positive, I would expect CSR to promote an increase in profitability.

Combining the above analysis with the results in Figure 2, I can identify the indirect effects that increase debt and those that decrease it. On the one hand, the increase in the size and weight of intangibles and the reduction in the fixed assets' weight contribute to a sharper increase in debt. On the other hand, the risk increase and the profitability reduction soften the growth trend of the debt ratio.

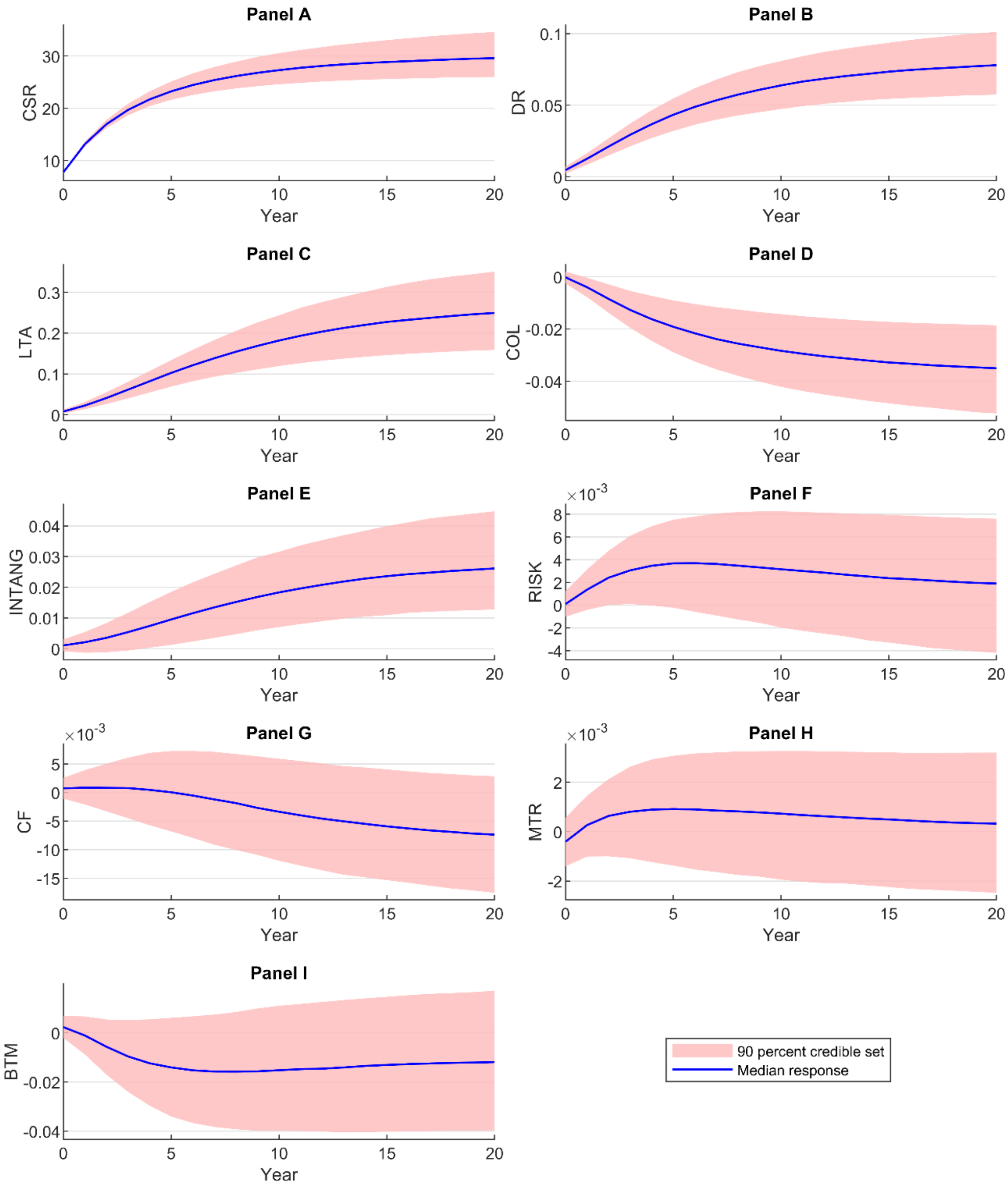
The analysis performed is relevant for short-term debt management, allowing me to determine whether the debt ratio should vary from one year to another. However, many financing decisions are medium to long-term, so it is crucial to understand if the debt ratio varies between year t and the moment immediately before the shock. To do so, I resort to Figure 4, which presents the cumulative IRFs for the vector of endogenous variables to an unexpected shock to the CSR score. In each graph plot, the blue line represents the median response, while the red shaded area signals the 90% confidence interval for the IRF.

From Figure 4, I highlight five key results. First, an impulse in the CSR score of about 8 points results in a continuous and accentuated growth in the score, yielding an improvement in the indicator of approximately 30 points after 20 years (Panel A). This sharp growth may

[13] Despite the profitability reduction, a CSR shock leads to an earnings increase. Annexes presents the cumulative IRF to EBITDA due to a CSR shock.

be justified by the existence of bidirectional relations between CSR and size. CSR generates an increase in size (as seen before), and in turn, this increase in size generates greater social pressure to increase responsible practices, which translates into an increase in CSR (Kansal et al., 2014). As such, these relationships may lead to a continuous growth cycle.

Figure 4: Cumulative Impulse Responses Functions to a CSR Shock



This figure plots the cumulative IRF to a CSR shock. The CSR shock is equal to its standard deviation. The blue line represents the median response, while the shaded area represents the 90% confidence interval.

Second, a shock in CSR practices allows firms to reach dimensions considerably larger than those they would have without the adoption of such practices (Panel C). In the present sample, an initial 8-point increase in CSR score triggered a 28.3% increase in firm size over 20 years. This outcome suggests that CSR is a strategy that allows firms to extend the production scale, extending their growth potential.

Third, the firm's asset structure is reshaped (Panel D and E). The weight of collateral in total assets reduces by 3.5 percentage points and the weight of intangibles increases by 2.6 percentage points over 20 years. This means that the weight of collateral falls by 9.5% from its average, while intangibles grow by 12.3% relative to their average.

Fourth, a shock to the CSR score fails to alter the remaining firm characteristics - growth opportunities, risk, profitability, and MTR - in the long-term. Thus, although a CSR shock can affect the value of determinants from one year to the next, the level of these determinants in year t after the shock is not statistically different from the value. As such, CSR changes a firm's profile temporarily, but not in the long-term.

Finally, one can see that an initial shock to the CSR of about 8 points resulted in an increase in the debt ratio of about 7.8 percentage points over 20 years. This result signals that the debt ratio increases by about 44% of its average. However, these values only represent the average behaviour of several firms. Therefore, I cannot rule out the hypothesis that the direction and magnitude of the cumulative variation in the debt ratio – due to a shock in the CSR – varies from firm to firm, depending on its characteristics.

5.3. The impact of CSR on the optimal debt ratio: Depending on the firms' features

Table 3 presents the differences of the cumulative impact on the debt ratio following a CSR shock between firms with higher values of a specific determinant and firms with lower values for the same determinant, over time. Each row represents a specific determinant (i.e., a distinct firm feature), while the columns correspond to the distinct years associated with the differences between the IRFs.[14] Hence, this table allows me to discern which firm characteristics affect the magnitude and direction of the impact of a CSR shock on the cumulative change in the debt ratio.

[14] In the annexes, I present the graphical representation of cumulative IRFs for the key endogenous variables - CSR, debt ratio and OCS determinants - due to a CSR shock. Each figure corresponds to a different discriminant variable. Hence, each figure presents one cumulative IRF for high values of the respective discriminant variable and another for low values, as well as the difference between these IRFs.

Table 3: Cumulative response of debt ratio to CSR shock: depending on firm's characteristics.

	Year 1	Year 5	Year 10	Year 15	Year 20
LTA	.0009	.0108	.0233*	.0304**	.0341**
	(.0018)	(.0090)	(.0136)	(.0163)	(.0181)
COL	-.0008	-.0009	-.0009	-.0012	-.0013
	(.0011)	(.0037)	(.0048)	(.0055)	(.0060)
INTANG	-.0009	-.0021	-.0010	-.0003	-.0001
	(.0014)	(.0051)	(.0067)	(.0075)	(.0081)
RISK	-.0006*	-.0013	-.0008	-.0004	-.0001
	(.0003)	(.0011)	(.0014)	(.0017)	(.0019)
CF	.0001	-.0025	-.0036	-.0039	-.0040
	(.0007)	(.0023)	(.0028)	(.0031)	(.0033)
MTR	.0000	.0000	-.0000	-.0001	-.0001
	(.0000)	(.0001)	(.0002)	(.0004)	(.0006)
BTM	.0002	.0027	.0044	.0048	.0049
	(.0009)	(.0033)	(.0042)	(.0048)	(.0051)

This table presents the difference between: The cumulative IRF for the debt ratio and higher values of the discriminant variable; and the cumulative IRF for the debt ratio and lower values of that discriminant variable. Each row represents a different discriminant variable, while the columns correspond to the different years associated with that difference. The standard deviation of that difference is presented in parentheses. ***, ** and * represent that the parameters are significant at 1%, 5% and 10%, respectively.

The first column of Table 3 shows that only the firm's risk significantly affects the magnitude of the variation in debt ratio after one year from the shock. This result suggests that risk is the only firm's characteristic that affects the intensity of the direct impact of CSR on the debt ratio, exerting influence in the *short-term*. In fact, less risky companies (i.e., less volatile earnings) – compared to risky ones – show a higher increase in the debt ratio at the end of the first year. In fact, firms with higher volatility of results suffer higher bankruptcy costs/risks (Bradley et al., 1984), hence it is expected that more volatile firms do not increase their debt level as much, under the threat of facing higher bankruptcy costs.

The second column shows that the cumulative variation of the debt ratio – in year 5 and due to the CSR shock – does not depend on any of the seven characteristics of the firm under analysis. This result suggests that, in the *medium-term*, the impact of CSR on the debt ratio will be similar for all firms, regardless of their profile.

From the last three columns, I find that the impact of a CSR shock on the cumulative change in the debt ratio – in years 10, 15 and 20 (i.e., in the *long-term*) – only depends on the firm size. The results suggest that larger firms – compared to smaller ones – exhibit a higher increase in the debt ratio in the *long-term* due to a CSR shock. Besides being statistically significant, the result is also economically meaningful because the debt ratio grows more in larger firms by 3.41 percentage points (at the end of 20 years).[15] This absolute increase indicates that the increase in the debt ratio is higher by 61.4% in larger firms than in smaller ones.

Nevertheless, to comprehend the origin of this behaviour, it is essential to understand the dynamics generated by the CSR shock (i.e., the direct and indirect effects produced) and how the firm size may condition the direction and magnitude of these dynamics. Table 4 allows me to perform this analysis, revealing whether the CSR shock's impact on the firm's determinants depends on firm size. If so, the firm size influences the intensity of the indirect effects of CSR on the debt ratio. The values presented in Table 4 represent the difference between: The cumulative IRF for the endogenous variable in the row (and for firms with larger size); and the cumulative IRF for the endogenous variable in the row (and for firms with lower size). The two differentiated IRFs result from a CSR shock. The displayed values only report the difference between the IRFs in year 20 after the shock. From Table 4, I highlight two key patterns.

First, a boost in CSR leads larger companies - compared to smaller ones - to show greater size growth, a greater increase in intangibles' weight and a sharper reduction in tangibles' weight. In fact, larger firms are more exposed to public scrutiny, generating greater social pressure to implement CSR practices (Kansal et al., 2014). But this greater scrutiny also implies that CSR practices implemented in larger firms are more easily recognized and valued by stakeholders, generating greater product differentiation/competitive advantage. In this way, a higher dimension makes it easier to transform CSR investment into brand value (and intangibles) gains and allows the firm to grow faster. Additionally, one can see that the variation in the intangibles' weight is similar to the opposite of the variation in the tangibles' weight. This relationship suggests that the tangibles' weight reduces as a direct counterpart of the higher variation of intangibles' weight.[16]

Second, risk evolves more favourably in larger companies than in smaller ones. In larger firms, control over the manager becomes harder to achieve, given the increased complexity of the firm's management structure. This context leads to emerging agency costs between shareholders and managers (Singh & Davidson, 2003), increasing the corporate risk level. In

[15] The group of larger firms presents a median LTA fixed at 23.99, while the group of smaller firms presents a median LTA of 21.41. These values signal that the group of larger firms displays a median size 12 times larger.
[16] In Annexes, I show that the variation in the weight of other assets does not depend on the firm size. This result reinforces that the tangible's weight goes down as a counterpart of the increase in the intangible's weight.

this context, the CSR practices disclosure exposes managers' options, making the control over them more effective (e.g., Kanodia & Lee, 1998). Thus, CSR practices may control the higher agency costs in larger firms, generating a more favourable evolution of risk.

Table 4: Cumulative response of determinants to CSR shock: depending on size.

	Size
CSR	4.2001
	(3.1833)
LTA	.2067**
	(.0854)
COL	-.0265*
	(.0155)
INTANG	.0377***
	(.0143)
RISK	-.0116**
	(.0052)
CF	-.0049
	(.0097)
MTR	.0011
	(.0026)
BTM	-.0079
	(.0244)

This table presents the difference between: Cumulative IRF for the endogenous variable in the row (and larger firms); and Cumulative IRF for the endogenous variable in the row (and smaller firms). The table only reports the difference between the IRFs in year 20 after the CSR shock. The standard deviation of that difference is presented in parentheses. ***, ** and * represent that the parameters are significant at 1%, 5% and 10%, respectively.

Thus, in response to a CSR score shock, larger firms - compared to the smaller ones - exhibit four differences: higher growth, a higher increase(decrease) in the weight of intangibles(tangibles), and a more favourable evolution in risk. All these reasons lead to debt increasing more in larger firms than in smaller ones (based on conclusions from Figure 2).

5.4. The impact of determinants on the optimal debt ratio: Depending on CSR level

From the strategic management standpoint, it is crucial to understand how CSR levels can influence the dynamic relationship between the OCS determinants and the debt ratio. In this context, Table 5 presents the differences of the cumulative impact on the debt ratio between firms with higher CSR values and firms with lower CSR values following a shock in a determinant. Each row represents a specific shock variable, while the columns correspond to distinct years associated with the differences between the cumulative IRFs.[17] Hence, Table 5 allows assessing whether the level of CSR affects the cumulative variation of the debt ratio due to an initial shock in each determinant.

The first column of Table 5 shows that, in year 1, only the link between risk and debt ratio is affected by the intensity of CSR activities. The results suggest that in firms with higher CSR levels - compared to those with lower levels - a risk shock triggers a larger reduction in the debt ratio, intensifying the direct impact of risk. Indeed, firms with higher CSR levels show greater transparency and higher consideration for the interests of their stakeholders (e.g., Cui et al., 2018). Therefore, more responsible firms may tend to protect lenders, shielding them from the risk of expropriation of their wealth by shareholders that may arise from increased corporate risk. However, this behaviour may make financing less favourable in the *short-term* rendering debt less attractive.

Table 5: Cumulative response of debt ratio to OCS determinants shock: depending on CSR level.

	Year 1	**Year 5**	**Year 10**	**Year 15**	**Year 20**
LTA	-.0001	.0002	.0052	.0067*	.0075**
	(.0006)	(.0028)	(.0033)	(.0039)	(.0042)
COL	-.0008	-.0032	-.0043	-.0050	-.0055
	(.0009)	(.0028)	(.0036)	(.0039)	(.0041)
INTANG	-.0010	-.0021	-.0009	-.0002	.0001
	(.0011)	(.0040)	(.0051)	(.0056)	(.0059)
RISK	-.0033*	-.0061	-.0024	.0000	.0012
	(.0020)	(.0061)	(.0076)	(.0083)	(.0087)
CF	.0007	-.0060	-.0121**	-.0149**	-.0163***
	(.0017)	(.0053)	(.0065)	(.0071)	(.0074)
MTR	-.0012	-.0075	-.0133**	-.0161**	-.0176**
	(.0024)	(.0056)	(.0067)	(.0073)	(.0076)
BTM	-.0002	.0025	.0051	.0060	.0063
	(.0019)	(.0066)	(.0084)	(.0093)	(.0097)

This table presents the difference between: Cumulative IRF for the debt ratio and firms with higher CSR levels - due to shock in a determinant; and Cumulative IRF for the debt ratio and firms with lower CSR levels - due to a shock in that determinant. Each row represents a different shock variable, while the columns correspond to distinct years associated with that difference. The standard deviation of that difference is presented in parentheses. ***, ** and * represent that the parameters are significant at 1%, 5% and 10%, respectively.

[17] In the annexes, I present the graphical representation of the cumulative IRFs for the key endogenous variables - CSR, debt ratio and OCS determinants - due to a determinant shock. Each figure corresponds to a different shock variable. Hence, each figure presents one cumulative IRF for firms with higher CSR levels and another for firms with lower levels, as well as the difference between these IRFs.

From the second column, I observe that the cumulative variation of the debt ratio - at the year 5 and due to the shock on each one of the seven determinants - does not depend on the CSR level. This finding suggests that, in the *medium-term*, the level of CSR does not condition the cumulative response of the debt ratio to the determinants shock.

In the last three columns, I verify that the impact of a determinants' shock on the cumulative change in the debt ratio - in years 10, 15 and 20 (i.e., in the *long-term*) - may depend on the CSR levels. Nevertheless, CSR only conditions this relationship when the shock occurs in three determinants. First, a size shock causes a higher increase in the debt ratio in firms with higher CSR levels than in less responsible firms. In year 20, this growth difference is fixed at 0.75 percentage points, which means that the growth of the debt ratio is 9.4% higher in firms with higher CSR levels.[18] Second, a boost in profitability causes a less favourable evolution of debt ratio in more responsible firms. After 20 years, this difference (1.63 percentage points) is so sharp that the debt ratio growth for the less responsible firms is 295% higher than for firms with higher CSR levels. Third, an unexpected increase in MTR generates a less favourable evolution of debt intensity in firms with higher CSR levels. This growth difference is fixed at 1.76 percentage points.

To grasp the origin of these three findings it is critical to assess what dynamics are generated by the determinant's shock and how the CSR level can condition these dynamics. A determinant's impulse leads to variations in the other determinants, whereby the CSR level may affect the strength of these intertemporal relationships between the determinants. By affecting such relations, the variation in the determinants' value becomes dependent on the CSR level. Thus, such practices condition indirectly the debt ratio evolution in the *long-term*.

That said, for each of the three outcomes, I analyse the dynamics conditioned by the CSR level, which are reflected in Table 6. Hence, the values presented in Table 6 represent the difference between the cumulative IRFs for the endogenous variable (in each row) for firms with higher CSR levels and the cumulative IRFs for firms with lower CSR levels, following a shock in each of the three key determinants (one for each column). The displayed values only report the difference between the IRFs in year 20 after the shock.

Starting with the size shock, two key dynamics may be highlighted. First, the unexpected size shock leads firms with higher CSR levels - compared to firms with lower levels - to show

[18] The group of firms with the highest CSR levels presents a median CSR score of 68.17%, while the group of firms with the lowest CSR levels presents a median CSR score of 24.98%.

higher cumulative growth in firm size and intangibles weight. In the face of a size shock, firms become more publicly exposed, so consumers and stakeholders have a wider knowledge of practices. If these practices are responsible, then this wider exposure helps to generate stronger customer loyalty and more favourable relationships with the other stakeholders (e.g., Hsu, 2012; Luo & Bhattacharya, 2009). In this way, these strengthened relationships may allow the firm to obtain competitive advantages that let them grow even more and generate an enhanced brand value (and intangible value).

Table 6: Cumulative response of determinants: depending on CSR level.

	LTA shock	CF shock	MTR shock
CSR	.8098	-2.7534**	-2.0761
	(.7559)	(1.4125)	(1.3661)
LTA	.0429**	-.1053***	-.1278***
	(.0196)	(.0327)	(.0339)
COL	-.0011	.0055	.0047
	(.0034)	(.0058)	(.0058)
INTANG	.0066**	-.0110**	-.0144**
	(.0033)	(.0053)	(.0054)
RISK	-.0036***	.0050***	-.0004
	(.0011)	(.0020)	(.0020)
CF	.0003	-.0025	-.0028
	(.0023)	(.0037)	(.0038)
MTR	.0001	-.0023**	-.0037***
	(.0006)	(.0011)	(.0011)
BTM	-.0080	.0267***	.0063
	(.0056)	(.0097)	(.0101)

This table presents the difference between: Cumulative IRF for the endogenous variable in the row and firms with higher CSR levels; and Cumulative IRF for the endogenous variable in the row and firms with lower CSR levels. The table only reports the difference between the IRFs in year 20 after the shock (of the variable in the column). The standard deviation of that difference is presented in parentheses. ***, ** and * represent that the parameters are significant at 1%, 5% and 10%, respectively.

Second, one can observe that, in the face of a size shock, the cumulative evolution of risk is more favourable in firms with higher CSR levels, suggesting that CSR allows the firm to grow more stably. An increase in the firm size can make the firm's management structure more complex, hampering control over the manager, which raises agency costs and thereby increases the risk (Singh & Davidson, 2003). These results suggest that CSR as a disclosure tool makes the control over the manager more effective (e.g., Kanodia & Lee, 1998), limiting the increase in agency costs. Therefore, more CSR helps to reduce risk.

Thus, in the face of a size shock, firms with higher CSR levels - compared to those with lower levels - show stronger growth, a greater increase in the weight of intangibles and a more favourable evolution of risk. All these differences contribute to a greater increase in the debt ratio for firms with more intensive CSR programmes.

Moving to the second column of Table 6, I can point out two key dynamics. First, a boost in profitability drives firms with higher CSR levels - compared to those with lower levels - to exhibit lower cumulative growth in size and growth opportunities. On the one hand, firms with higher CSR levels - compared to those with lower levels - may have higher growth caps, thus, higher market shares. This means that it will be more difficult for these firms to gain more market share since they already have a more prominent position in the market. Therefore, the growth of these firms will be more conditioned by the market's growth. On the other hand, less responsible firms may have lower market shares, and thus the increase in profitability (signalling a competitive advantage) helps these firms to gain market share from their competitors. In this way, they can grow more sharply.

In addition, one can see that a profitability shock leads firms with higher CSR scores to show lower cumulative growth in the intangibles weight, CSR score and MTR. The three effects may result from the higher growth of firms with lower intensity of CSR practices (as seen in Figure 2)

Second, I can state that, due to a profitability shock, the cumulative evolution of risk is less favourable in more responsible firms. Since increased profitability is accompanied by a smaller increase in growth opportunities in more responsible firms, then following the agency theory it is expected that, in these more responsible firms, there is a greater propensity for opportunistic behaviour by managers, raising the firm's risk (Jensen, 1986).

Completing this analysis with the conclusions from Figure 2, I can state that all the differences - between firms with higher and lower CSR levels - listed in the two previous points contribute to a less favourable evolution of the debt ratio in more responsible firms.

From the last column of Table 6, I may infer that a push in MTR leads firms with higher CSR levels - compared to those with lower levels - to show lower cumulative growth in firm size, intangibles weight and MTR. An increase in MTR may occur because earnings increase or become more stable. Therefore, the MTR increase may result from increased size and/or improved profitability. This increase signals that the firm has a more favoured position within the market, which allows it to grow over time. However, this growth tends to be less pronounced in firms with higher CSR levels since they already have a more prominent position in their markets (as concluded before), so it is harder for them to grow by gaining more market share. Therefore, in firms with higher CSR levels, long-term growth is more dependent on market growth. In addition, the lower size growth in the most responsible firms also leads to a more moderate increase in the brand (and intangible) valuation and MTR value in those firms (as seen in Figure 2). All these differences between firms with higher CSR levels and firms with lower levels contribute to the debt ratio varying more favourably in less responsible firms (based on Figure 2).

In sum, in the long-term, the CSR level may influence whether a shock to one determinant translates into a higher or lower change in the value of the other determinants. By affecting the magnitude of these intertemporal relationships, the CSR is shifting the level of each determinant, thus changing the relative importance of each determinant in the OCS definition.

6. Conclusion

In this dissertation, I analyse how CSR dynamically affects the OCS definition, dividing my analysis into four objectives. First, I explore the dynamic impact of determinants on OCS. Second, I explore the dynamic impact of CSR on the optimal debt ratio. Third I assess whether the impact of CSR on debt ratio depends on the firm's profile, i.e., its characteristics. Fourth, I assess whether the effect of determinants on OCS depends on the CSR level.

Overall, I highlight three main elements in my methodology. First, I develop two models (P-VAR and IP-VAR) that assume the existence of intertemporal causal relationships among the various OCS determinants and between the determinants and the optimal debt ratio. Second, I allow my IP-VAR model to consider the existence of potential causal relationships between CSR and the determinants, and between the CSR and the debt ratio. Third, the IP-VAR includes a set of seven interaction terms between CSR and each of the determinants. This inclusion allows for exploring non-linear relations between CSR and the debt ratio, and between the determinants and the debt ratio. From IP-VAR, it is possible to construct and compare two IRFs at different percentiles of the distributions of the variables involved in the interactions. If the difference between the IRFs is meaningful, there are non-linear relationships, which depend on the level of CSR or the firm features.

The findings can be divided into four distinct groups. First, the results suggest that causal relationships exist among the OCS determinants. As such, the determinants impact OCS through direct and indirect effects. Regarding direct effects – the target of the empirical OCS literature – there are relationships with opposite effects. On the one hand, the results suggest that the increase in size, intangibles' weight, and growth opportunities lead to an increase in the optimal debt ratio. On the other hand, the increase in the tangibles' weight, profitability and risk contributes to the debt ratio reduction. Therefore, most outcomes tend to support the relations argued by the POT, although some relationships are better framed by agency theory or TOT. Regarding indirect effects, it is imperative to acknowledge their existence, as such consideration allows for a full assessment of the long-term effect on the debt ratio yielded by the change in the value of determinants.

Second, I found that a CSR investment leads to continuous growth – albeit at decreasing rates – of the debt ratio, over time. This growth may be explained by two perspectives. First, the direct impact of CSR on the OCS is positive; Second, CSR investment triggers a set of indirect effects on the OCS, and the sum of these effects yields a net increase in the debt ratio. Regarding indirect effects, the CSR increase generates two medium- and long-term effects: the increase in the firm's growth potential and the reshaping of the firm's asset structure in favour of intangibles. These effects contribute to a sharper increase in the debt ratio. I also found that CSR promotes risk increase (in years 1 and 2 after the shock) and profitability reduction (after year 7), which helps attenuate the debt ratio's growth trend.

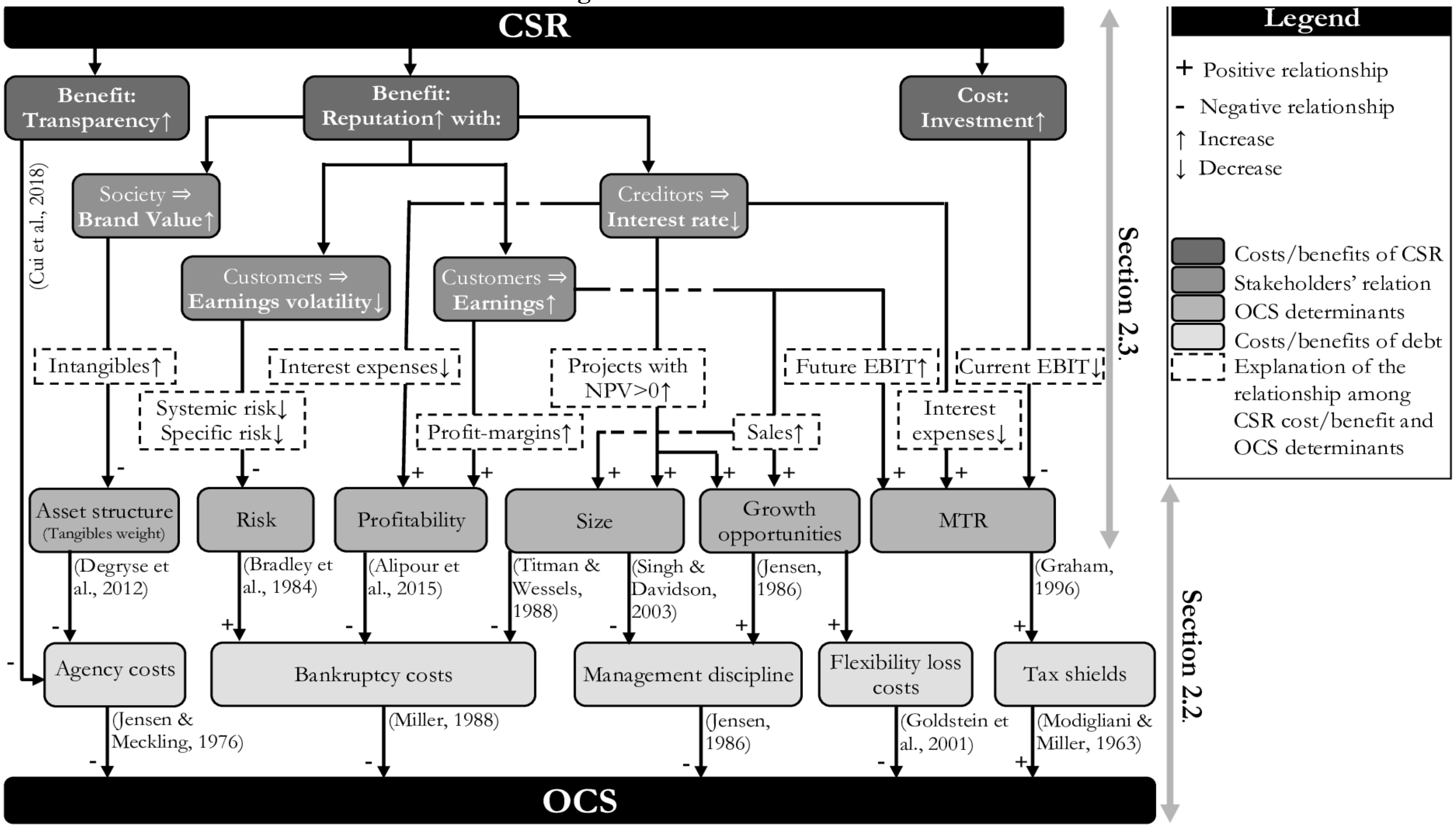
Third, I checked that the dynamic response of the debt ratio to CSR investment may depend on firms' characteristics. I divide these responses into three temporal dimensions: (*i*) in the short-term, the debt ratio grows more in less risky firms; (*ii*) in the medium-term, the increase in the debt ratio does not depend on any firm characteristics; (*iii*) in the long-term, the debt ratio grows more in larger firms. Exploring the last finding in more detail, I found that firm size affects the magnitude of several indirect effects of CSR on OCS. Namely, larger firms - compared to smaller ones - show higher size growth, a higher increase in intangibles' weight, a sharper reduction in tangibles' weight, and a more favourable evolution of risk. All these differences contribute to the higher growth of the debt ratio in larger firms.

Fourth, the findings suggest that the dynamic response of the debt ratio to changes in the firm's profile (i.e., changes in the OCS determinants) may depend on the CSR level. I divide these responses into three temporal dimensions: (*i*) in the short-term, and in the face of risk shock, the debt ratio decreases more in more responsible firms; (*ii*) in the medium-term, the variation of the debt ratio does not depend on the level of CSR for whichever determinant suffering the shock; (*iii*) in the long-term, an increase in size generates a higher increase in the debt ratio for more responsible firms, whereas an increase in profitability and tax shields generates a higher increase in the debt ratio for less CSR-intensive firms.

The results presented have two important implications for the design of dynamic financing policies. First, the findings show that investment in CSR and the changing firm's profile (i.e., in the OCS determinants) have long-term effects on OCS and firm profile. In this sense, it will be imperative that firms anticipate how the optimal debt ratio and determinants evolve. This anticipation allows firms to manage better the determinants that gain and lose relevance, ensuring better financing conditions over time. Second, long-term debt management is not a one-size-fits-all policy, following two perspectives. On the one hand, to manage the long-term effects on debt - resulting from investment in CSR - firms should consider the firm features, especially the firm size. On the other hand, to manage long-term effects on debt – resulting from reshaping the firm features – firms should consider their level of CSR policies.

Appendix A: Indirect Effects

Figure 5: Effects of CSR on OCS



This scheme systematises Sections 2.2 and 2.3 of the literature review, representing the indirect effects through which CSR practices may affect OCS.

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Annexes

In this annexe, I begin by presenting the exhaustive data treatment performed to construct the MTR variable. The MTR represents the present value of the tax benefit resulting from an additional dollar of interest deduction (Graham, 1996).[19] To construct this metric, I rely on the proposals of Graham (2000) and Blouin et al. (2010) by considering two opposing dynamic tax features: carrybacks and carryforwards. On the one hand, carrybacks are a tax feature that allows a firm, in the presence of a loss, to be refunded up to the maximum amount of taxes paid in the last two years. Carryforwards enable a firm that had a loss in one year to carry that loss forward, helping to reduce the tax burden for up to 20 years following the loss.[20]

Table B1 helps to understand the intuition behind the MTR construction, using a simplified scenario in which the tax rate is assumed to be 35% and a 4-year forecast of taxable income is performed. The analysis of Table B1 accompanies the explanation of the six steps required to compute the MTR. First, I forecast taxable income 22 years into the future.[21] Second, for the current level of interest, I calculate how much tax is payable and receivable in each year, considering the tax elements of carrybacks and carryforwards.[22] Exemplifying, in Panel A, one can see that at $t = 1$ the firm has a loss, being reimbursed $1.40, due to the existence of carrybacks, i.e., taxes paid in the last two years. At $t = 2$, the firm is still incurring losses but can no longer receive any more because the carrybacks are exhausted. Thus, the firm accumulates carryforwards for later periods. At $t = 3$, the firm has profits but does not pay taxes, because the carryforwards from the previous year cover the entire amount of taxes. At $t = 4$, the firm exhausts the carryforwards and still pays $1.05 in taxes.

Third, I add a dollar of interest paid to period t=0 and recalculate the amount of payable and receivable taxes in each period, considering the tax elements of carrybacks and carryforwards. This step is exemplified in Panel B of Table B1. Fourth, I make the difference between the amounts paid/received in taxes in the two contexts - with and without the

[19] All citations in this annexe are duly referenced in the bibliography section (previously reported).

[20] The number of years associated with carrybacks and carryforwards is constant throughout the sample.

[21] The choice of 22 years is not arbitrary. Interest level variation can impact the amount of interest payable/receivable up to 22 years into the future. This period corresponds to the sum of the 2 years of carrybacks plus the 20 years of carryforwards.

[22] I have no data on initial values of carrybacks and carryforwards of firms. Therefore, I assume they are null, as Graham (2000) suggests.

additional dollar in interest. Subsequently, I discount this difference based on Moody's Baa bond yield associated with the year of observation, in line with Blouin et al. (2010). This step generates the MTR for one scenario. Using the example in Panel C and assuming a 10% discount rate, I get an MTR of 27.1%. Fifth, I generate a new scenario for the evolution of taxable income, where I repeat the previous four steps. I repeat this process 50 times, generating 50 different MTRs. Sixth, I average the MTRs to get the final MTR for a given firm and year.

Table 7: MTR computation

	$t = 0$	$t = 1$	$t = 2$	$t = 3$	$t = 4$
Panel A: Base Case					
Income	4	-4	-2	1	4
Carryforward	0	0	0.70	0.35	0
Carryback	1.40	0	0	0	1.05
Tax liability	1.40	-1.40	0	0	1.05
Panel B: Spend an extra dollar in interest at t=0					
Income	3	-4	-2	1	4
Carryforward	0	0.35	1.05	0.70	0
Carryback	1.05	0	0	0	0.7
Tax liability	1.05	-1.05	0	0	0.7
Panel C: Difference in Tax Liabilities					
Tax liability	0.35	-0.35	0	0	0.35

This table exemplifies the MTR calculation. Panel A shows the taxes paid/received in the base case. Panel B shows the taxes paid/received when $1 at $t = 0$ is added to the base case. Panel C makes up the difference between the amount paid/received in panels A and B. I assume that the tax rate is 35% and the discount rate is 10%.

To realize the first step, I follow Blouin et al. (2010). Thus, to estimate the taxable income, I estimate separately the interest amount and the taxable income before interest. Starting with the forecast of taxable income before interest, I follow five steps. First, I divide the firms into 30 groups, following two criteria and based on the values in year *t* - 2. With the first criterion, I split the firms into 6 bins based on the value of return-on-assets from *t* - 2 (ROA_{t-2} is measured as taxable income before interest in year *t* - 2 divided by average total assets in year t - 2).[23] The observations are distributed across the groups according to the ROA ranking of t - 2, whereby there are two bins with negative ROA and four bins with positive ROA. Using the second criterion, I subdivide each of the previous 6 bins into 5 smaller bins, accounting for a total of 30 bins. Thus, within a bin defined by the first criterion, the observations are distributed across the 5 bins according to the ATA ranking of t - 2 (ATA_{t-2} is measured as the mean of the total assets of t – 2 and t - 3).

Each observation for year t-2 is associated with two values: the change in return-on-assets ($ROA_{t-1} - ROA_{t-2}$) and the growth rate of assets (ATA_{t-1}/ATA_{t-2}). Meaning, for each of the 30 bins created is associated with a distribution for the growth of profitability and another distribution for the growth of assets. Since my sample includes 16 years, I repeated this step 16 times so that each *different year* is associated with a set of 30 distributions.

Second, considering the values of ROA and ATA for year t, I position the company within the bins created (based on the values for year t - 2). Once the firm-year observation is positioned within one of the 30 bins, I randomly choose an observation from that distribution. Thus, I obtain one estimate for the change in ROA between t and t +1 ($\Delta ROA_{t-1} = ROA_{t-1} - ROA_{t-2}$) and another for the growth in ATA between t and t +1 (ATA_{t-1}/ATA_{t-2}).

Third, I calculate the ROA for t +1 and the average total asset for t +1. Having these two forecasts, I can then compute the amount of taxable income before interest for year t +1 as the multiplication between the ROA for t +1 and the ATA for t +1.

Fourth, to obtain the taxable income for the year t +2, I repeat step 2. Based on the ROA and ATE values for t+1, I reframe the firm within the bins relating to year t - 2.[24] After framing, I forecast the ROA and ATE values for t +2. Blouin et al. (2010) repeat this process until t +22. However, I make a small change in the forecasting process since I do not consider it reasonable to forecast long-term evolution based on the behaviour of the economy

[23] In line with Blouin et al. (2010), I compute taxable income before interest as the sum of: Earnings Before Interest and Taxes (EBIT); Non-Operating Income; Deferred Taxes divided by the maximum tax rate.

[24] Following Blouin et al. (2010), to predict from t +2 to t +22, I assume that the bins and distributions are always the same. However, there can be changes in the criteria for fitting a firm into a bin (in the second step). This correction happens as the ATA grows over time (i.e., the ATA at t +22 can be expected to be higher than at t due to factors such as inflation). To mitigate the problem, as the years advance, the ATA boundaries for each bin are adjusted. The rate at which ATA varies from year to year is identified as the median growth rate of ATA between t - 3 and t - 2. Hence, for example, to fit a firm in year t, I multiply the original limits (at t +2) by $(1+\text{median growth rate})^2$.

between *t* - 1 and *t* - 2. That said, I only forecast up to *t* +3 (i.e., in the medium-term) based on the bins generated by observations in year *t* - 2. After that year, I assume that the evolution is no longer guided by the recent behaviour of the economy, adopting the following procedure: (*i*) randomly select a year from the 16 for which I created the set of 30 distributions. By selecting a year at random, I guarantee that the forecast for the long-term evolution is not dependent on the recent behaviour of the economy; (*ii*) within the chosen year, I frame the observation within one bin to generate a forecast for the evolution of ROA and ATE.[25]

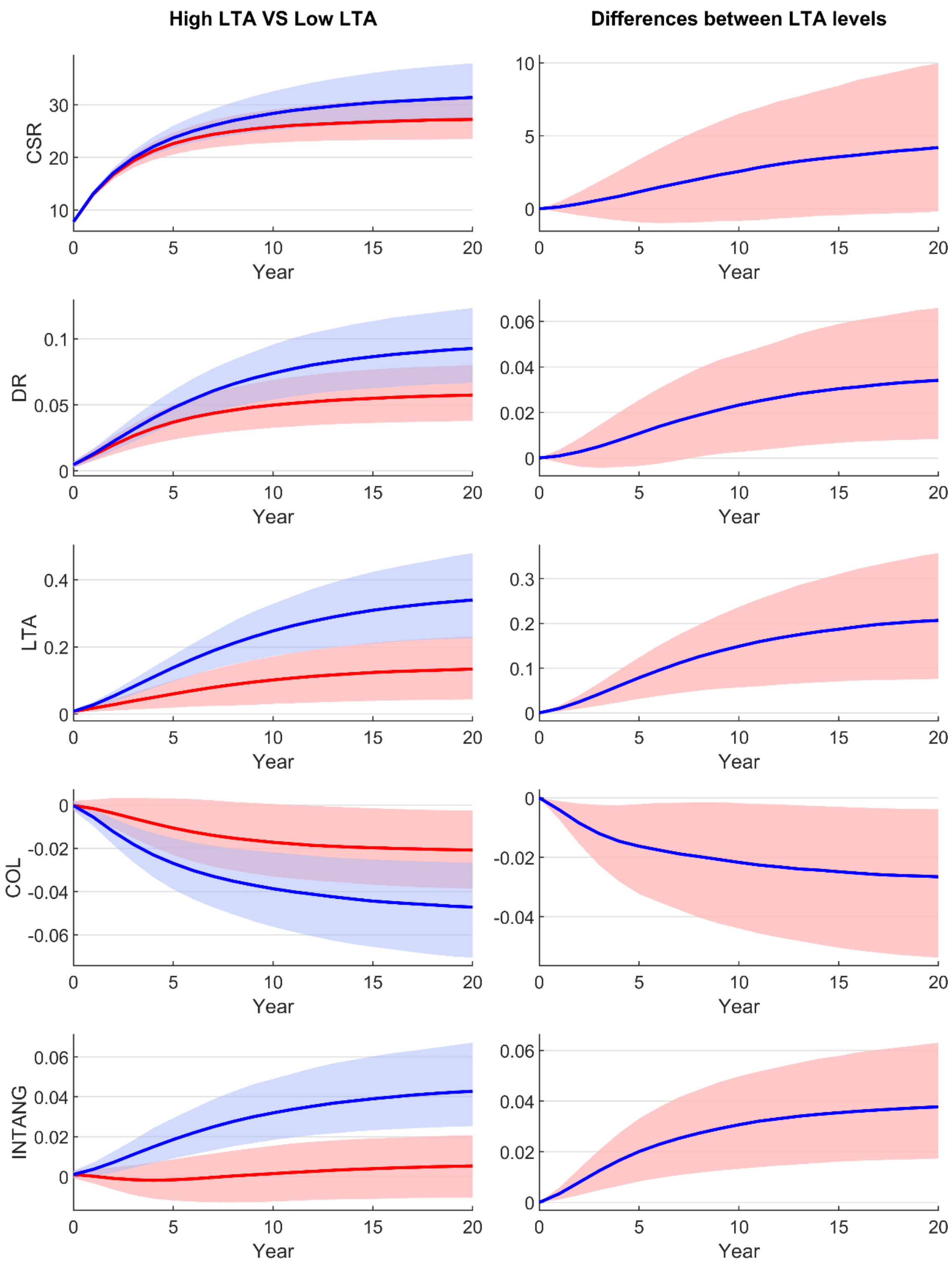
These four steps allow me to predict the taxable income before interest for one scenario. To generate the set of 50 scenarios, I repeat this process 50 times. Additionally, to forecast the amount of interest the firm bears in each of the 22 years of each scenario, I follow Graham (2000), assuming two assumptions: (*i*) if the forecasted taxable income of *t* +n is positive, then firms have an interest in keeping constant the interest over book-value ratio (IOB) verified in year t; (*ii*) if the forecasted taxable income of *t* +n is negative, then the firm maintains the interest level of the previous year (*t* +n - 1), because it does not have enough cash to retire debt (Graham, 2000).[26]

[25] I account for the differences between the ATA price level in year t+n and the ATA price level of the year selected to generate the distribution.

[26] There is a difference from Graham (2000) and Blouin et al. (2010). These authors fix the coverage ratio (i.e., EBIT divided by interest), while I fix the interest over book-value ratio (IOB). I choose the IOB since firms can rely on this metric to define their debt intensity, as suggested by Van Binsbergen et al. (2010).

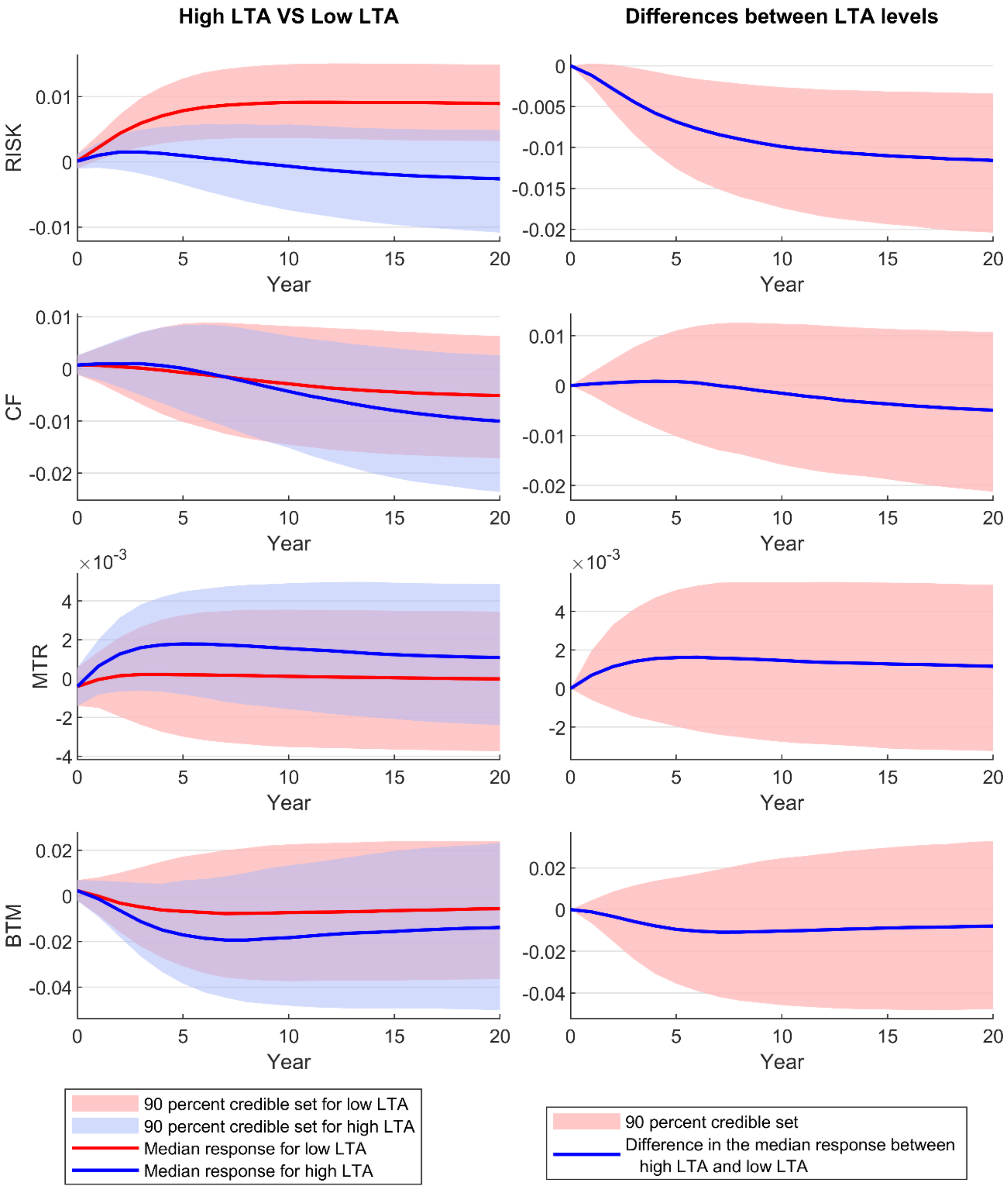
Next, I present the graphical representation of cumulative IRFs for the key endogenous variables - CSR, debt ratio, and OCS determinants - due to a determinant shock. Each figure corresponds to a different discriminant variable.

Figure A1: Cumulative IRF to a CSR shock: Depending on the size



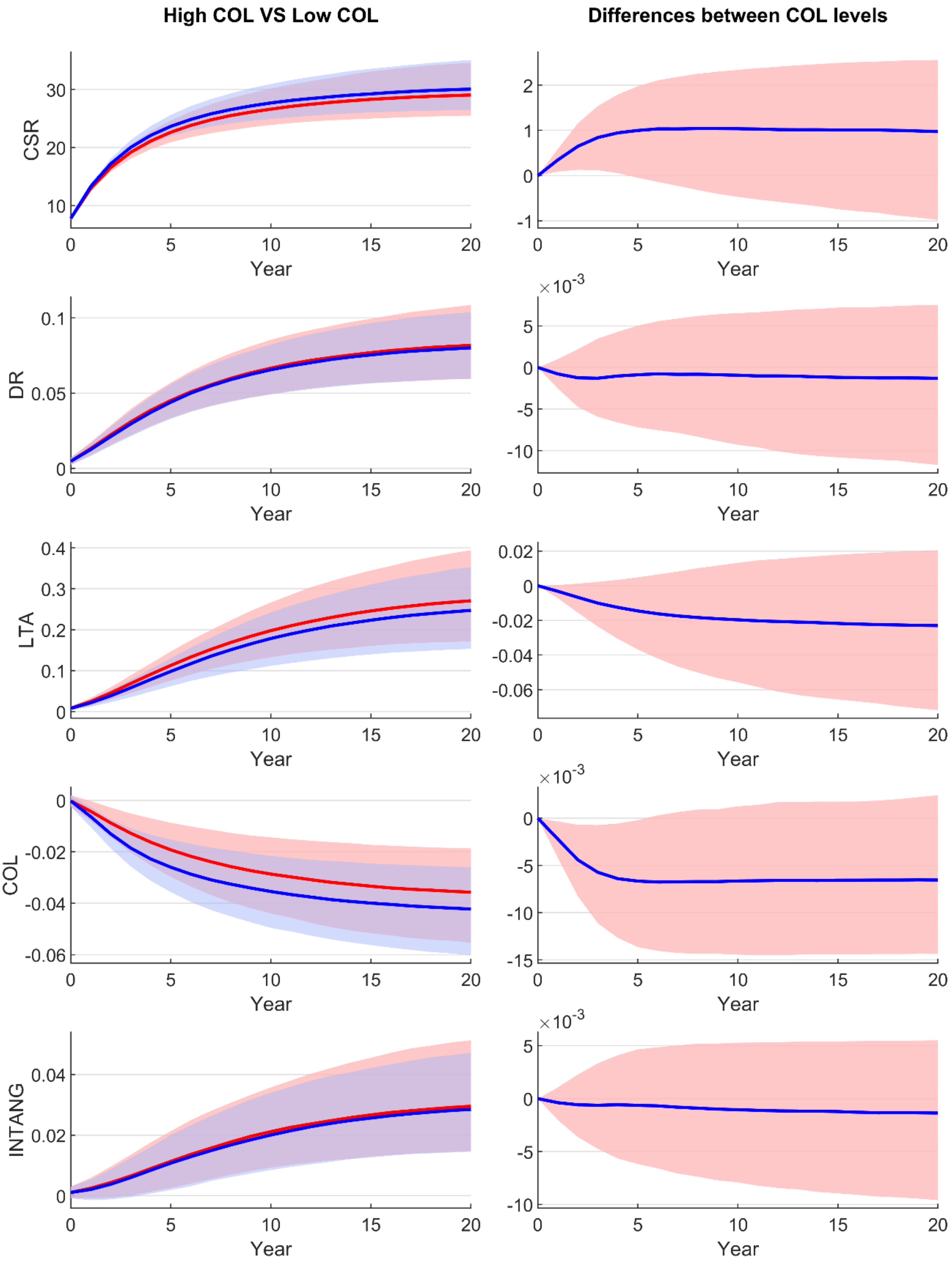
(continued)

Figure A1: Cumulative IRF to a CSR shock: Depending on the size (continued)



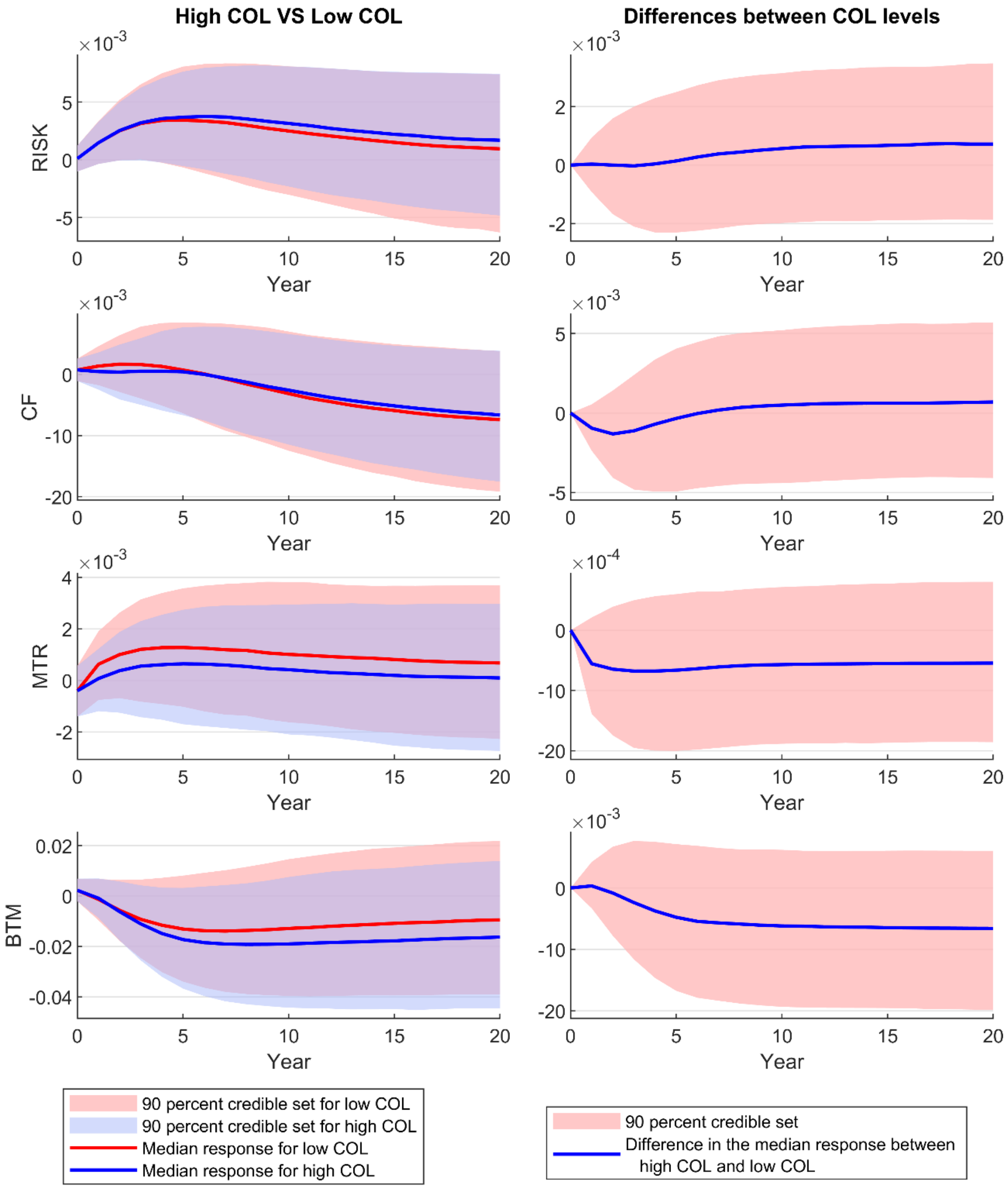
This figure plots the cumulative Impulse Response Function for the key endogenous variables - CSR, debt ratio, and the multiple determinants of OCS - to a CSR shock. The CSR Shock is equal to the dimension of its standard deviation. The figure has two columns of graphs. In the leftmost column, each graph plot has two IRFs: The blue line corresponds to the median response of the larger firms, while the blue shaded area is the respective 90% confidence interval; The red line corresponds to the median response of the smaller firms, while the red shaded area is the respective 90% confidence interval. The graph plots in the rightmost column show the difference between the two IRFs on the left graph plot (represented in the blue line), with the red shaded area representing the respective 90% confidence interval.

Figure A2: Cumulative IRF to a CSR shock: Depending on the tangible weight



(continued)

Figure A2: Cumulative IRF to a CSR shock: Depending on tangible weight (continued)



This figure plots the cumulative Impulse Response Function for the key endogenous variables - CSR, debt ratio, and the multiple determinants of OCS - to a CSR shock. The CSR Shock is equal to the dimension of its standard deviation. The figure has two columns of graphs. In the leftmost column, each graph plot has two IRFs: The blue line corresponds to the median response of the firms where tangibles are most relevant, while the blue shaded area is the respective 90% confidence interval; The red line corresponds to the median response of the firms where tangibles are least relevant, while the red shaded area is the respective 90% confidence interval. The graph plots in the rightmost column show the difference between the two IRFs on the left graph plot (represented in the blue line), with the red shaded area representing the respective 90% confidence interval.

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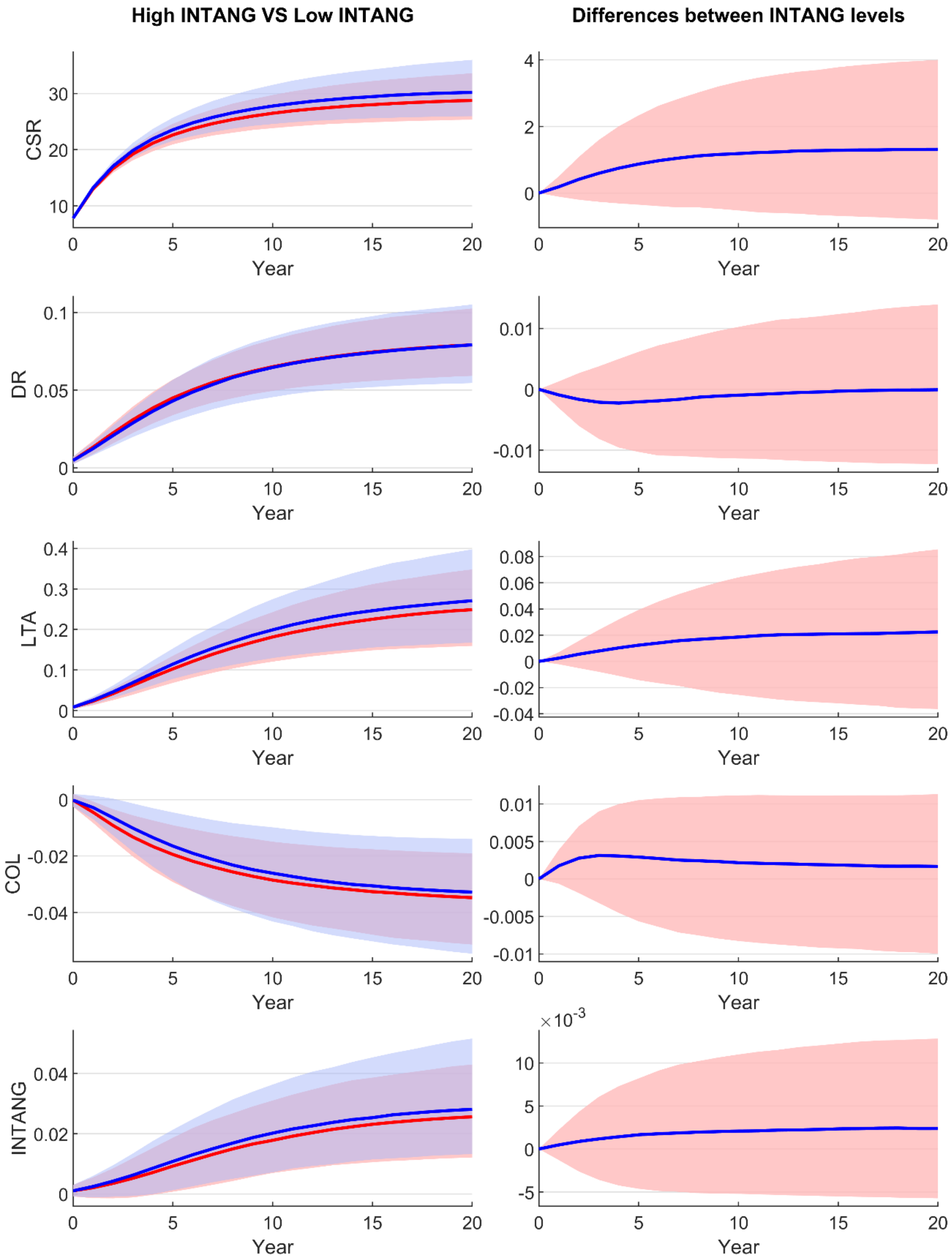
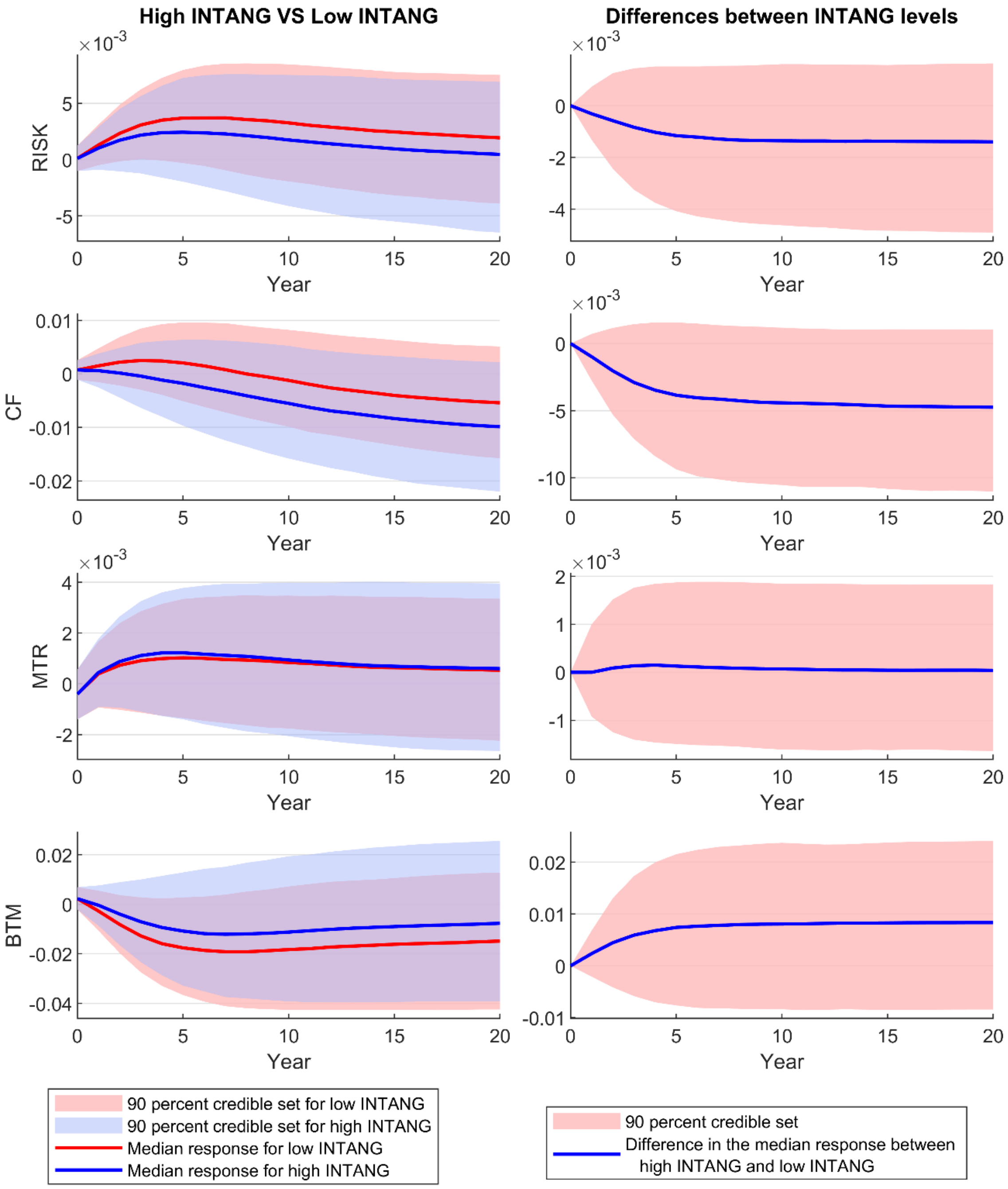
Figure A3: Cumulative IRF to a CSR shock: Depending on the intangible weight



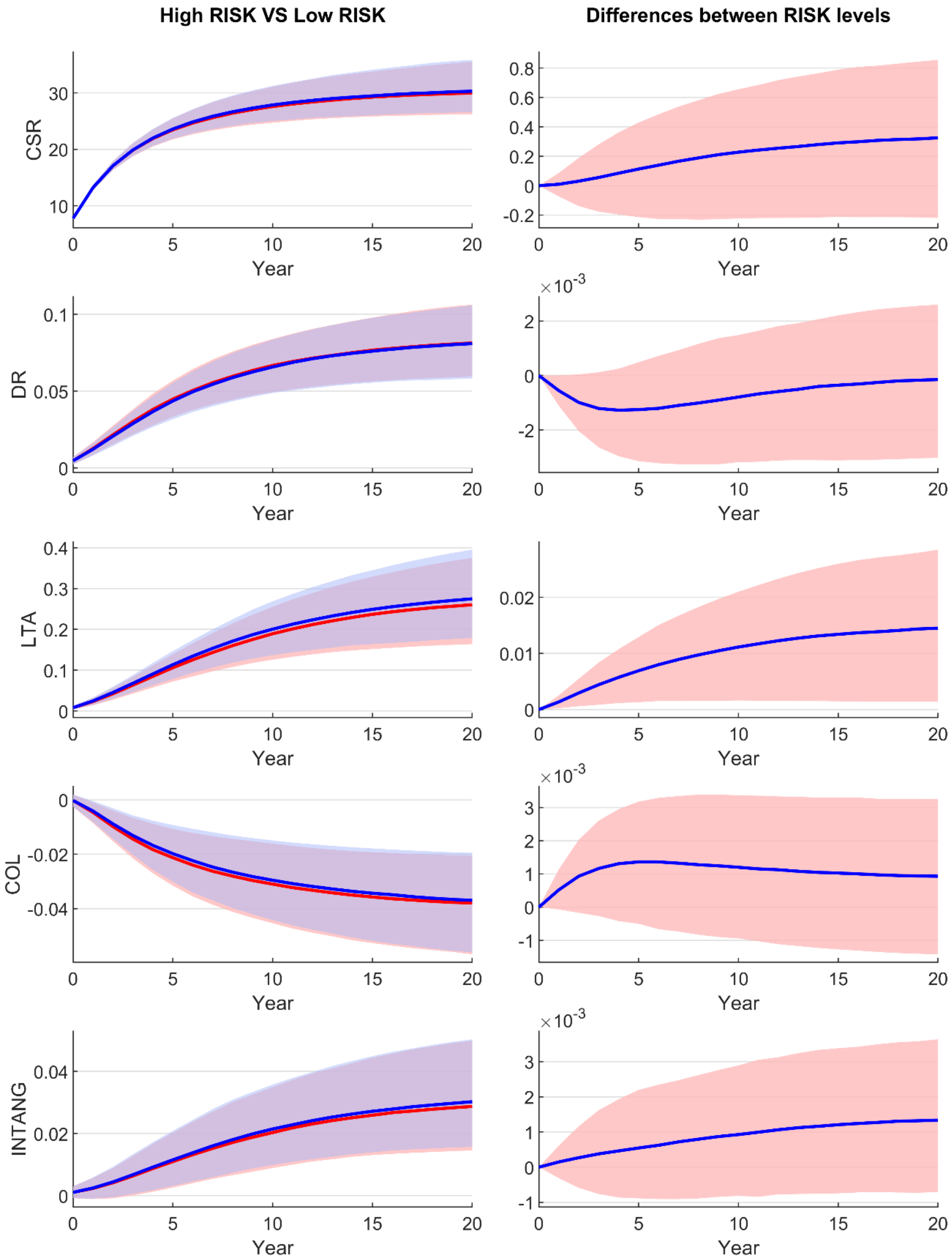
(continued)

Figure A3: Cumulative IRF to a CSR shock: Depending on intangible weight (continued)



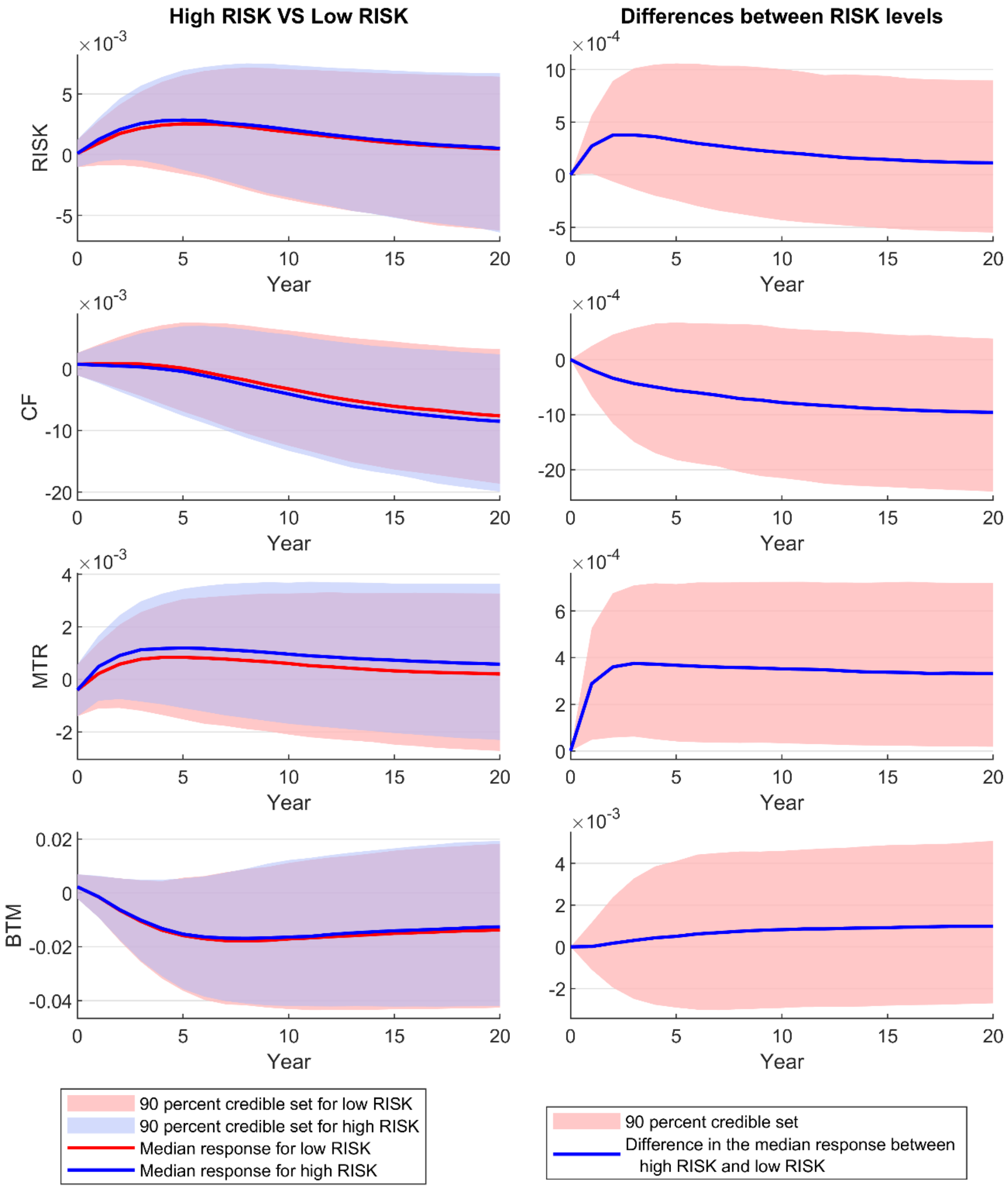
This figure plots the cumulative Impulse Response Function for the key endogenous variables - CSR, debt ratio, and the multiple determinants of OCS - to a CSR shock. The CSR Shock is equal to the dimension of its standard deviation. The figure has two columns of graphs. In the leftmost column, each graph plot has two IRFs: The blue line corresponds to the median response of the firms where intangibles are most relevant, while the blue shaded area is the respective 90% confidence interval; The red line corresponds to the median response of the firms where intangibles are least relevant, while the red shaded area is the respective 90% confidence interval. The graph plots in the rightmost column show the difference between the two IRFs on the left graph plot (represented in the blue line), with the red shaded area representing the respective 90% confidence interval.

Figure A4: Cumulative IRF to a CSR shock: Depending on risk



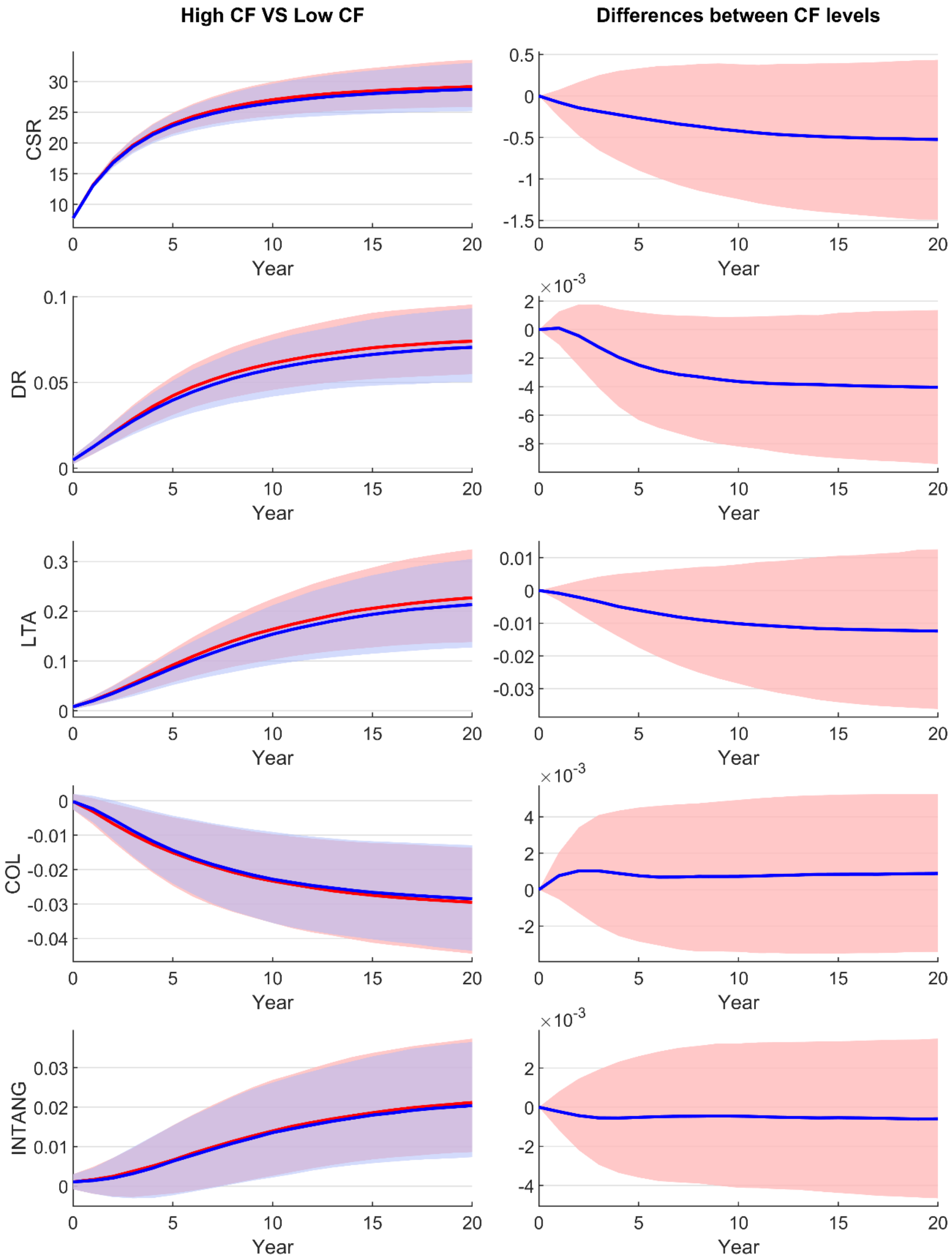
(continued)

Figure A4: Cumulative IRF to a CSR shock: Depending on risk (continued)



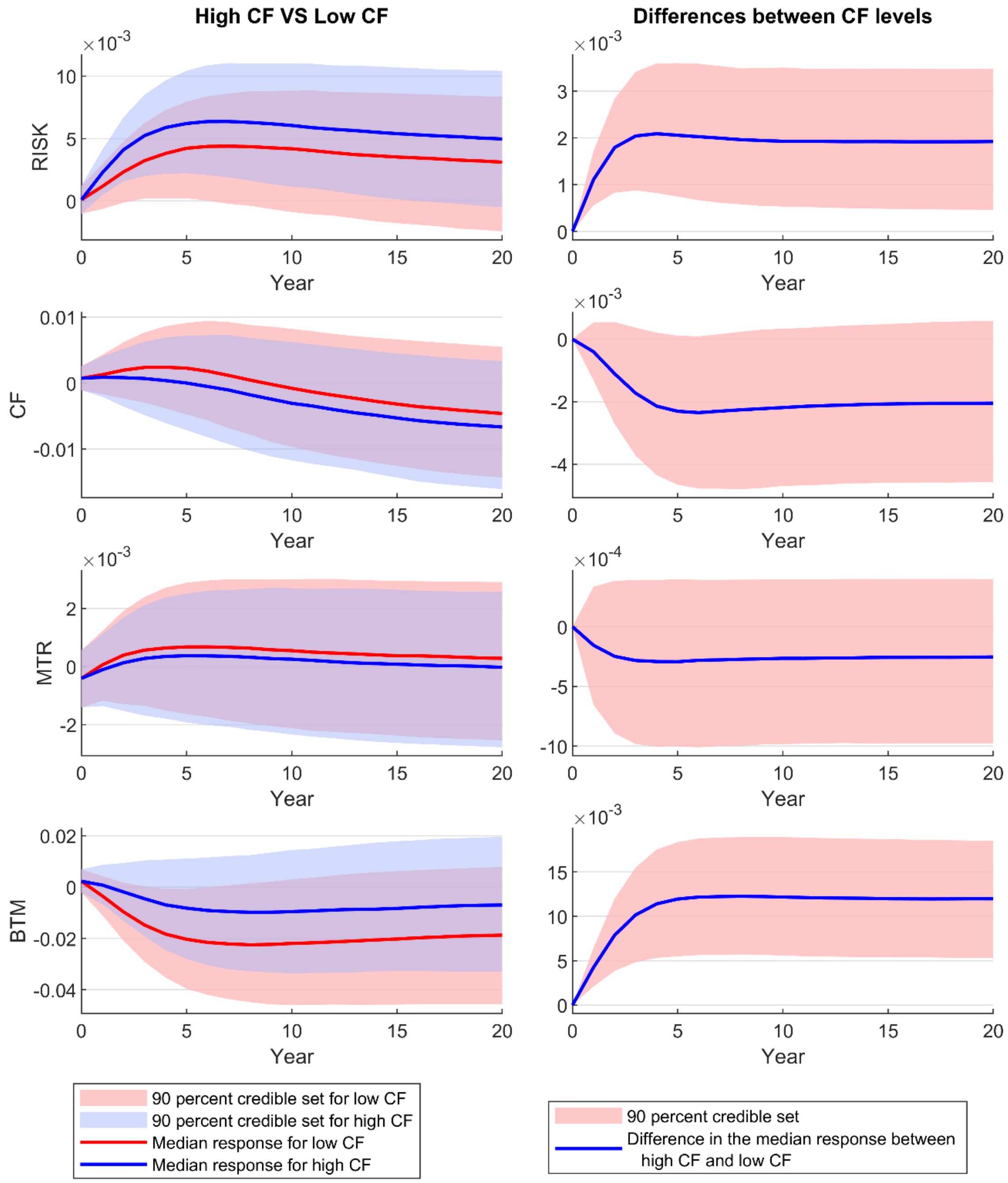
This figure plots the cumulative Impulse Response Function for the key endogenous variables - CSR, debt ratio, and the multiple determinants of OCS - to a CSR shock. The CSR Shock is equal to the dimension of its standard deviation. The figure has two columns of graphs. In the leftmost column, each graph plot has two IRFs: The blue line corresponds to the median response of the firms with higher risk, while the blue shaded area is the respective 90% confidence interval; The red line corresponds to the median response of the firms with lower risk, while the red shaded area is the respective 90% confidence interval. The graph plots in the rightmost column show the difference between the two IRFs on the left graph plot (represented in the blue line), with the red shaded area representing the respective 90% confidence interval.

Figure A5: Cumulative IRF to a CSR shock: Depending on profitability



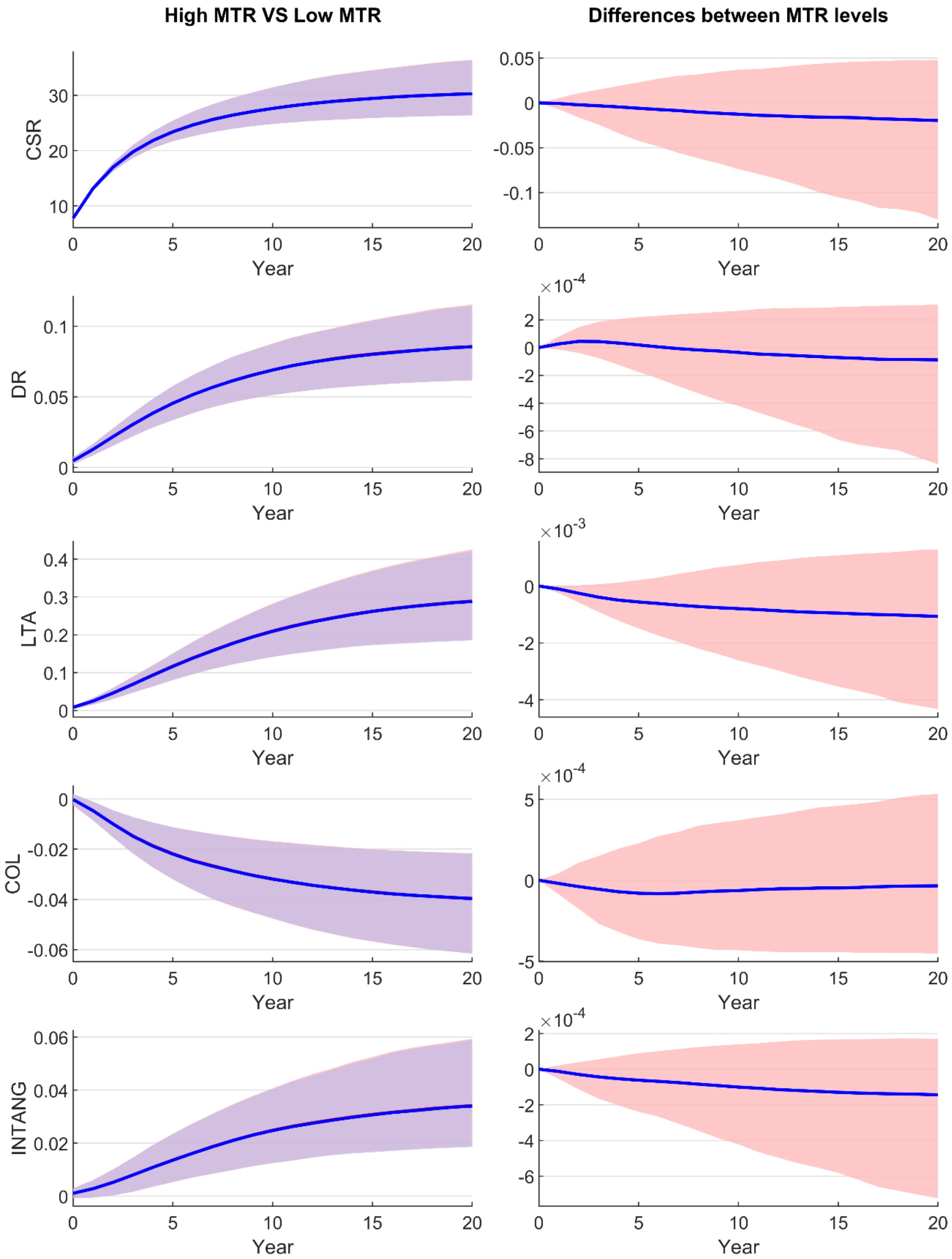
(continued)

Figure A5: Cumulative IRF to a CSR shock: Depending on profitability (continued)



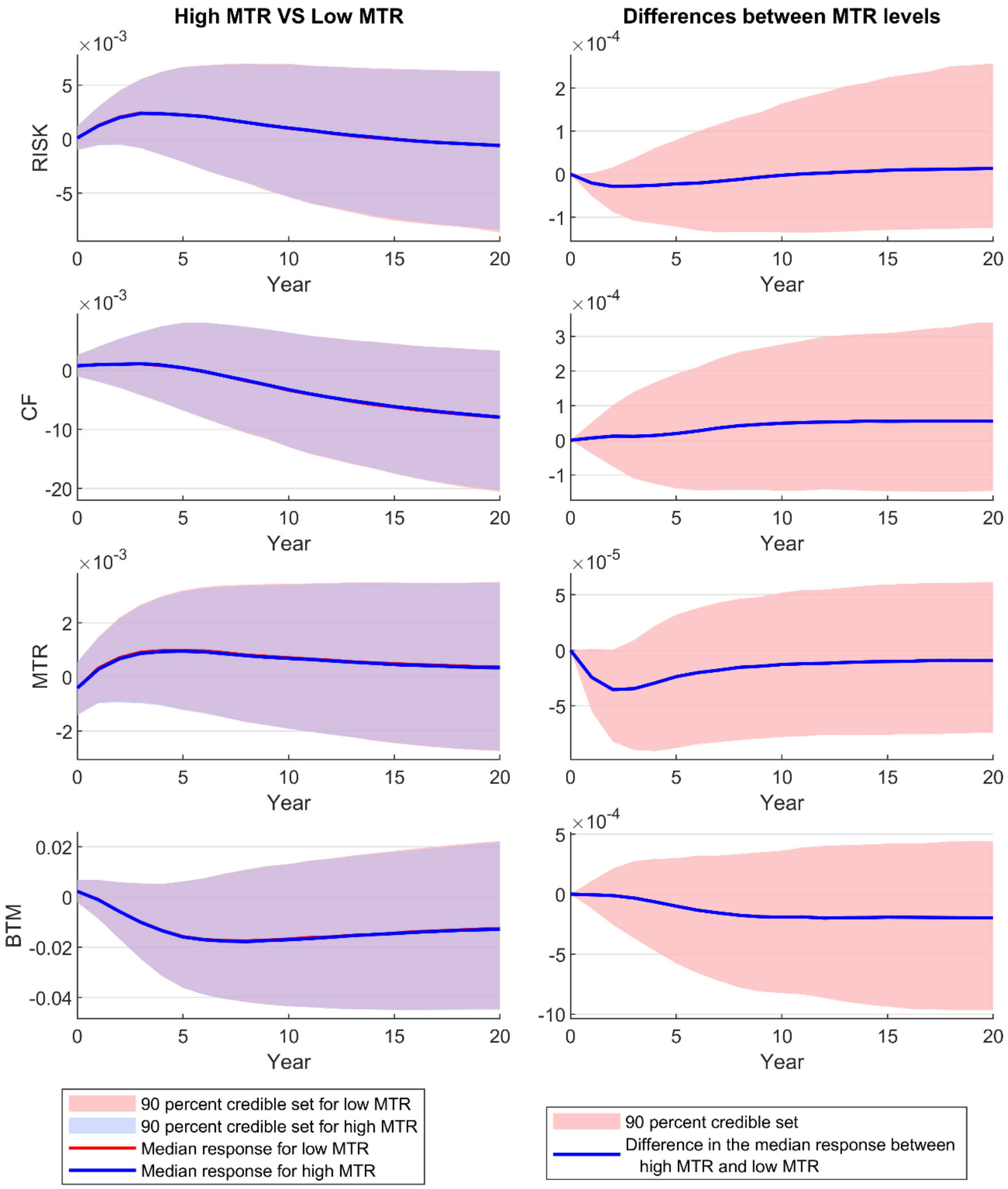
This figure plots the cumulative Impulse Response Function for the key endogenous variables - CSR, debt ratio, and the multiple determinants of OCS - to a CSR shock. The CSR Shock is equal to the dimension of its standard deviation. The figure has two columns of graphs. In the leftmost column, each graph plot has two IRFs: The blue line corresponds to the median response of the most profitable firms, while the blue shaded area is the respective 90% confidence interval; The red line corresponds to the median response of the least profitable firms, while the red shaded area is the respective 90% confidence interval. The graph plots in the rightmost column show the difference between the two IRFs on the left graph plot (represented in the blue line), with the red shaded area representing the respective 90% confidence interval.

Figure A6: Cumulative IRF to a CSR shock: Depending on MTR



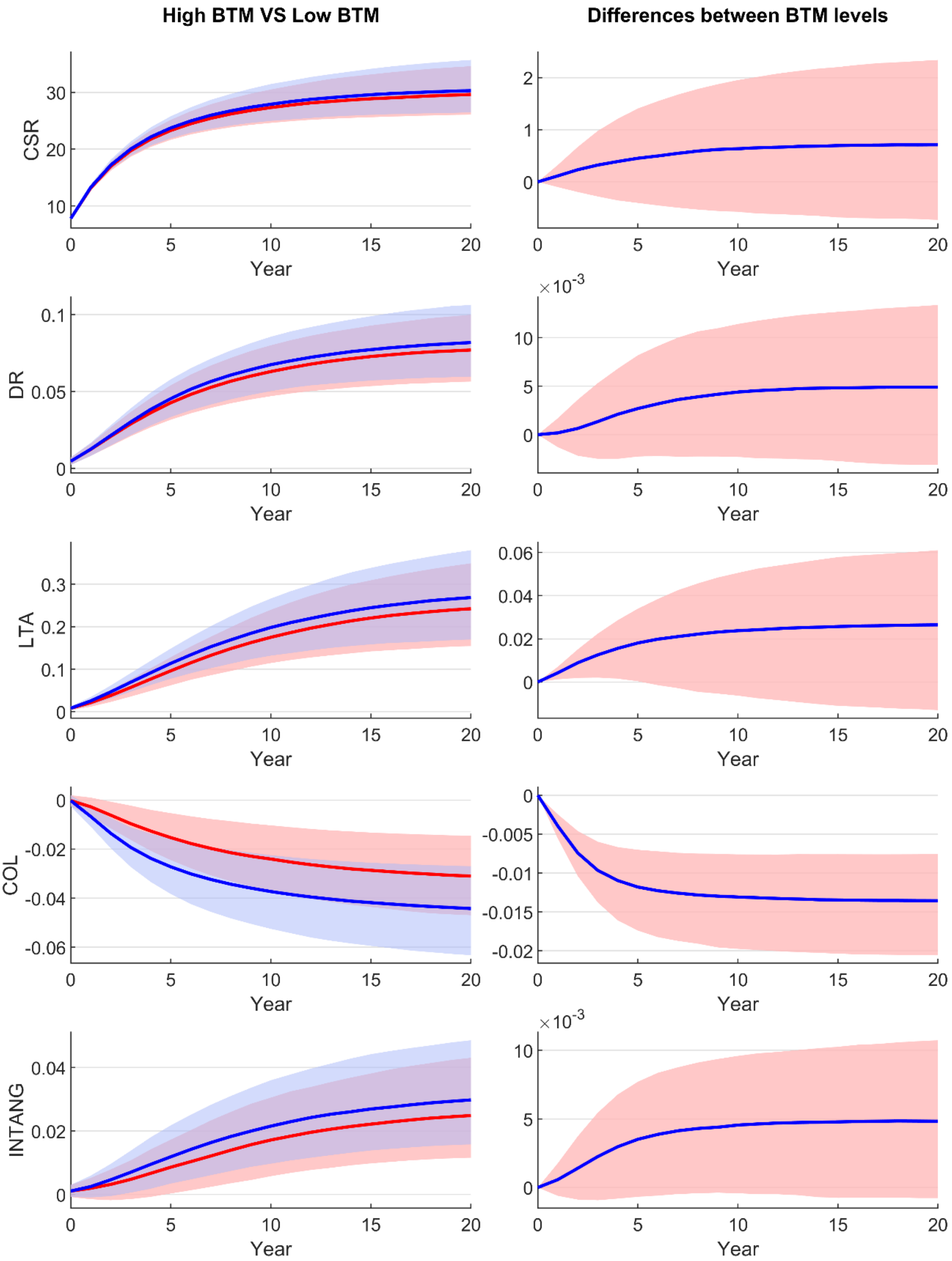
(continued)

Figure A6: Cumulative IRF to a CSR shock: Depending on MTR (continued)



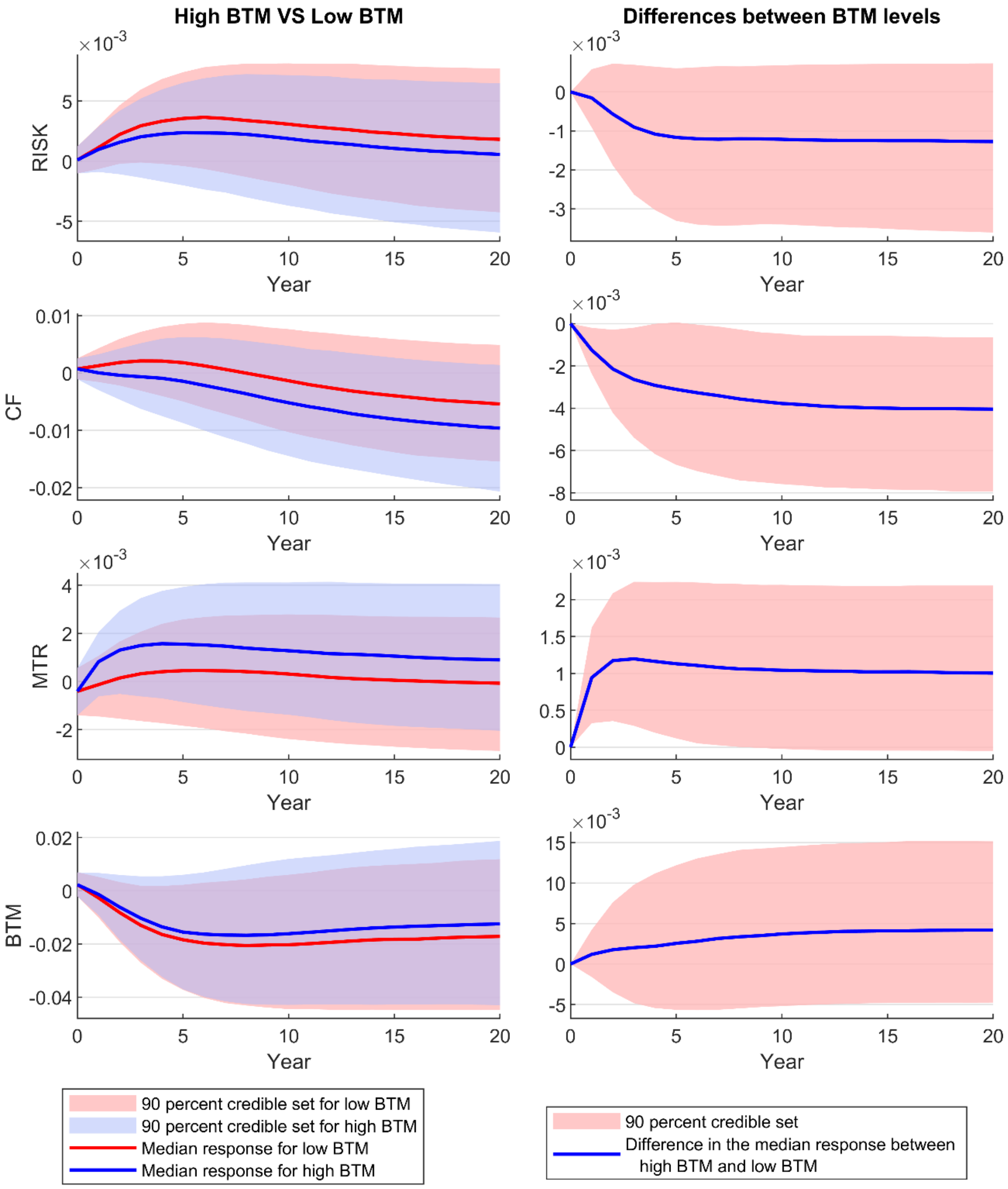
This figure plots the cumulative Impulse Response Function for the key endogenous variables - CSR, debt ratio, and the multiple determinants of OCS - to a CSR shock. The CSR Shock is equal to the dimension of its standard deviation. The figure has two columns of graphs. In the leftmost column, each graph plot has two IRFs: The blue line corresponds to the median response of firms with higher tax shields, while the blue shaded area is the respective 90% confidence interval; The red line corresponds to the median response of firms with higher tax shields, while the red shaded area is the respective 90% confidence interval. The graph plots in the rightmost column show the difference between the two IRFs on the left graph plot (represented in the blue line), with the red shaded area representing the respective 90% confidence interval.

Figure A7: Cumulative IRF to a CSR shock: Depending on BTM



(continued)

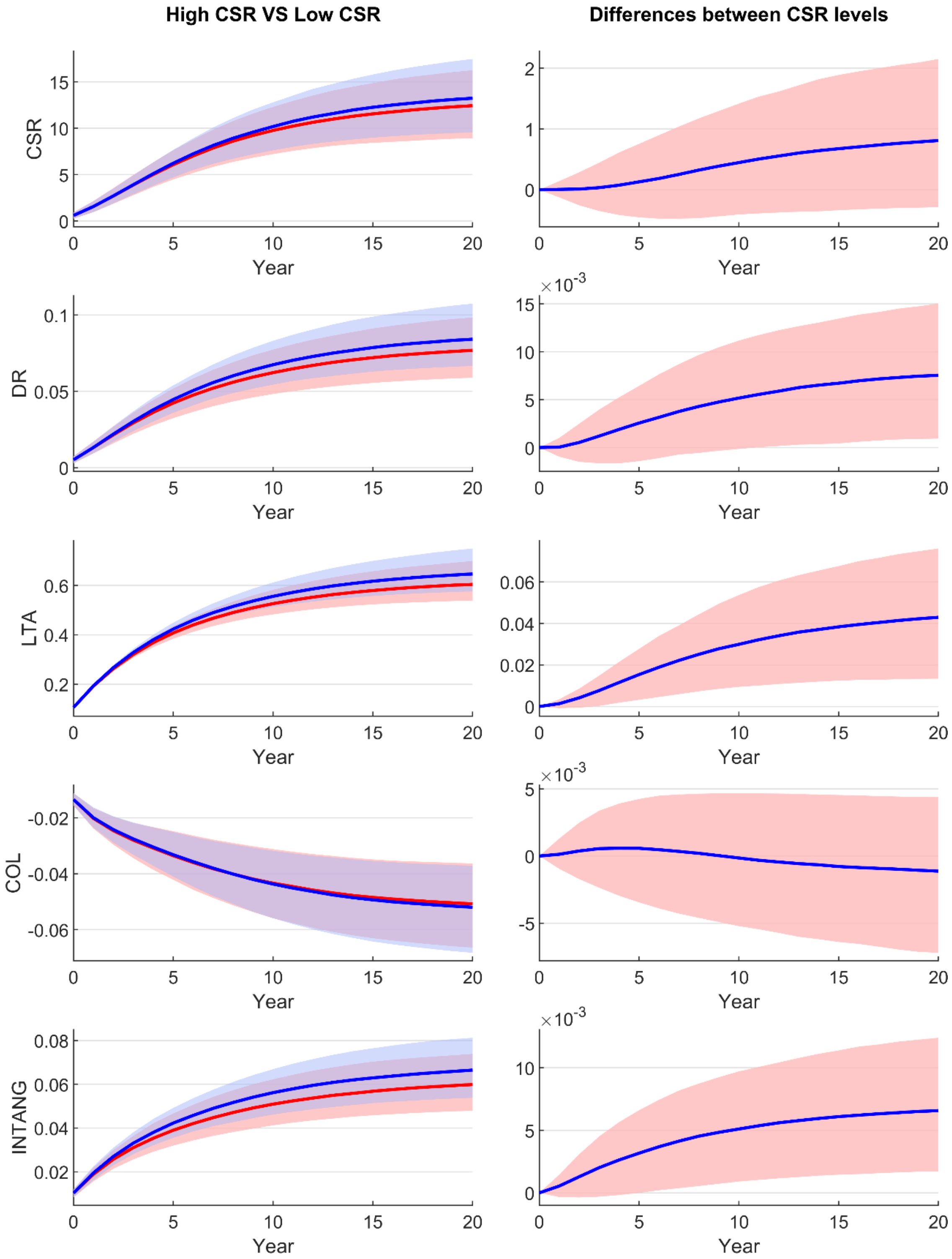
Figure A7: Cumulative IRF to a CSR shock: Depending on BTM (continued)



This figure plots the cumulative Impulse Response Function for the key endogenous variables - CSR, debt ratio, and the multiple determinants of OCS - to a CSR shock. The CSR Shock is equal to the dimension of its standard deviation. The figure has two columns of graphs. In the leftmost column, each graph plot has two IRFs: The blue line corresponds to the median response of firms with fewer growth opportunities, while the blue shaded area is the respective 90% confidence interval; The red line corresponds to the median response of firms with more growth opportunities, while the red shaded area is the respective 90% confidence interval. The graph plots in the rightmost column show the difference between the two IRFs on the left graph plot (represented in the blue line), with the red shaded area representing the respective 90% confidence interval.

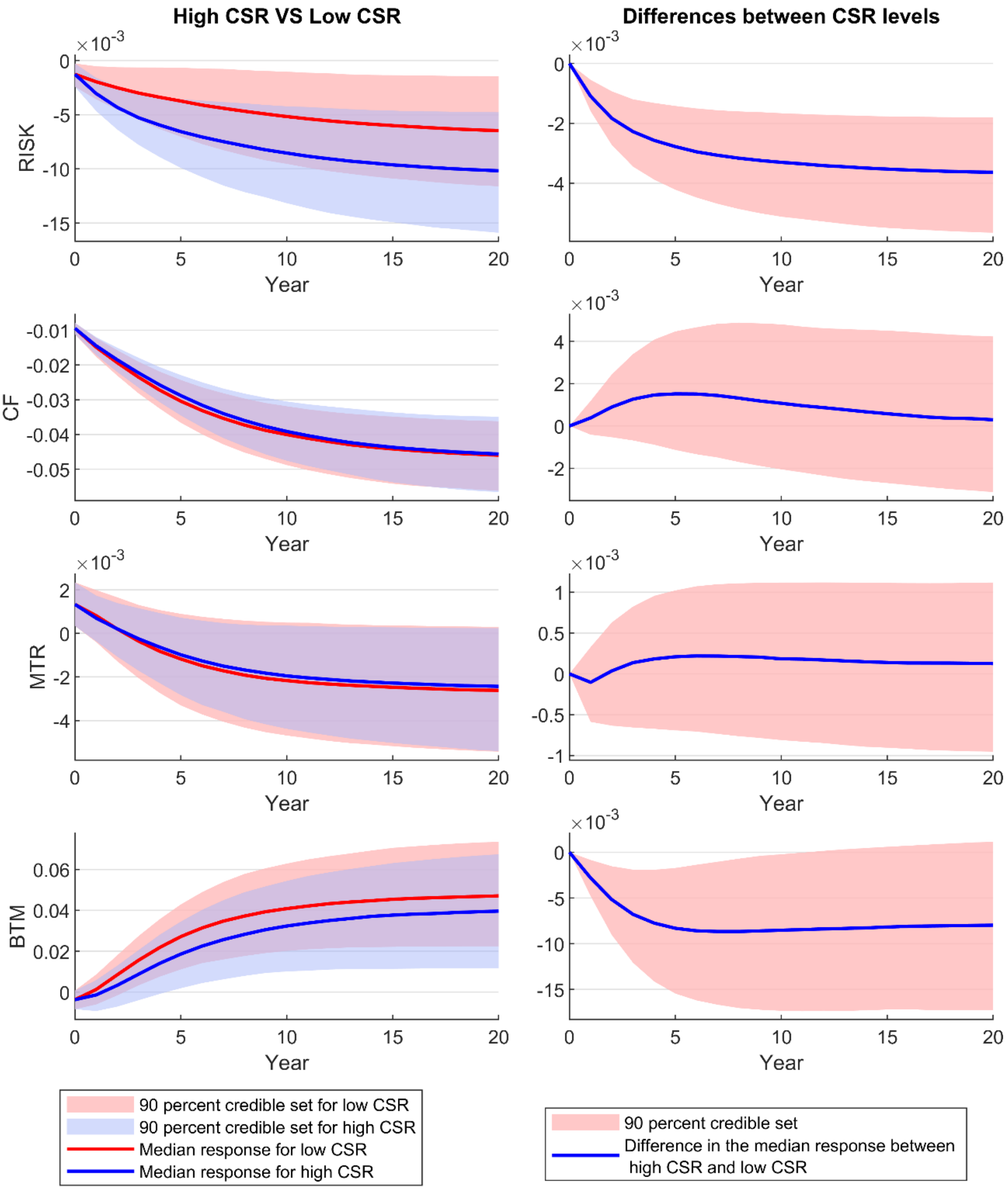
Now, I present the graphical representation of cumulative IRFs for the key endogenous variables - CSR, debt ratio, and OCS determinants - due to a determinant shock. Each figure corresponds to a different shock variable.

Figure A8: Cumulative IRF to a size shock: Depending on CSR level



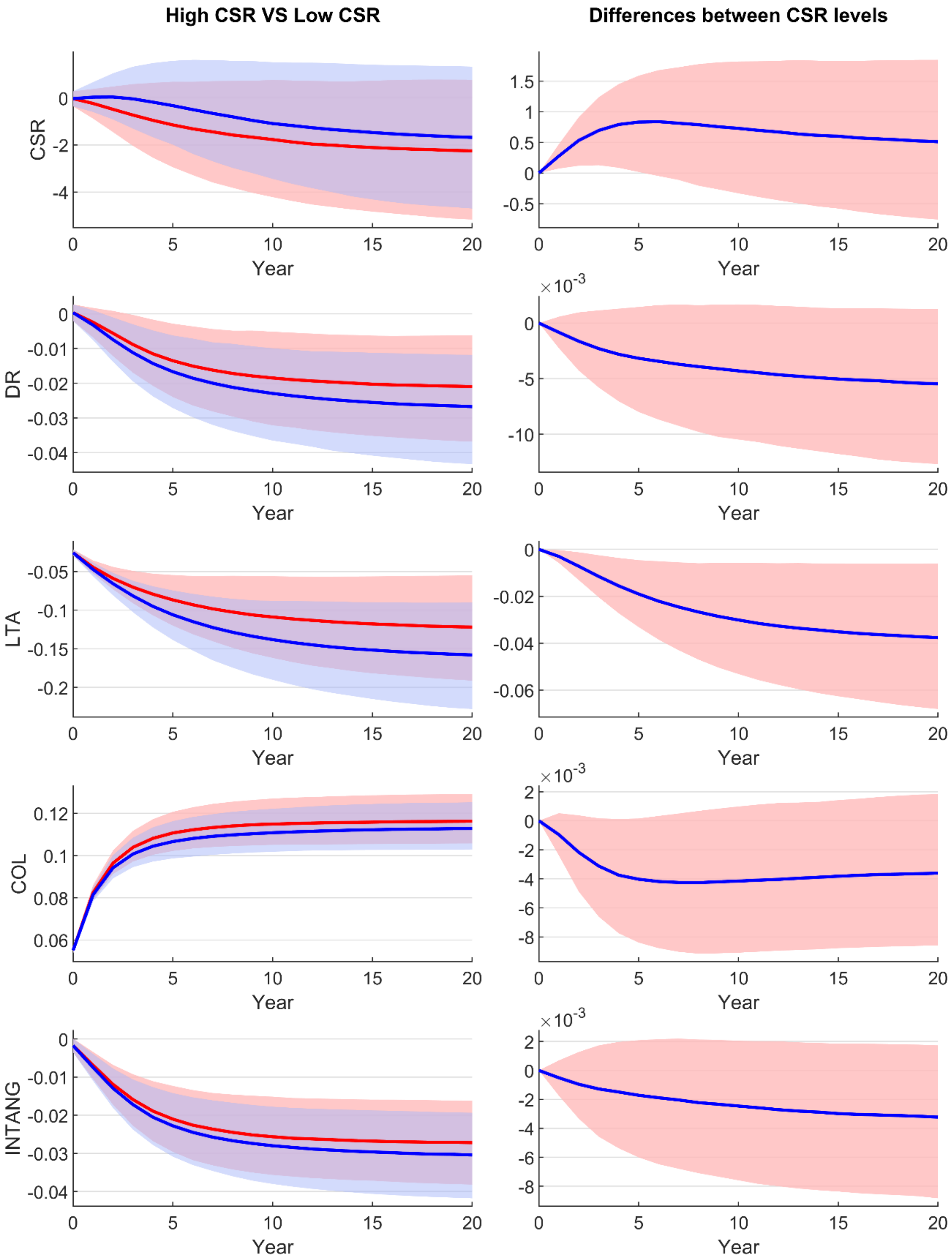
(continued)

Figure A8: Cumulative IRF to a size shock: Depending on CSR level (continued)



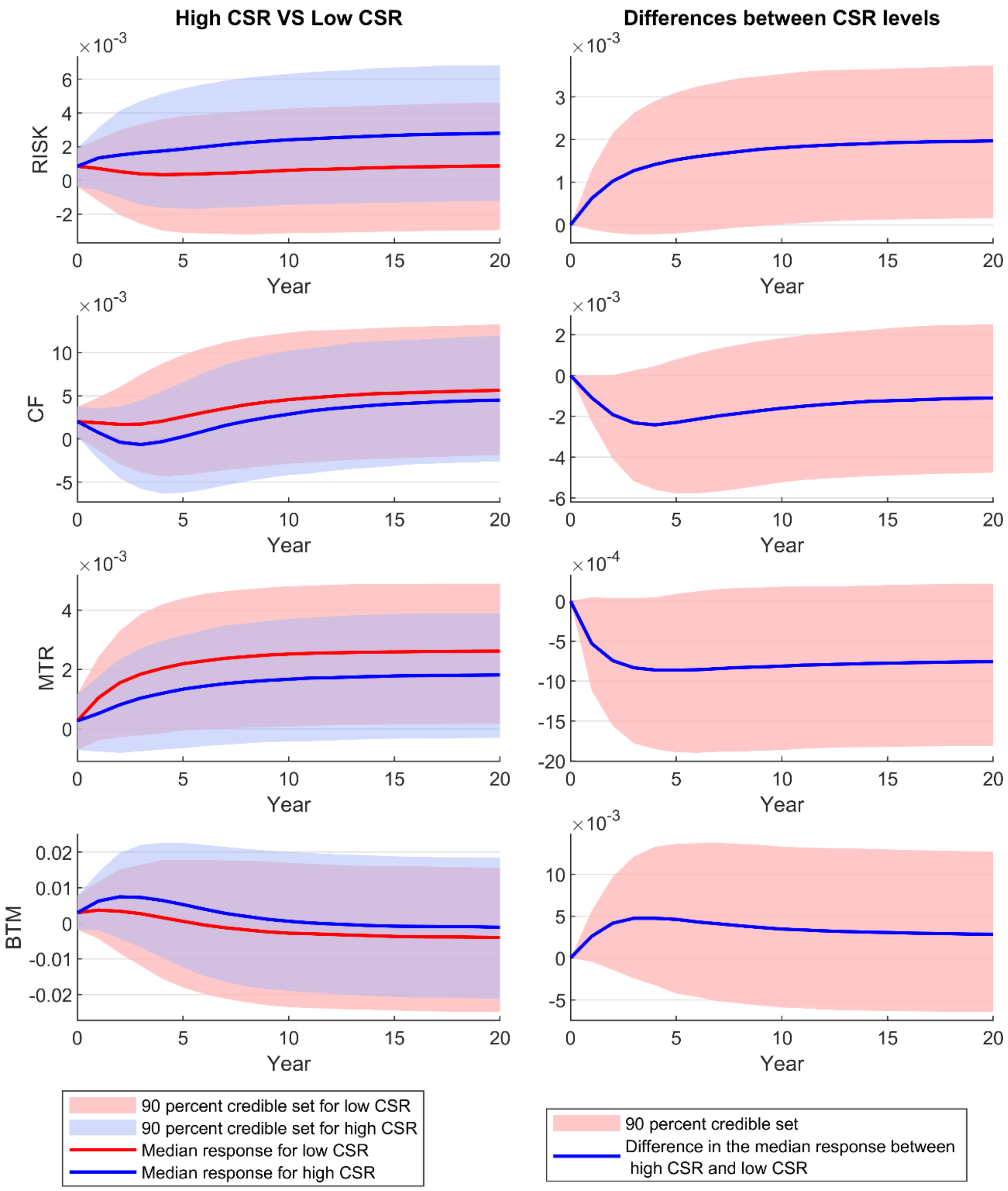
This figure plots the cumulative Impulse Response Function for the key endogenous variables - CSR, debt ratio, and the multiple determinants of OCS - to a size shock. The size shock is equal to the dimension of its standard deviation. The figure has two columns of graphs. In the leftmost column, each graph plot has two IRFs: The blue line corresponds to the median response of firms with higher CSR levels, while the blue shaded area is the respective 90% confidence interval; The red line corresponds to the median response of firms with lower CSR levels, while the red shaded area is the respective 90% confidence interval. The graph plots in the rightmost column show the difference between the two IRFs on the left graph plot (represented in the blue line), with the red shaded area representing the respective 90% confidence interval.

Figure A9: Cumulative IRF to a tangibles weight shock: Depending on CSR level



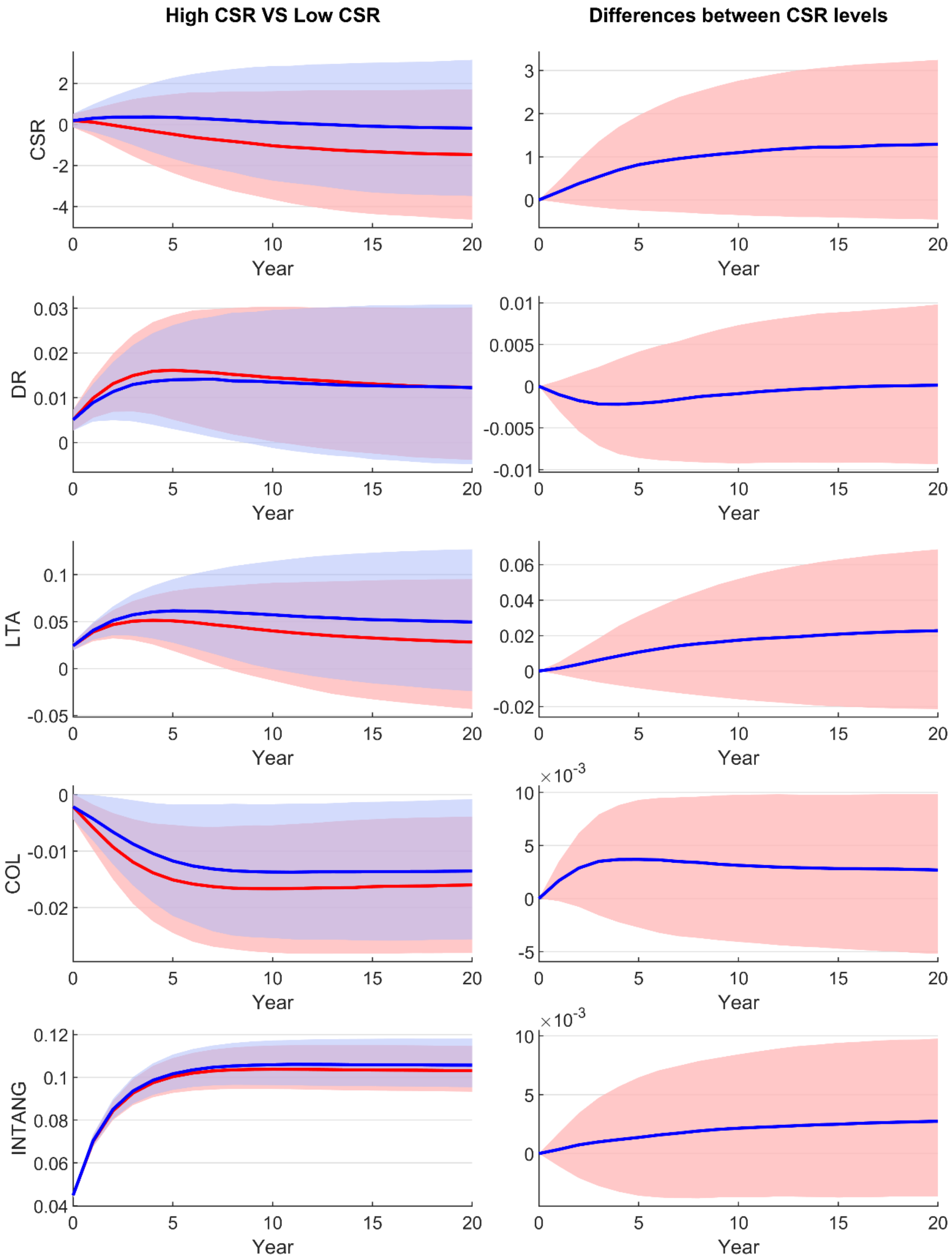
(continued)

Figure A9: Cumulative IRF to a tangibles weight shock: Depending on CSR level (continued)



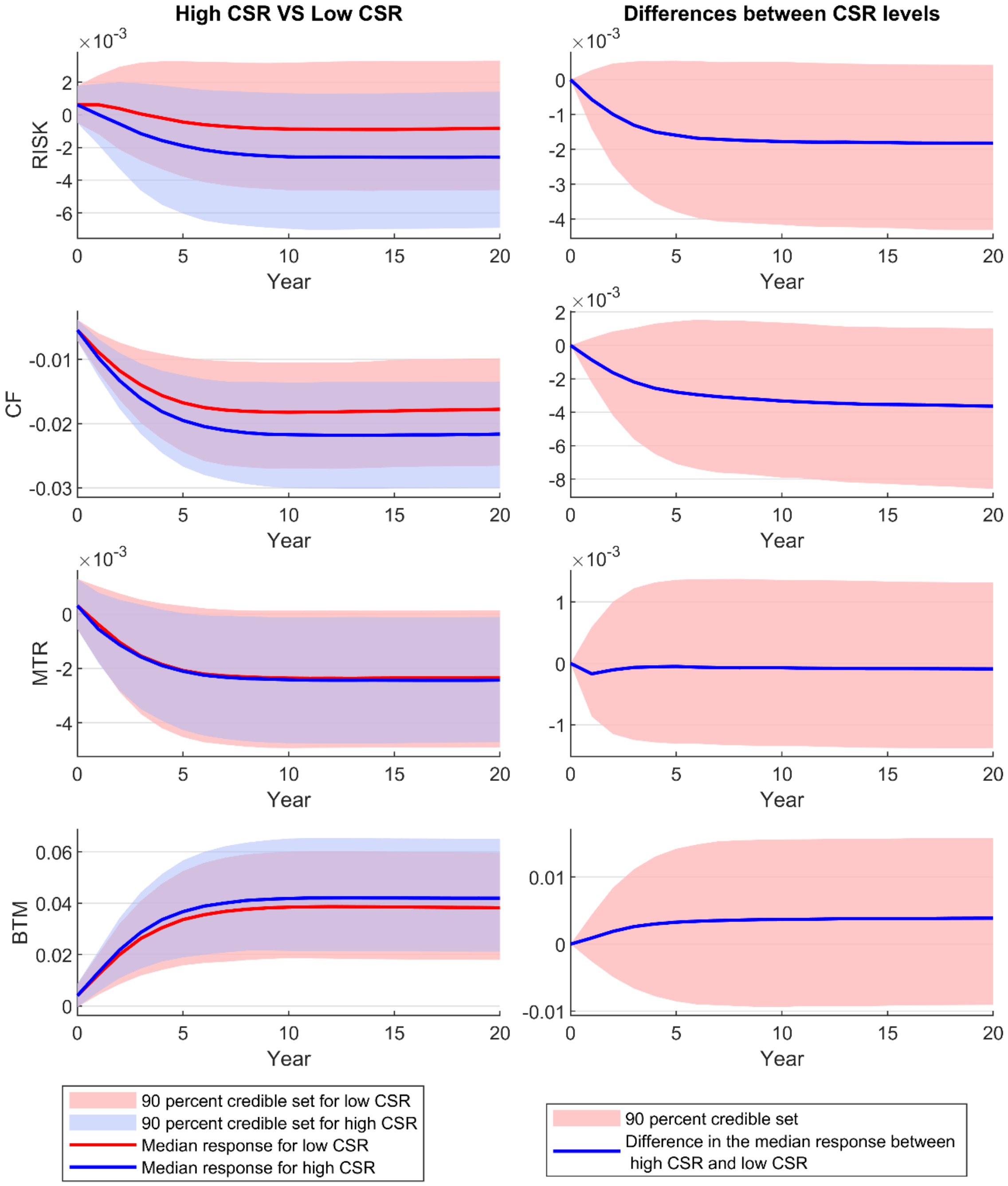
This figure plots the cumulative Impulse Response Function for the key endogenous variables - CSR, debt ratio, and the multiple determinants of OCS - to a tangibles weight shock. The tangibles weight shock is equal to the dimension of its standard deviation. The figure has two columns of graphs. In the leftmost column, each graph plot has two IRFs: The blue line corresponds to the median response of firms with higher CSR levels, while the blue shaded area is the respective 90% confidence interval; The red line corresponds to the median response of firms with lower CSR levels, while the red shaded area is the respective 90% confidence interval. The graph plots in the rightmost column show the difference between the two IRFs on the left graph plot (represented in the blue line), with the red shaded area representing the respective 90% confidence interval.

Figure A10: Cumulative IRF to an intangibles weight shock: Depending on CSR level



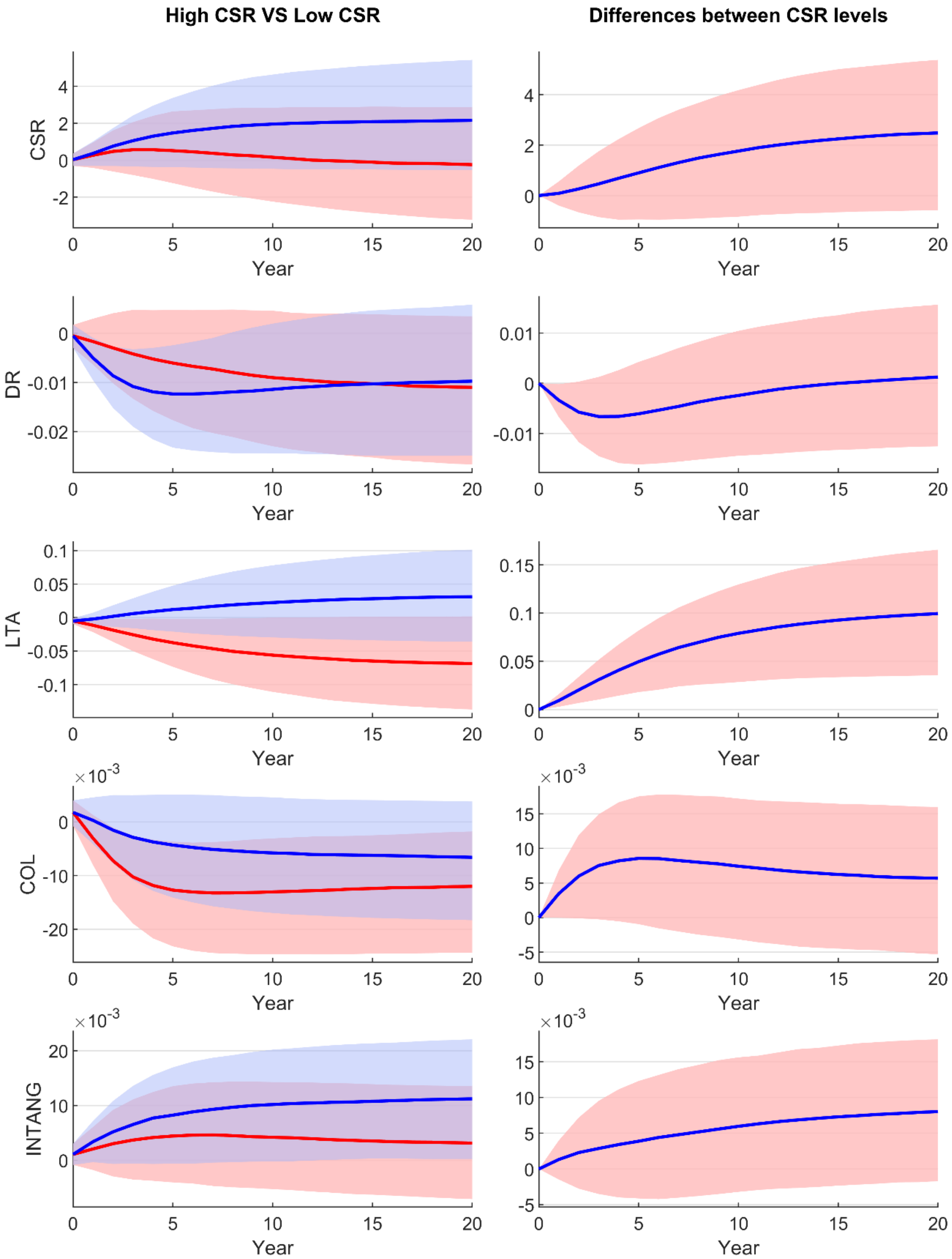
(continued)

Figure A10: Cumulative IRF to an intangibles weight shock: Depending on CSR level (continued)



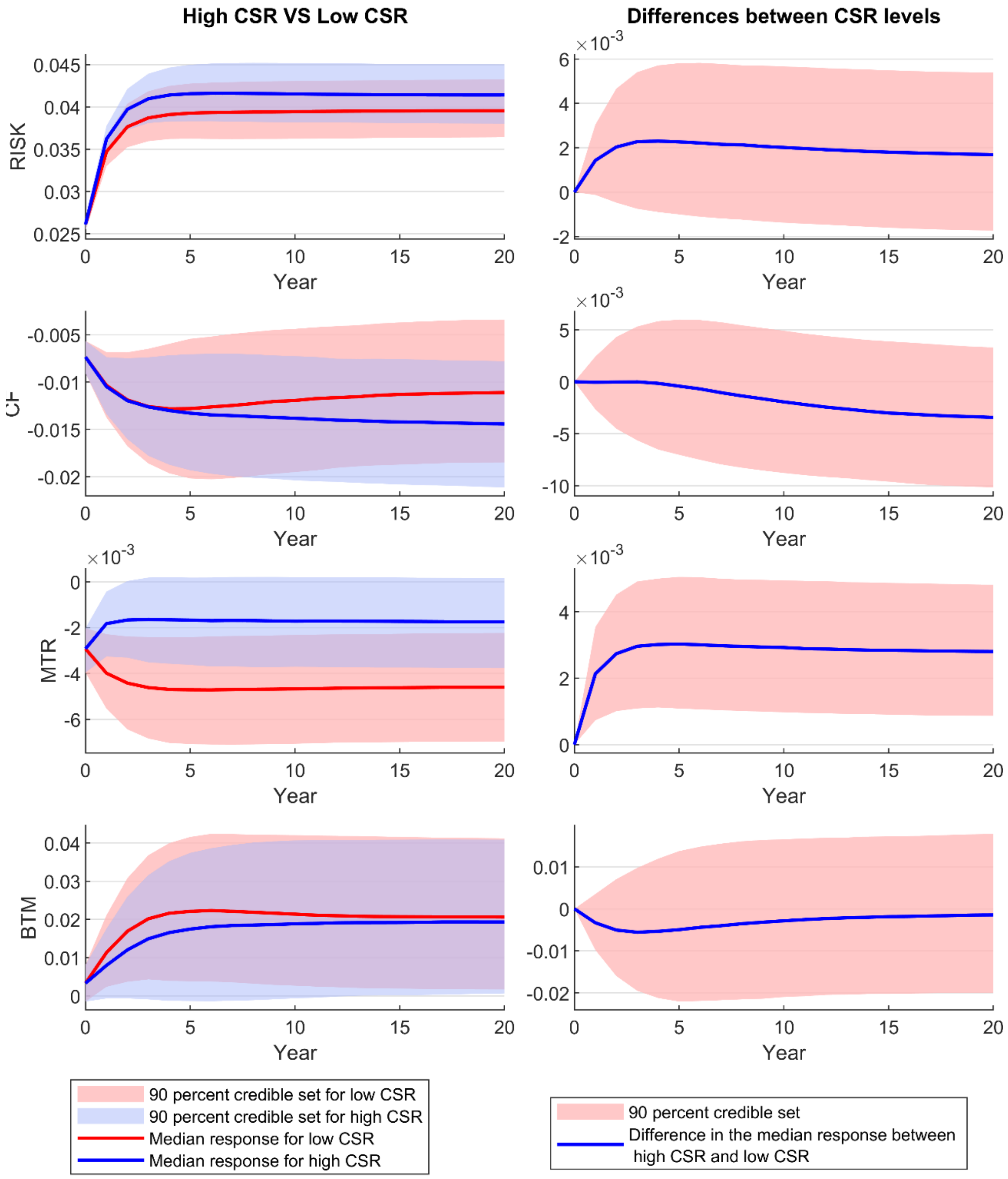
This figure plots the cumulative Impulse Response Function for the key endogenous variables - CSR, debt ratio, and the multiple determinants of OCS - to an intangibles weight shock. The intangibles weight shock is equal to the dimension of its standard deviation. The figure has two columns of graphs. In the leftmost column, each graph plot has two IRFs: The blue line corresponds to the median response of firms with higher CSR levels, while the blue shaded area is the respective 90% confidence interval; The red line corresponds to the median response of firms with lower CSR levels, while the red shaded area is the respective 90% confidence interval. The graph plots in the rightmost column show the difference between the two IRFs on the left graph plot (represented in the blue line), with the red shaded area representing the respective 90% confidence interval.

Figure A11: Cumulative IRF to a risk shock: Depending on CSR level



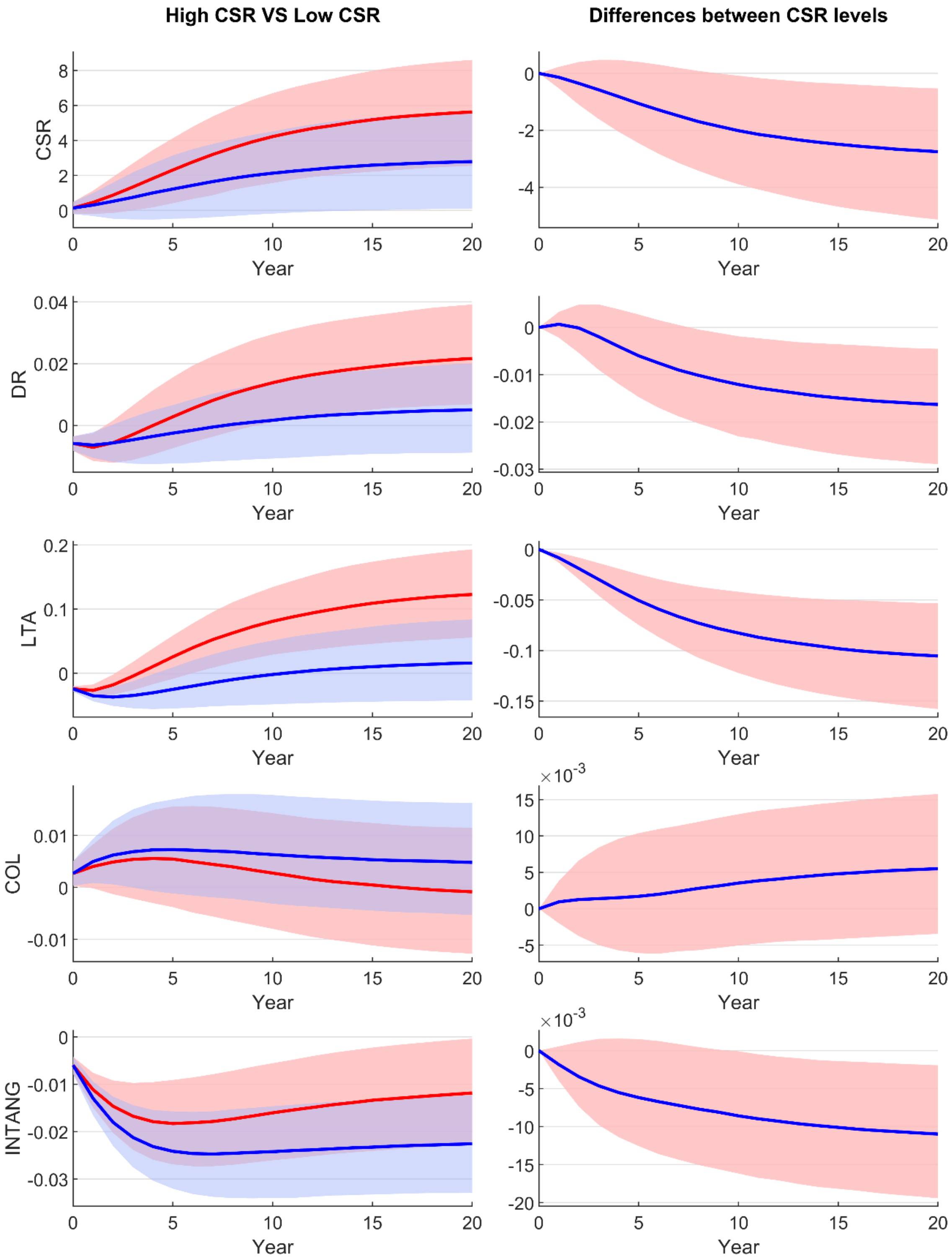
(continued)

Figure A11: Cumulative IRF to a risk shock: Depending on CSR level (continued)



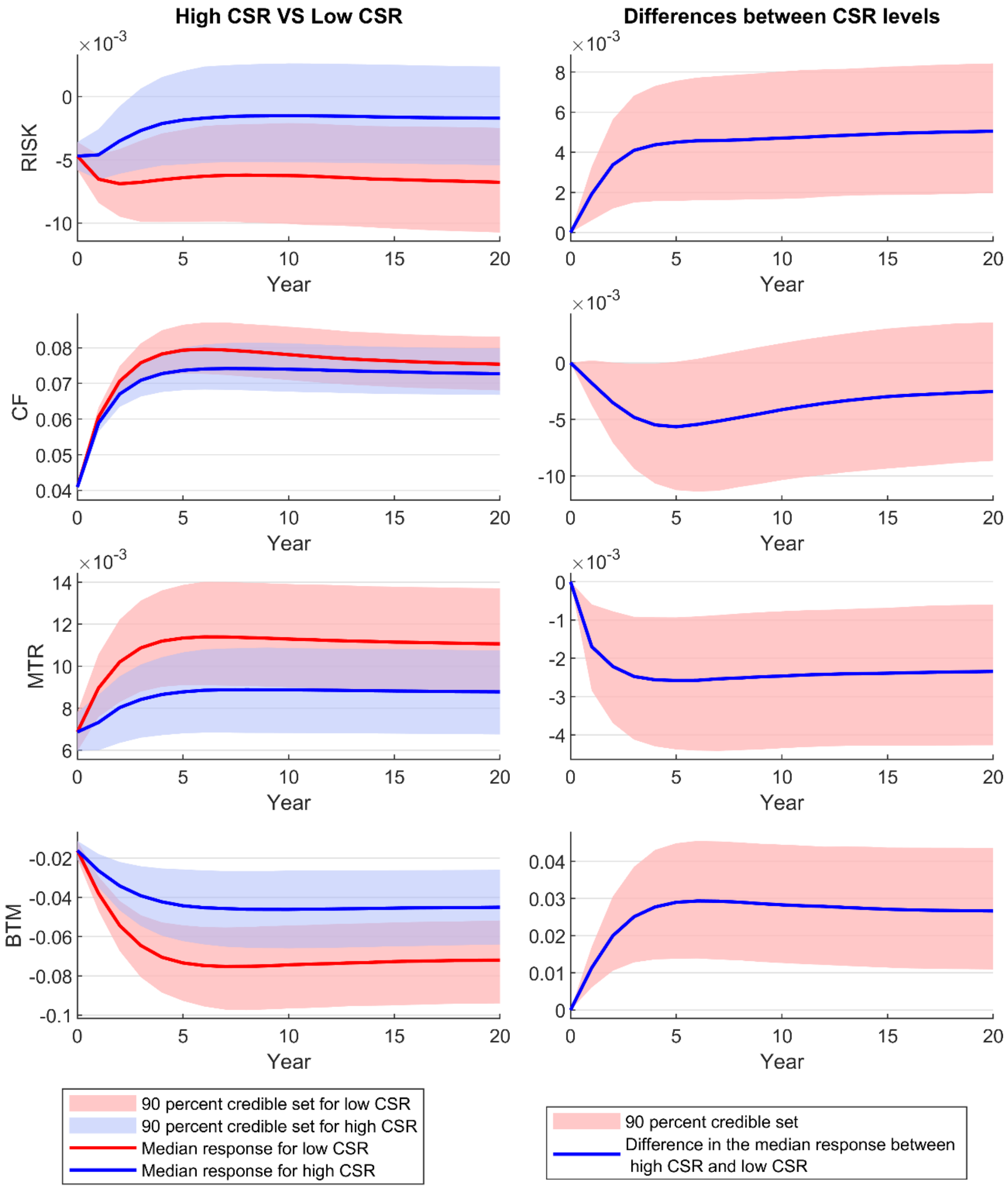
This figure plots the cumulative Impulse Response Function for the key endogenous variables - CSR, debt ratio, and the multiple determinants of OCS - to a risk shock. The risk shock is equal to the dimension of its standard deviation. The figure has two columns of graphs. In the leftmost column, each graph plot has two IRFs: The blue line corresponds to the median response of firms with higher CSR levels, while the blue shaded area is the respective 90% confidence interval; The red line corresponds to the median response of firms with lower CSR levels, while the red shaded area is the respective 90% confidence interval. The graph plots in the rightmost column show the difference between the two IRFs on the left graph plot (represented in the blue line), with the red shaded area representing the respective 90% confidence interval.

Figure A12: Cumulative IRF to a profitability shock: Depending on CSR level



(continued)

Figure A12: Cumulative IRF to a profitability shock: Depending on CSR level (continued)



This figure plots the cumulative Impulse Response Function for the key endogenous variables - CSR, debt ratio, and the multiple determinants of OCS - to a profitability shock. The profitability shock is equal to the dimension of its standard deviation. The figure has two columns of graphs. In the leftmost column, each graph plot has two IRFs: The blue line corresponds to the median response of firms with higher CSR levels, while the blue shaded area is the respective 90% confidence interval; The red line corresponds to the median response of firms with lower CSR levels, while the red shaded area is the respective 90% confidence interval. The graph plots in the rightmost column show the difference between the two IRFs on the left graph plot (represented in the blue line), with the red shaded area representing the respective 90% confidence interval.

Figure A13: Cumulative IRF to an MTR shock: Depending on CSR level

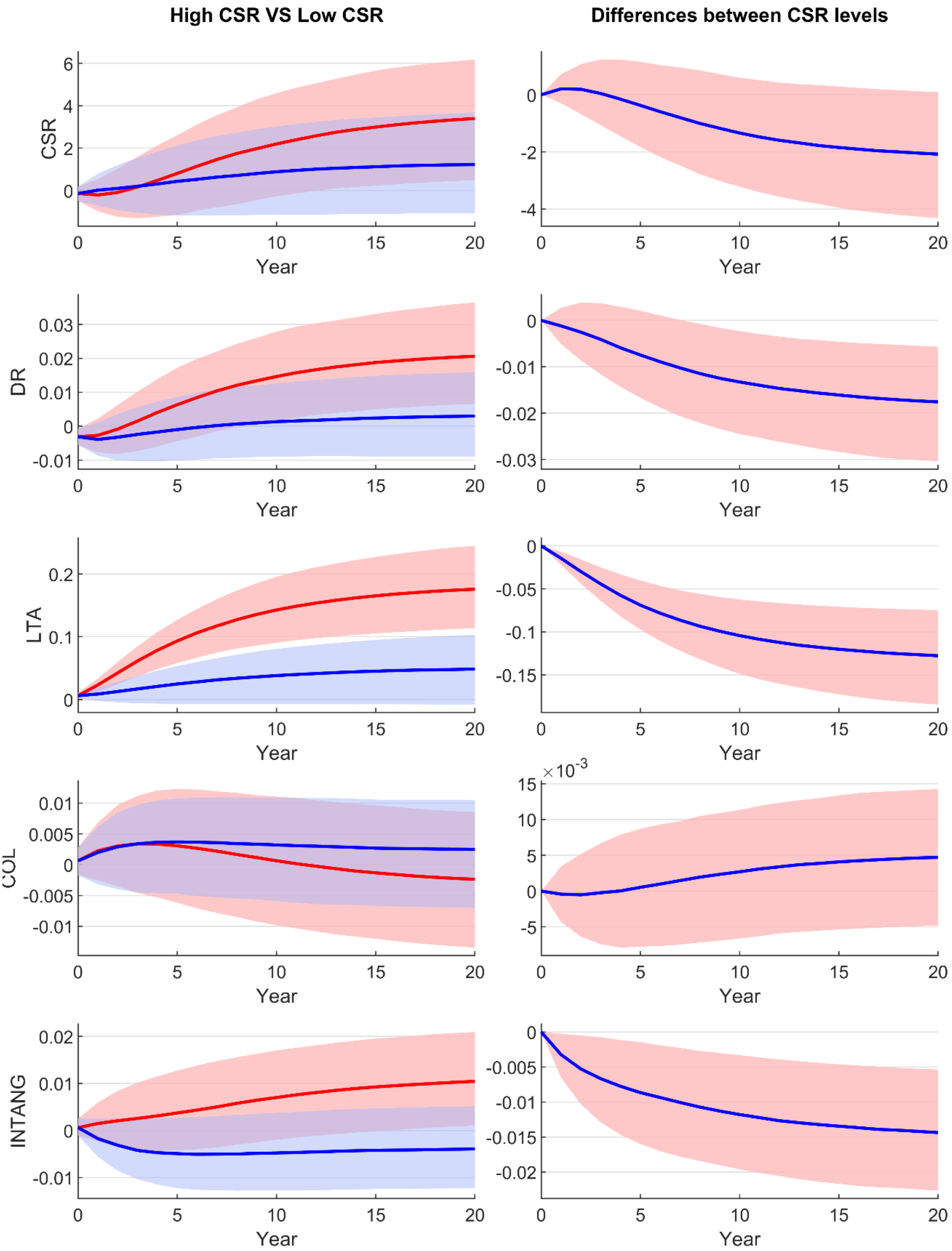


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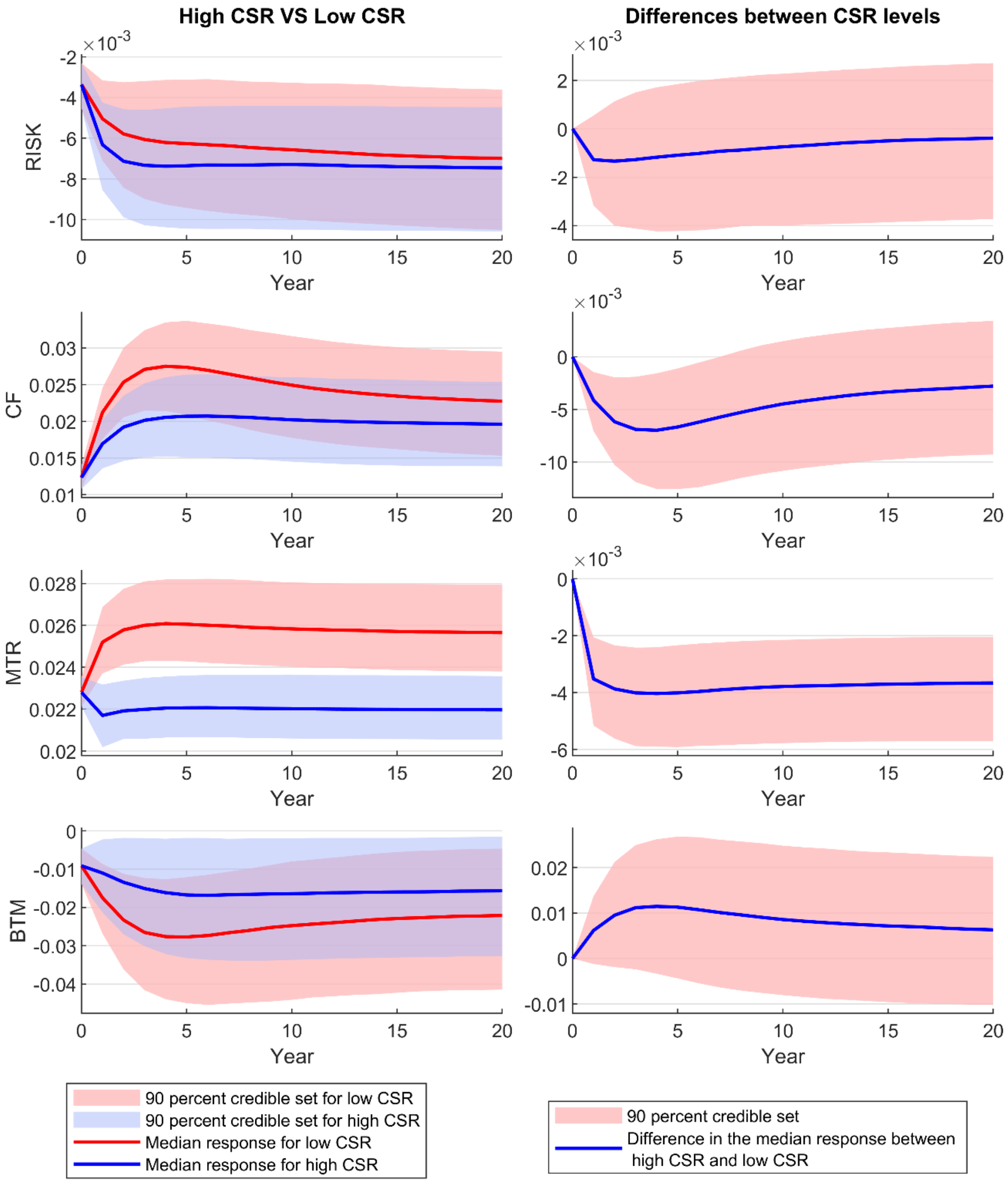
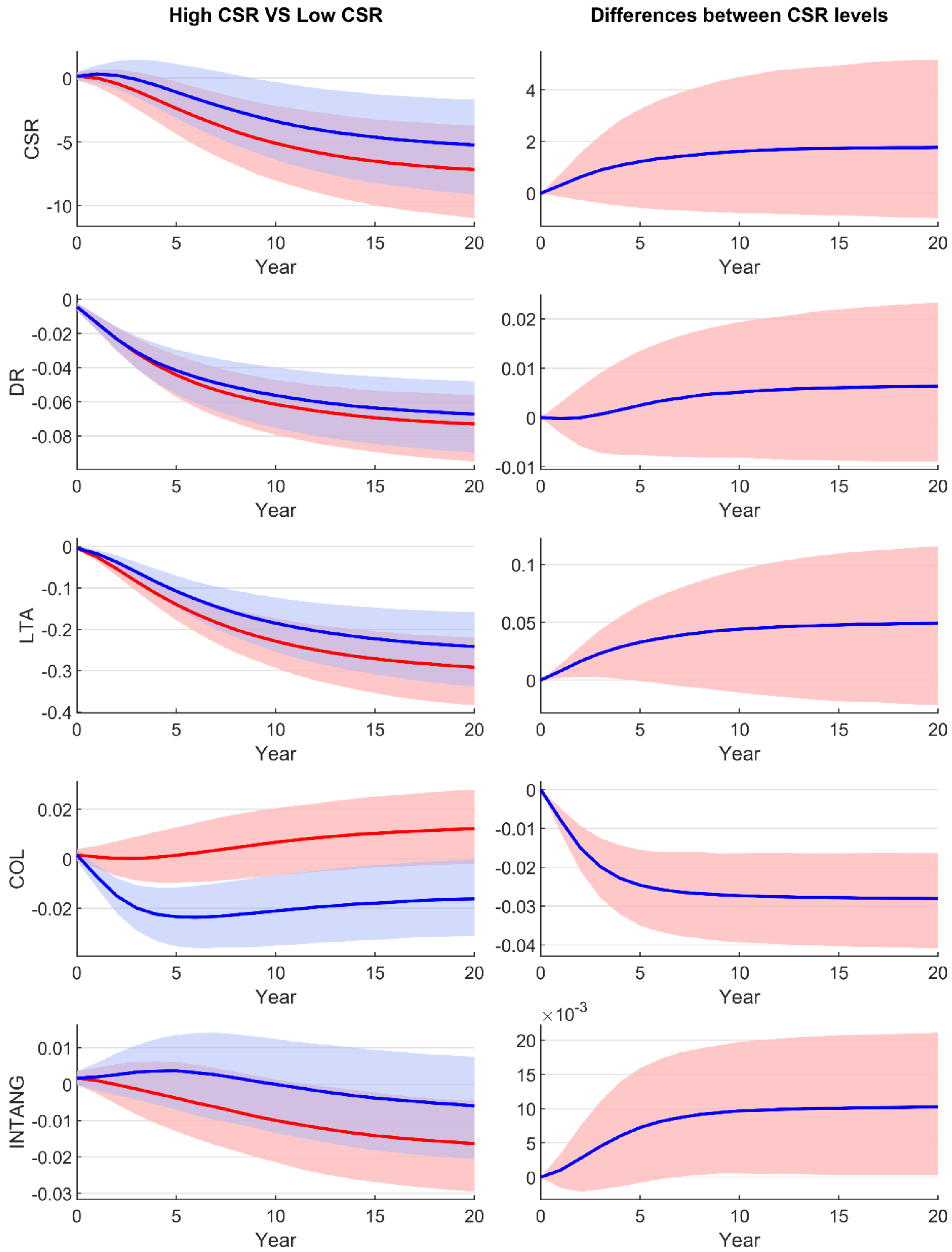
Figure A13: Cumulative IRF to an MTR shock: Depending on CSR level (continued)



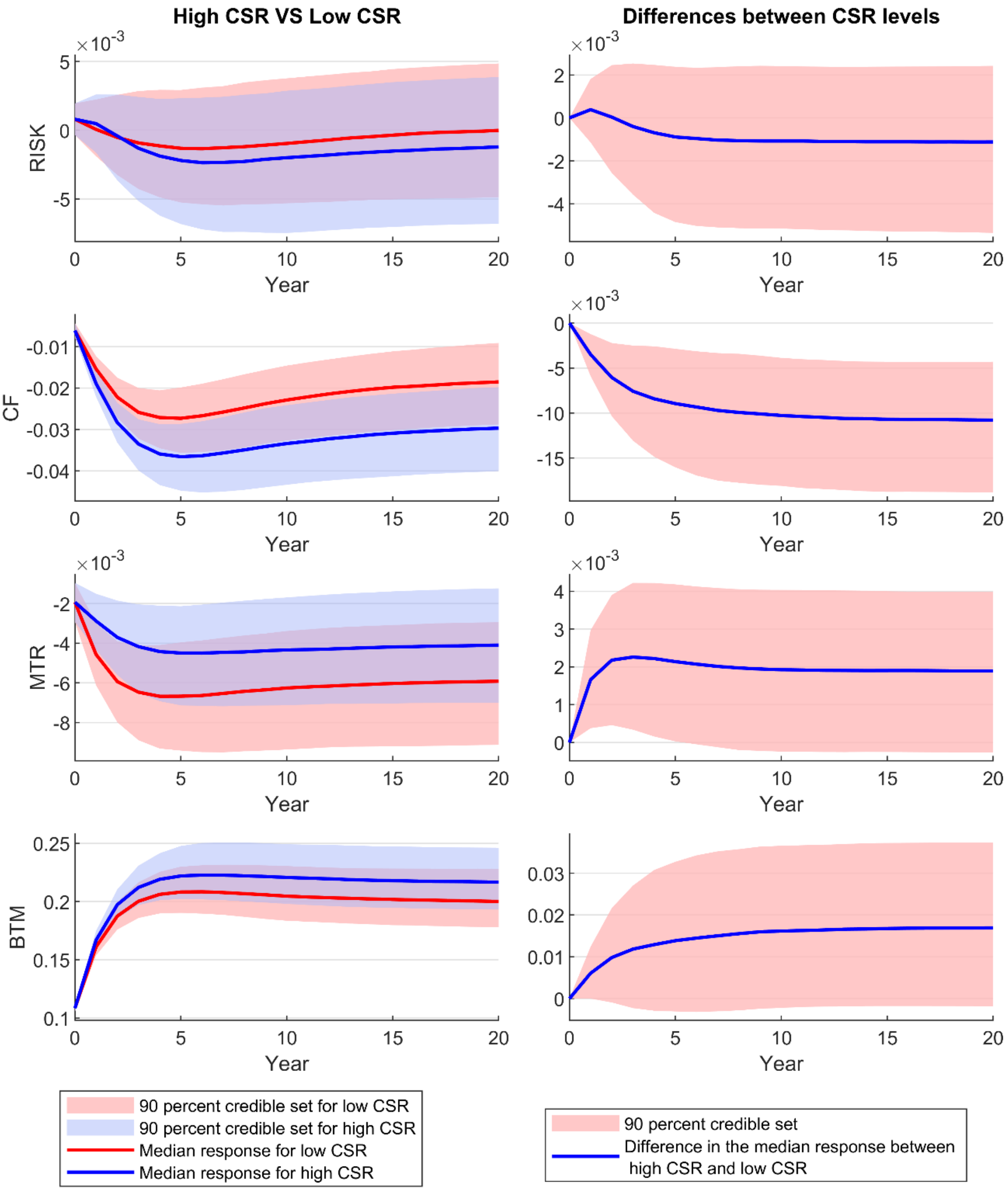
This figure plots the cumulative Impulse Response Function for the key endogenous variables - CSR, debt ratio, and the multiple determinants of OCS – to an MTR shock. The MTR shock is equal to the dimension of its standard deviation. The figure has two columns of graphs. In the leftmost column, each graph plot has two IRFs: The blue line corresponds to the median response of firms with higher CSR levels, while the blue shaded area is the respective 90% confidence interval; The red line corresponds to the median response of firms with lower CSR levels, while the red shaded area is the respective 90% confidence interval. The graph plots in the rightmost column show the difference between the two IRFs on the left graph plot (represented in the blue line), with the red shaded area representing the respective 90% confidence interval.

Figure A14: Cumulative IRF to a BTM shock: Depending on CSR level



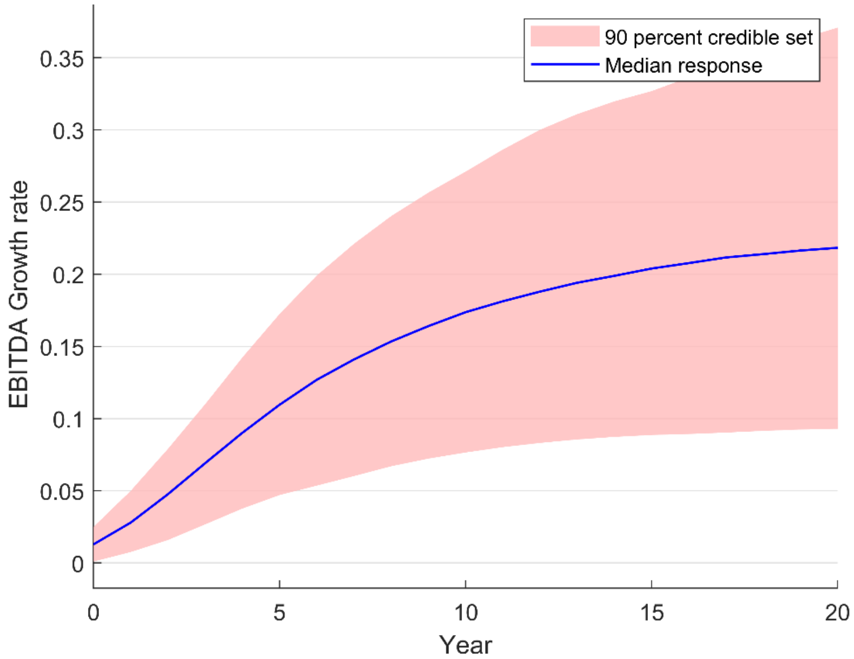
(continued)

Figure D14: Cumulative IRF to a BTM shock: Depending on CSR level (continued)



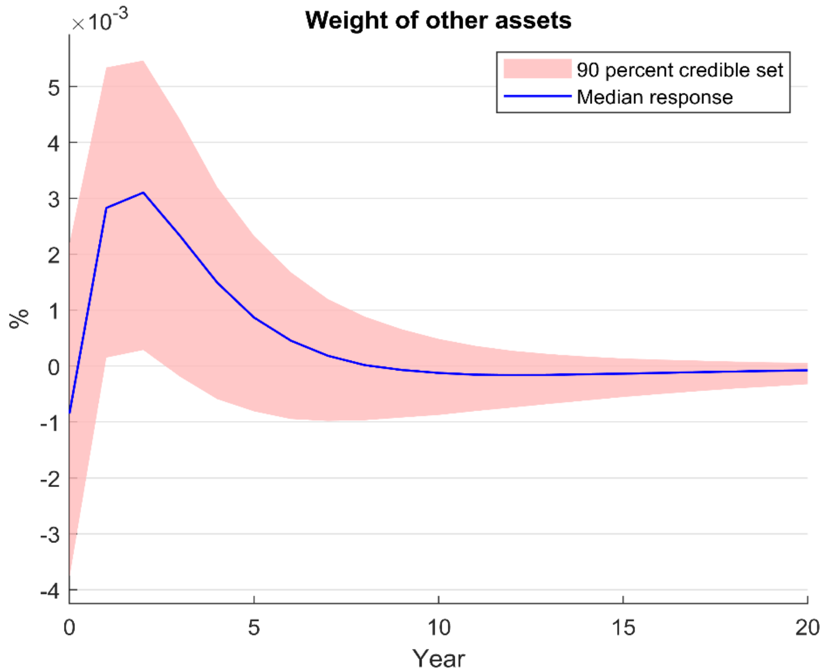
This figure plots the cumulative Impulse Response Function for the key endogenous variables - CSR, debt ratio, and the multiple determinants of OCS – to a BTM shock. The BTM shock is equal to the dimension of its standard deviation. The figure has two columns of graphs. In the leftmost column, each graph plot has two IRFs: The blue line corresponds to the median response of firms with higher CSR levels, while the blue shaded area is the respective 90% confidence interval; The red line corresponds to the median response of firms with lower CSR levels, while the red shaded area is the respective 90% confidence interval. The graph plots in the rightmost column show the difference between the two IRFs on the left graph plot (represented in the blue line), with the red shaded area representing the respective 90% confidence interval.

Figure A15: Response of EBITDA to a CSR shock



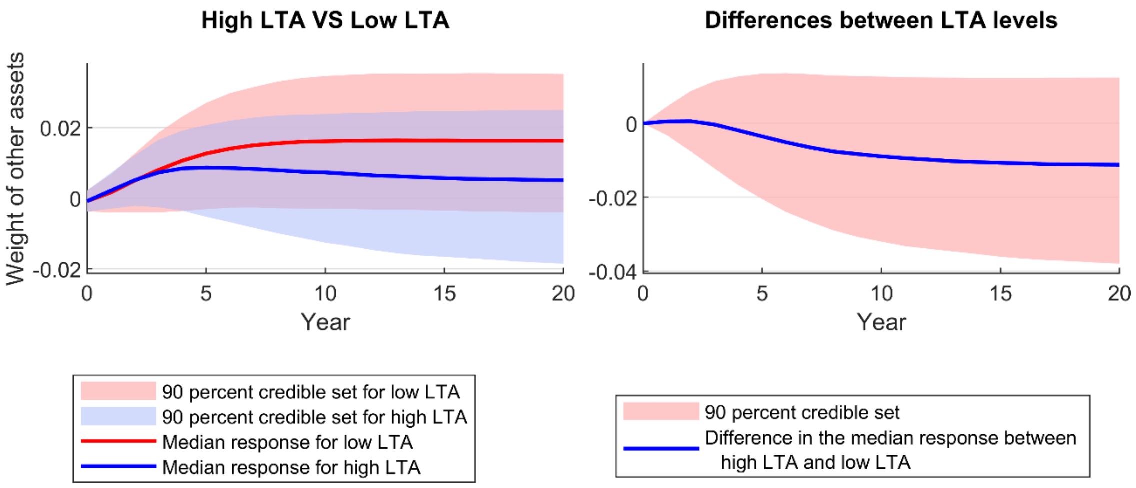
This graph shows the cumulative Impulse Response Function for the EBITDA growth rate due to a CSR shock. The CSR shock is equal to the dimension of its standard deviation. The blue line represents the median response, while the red shaded area represents the respective 90% confidence interval.

Figure A16: Response of weight of other assets to a CSR shock



This graph shows the Impulse Response Function for the weight of other assets (e.g., cash) due to a CSR shock. The CSR shock is equal to the dimension of its standard deviation. The blue line represents the median response, while the red shaded area represents the respective 90% confidence interval.

Figure A17: Response of weight of other assets to a CSR shock: Depending on the size



This figure plots the cumulative Impulse Response Function for the weight of other assets (e.g., cash) due to a CSR shock. The CSR shock is equal to the dimension of its standard deviation. The figure has two. In the leftmost graph, there are two IRFs: The blue line corresponds to the median response of the larger firms, while the blue shaded area is the respective 90% confidence interval; The red line corresponds to the median response of the smaller firms, while the red shaded area is the respective 90% confidence interval. The graph on the right shows the difference between the two IRFs on the left graph (represented in the blue line), with the red shaded area representing the respective 90% confidence interval.