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Debt's Role in the Dynamics Between Interest Rates and Stock Returns

A Global Panel Data Analysis

Author: Bram Hamers
Student number: 577918
Thesis supervisor: dr. Ruben de Bliek
Second reader: dr. Yashvir Gangaram-Panday
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ABSTRACT

This thesis investigates the impact of interest rate changes on stock returns across nations with varying public and private debt levels. Using panel data from 60 countries and employing fixed effects and dynamic panel regressions, I found a significant negative relationship between interest rates and stock returns. This relationship was notably pronounced in nations with low to medium public debt but became insignificant in high public debt countries. These results suggest that as global public debt increases, the influence of interest rates on stock returns might diminish. This holds implications for policymakers suggesting a reduced effectiveness of interest rate adjustments in high-debt countries and investors who might need to prioritise factors like global market states over interest rate changes in predicting stock returns in high-debt nations. Future studies could delve deeper into the mechanisms of these findings, particularly as more countries accumulate higher debt levels.

Keywords: Stock Returns; Interest Rate Changes; Public Debt; Private Debt; Fixed Effects Panel Regression

JEL codes: G12, G15, G38, G51, F30, H63, C33

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CHAPTER 1 Introduction

After almost a decade of historically low interest rates, many countries in the world have had to deal with massive spikes in inflation since the beginning of 2022. Most central banks have responded in line with economics textbooks, they have gradually raised interest rates to combat the rise in prices. However, there have been exceptions and critics of this. Turkey's president Recep Tayyip Erdogan for instance supports cutting interest rates because according to him lower interest rates would boost business growth, exports and lead to more foreign investment. Other critics also have warned central banks against raising interest rates too sharply, they point out that the amount of debt in the economy has increased a lot globally in present times, recently global debt hit a record of $307 trillion in the second quarter of 2023, despite these rising interest rates (IIF, via Reuters). They argue that this combination of high interest rates and high debt could lead to economic growth being negatively impacted more than the central banks think, as households and corporations with high levels of debt may get into financial troubles, this also applies to developing countries that accrued a lot of debt in recent years, they will find it increasingly difficult to pay their debts off if rates increase, which could lead to countries defaulting on their debt, which in turn can have negative implications for domestic and foreign business activity.

Central banks will traditionally lower interest rates to 'speed up' the economy of countries where economic growth is weak or weakening and will raise interest rates when inflationary pressures rise too much above 'acceptable' levels determined by the central bank, this is best understood in terms of the "Taylor Rule" (1993). According to the expected cash flow hypothesis stock prices should drop (go up) when interest rates rise (fall) because future cash flows are discounted by a higher (lower) rate. The relationship between interest rates and stock returns has been a much-researched topic in literature. First in theoretical financial asset pricing models such as the Discounted Cash Flow model (Williams, 1938) and the Capital Asset Pricing Model (Sharpe, 1964; Lintner, 1965; Mossin, 1966), later in empirical settings that tested whether this relationship holds true in a real-world setting. Chen et al. (1986) and Thorbecke (1993) for example demonstrate a detrimental impact of interest rates on stock returns, primarily attributable to the inflationary aspect of these rates, they find interest rates and stock returns to be negatively correlated. Bernanke and Reinhart (2004) assert that anticipated low future interest rates can boost asset values, including stocks. Assefa et al. (2017) also find significant effects of interest rate changes on stock returns in developed economies.

There is reason to believe that stock returns react differently to increases or decreases in interest rates depending on the level of public and private debt of a country. Stock returns in countries with high public sector debt (money that a country's government owes to its creditors) and private sector debt (money owed by individuals, households, and businesses within a country, excluding the government) may be more sensitive to interest rate changes. Rising interest rates can increase sovereign debt servicing costs, prompting spending cuts, and tax hikes. Tavares and Volkanov (2001)

have found that contractionary (expansionary) fiscal policy has a negative (positive) effect on stock returns. There could also be a higher risk of currency depreciation, as investors become more concerned about debt sustainability and move their capital to safer investments, which influences stock performance (Inci & Lee, 2014). Governments with high public debt levels may compete with the private sector for available funds in the credit market. When interest rates rise, borrowing becomes more expensive, and this could lead to reduced private sector investment (Ford & Laxton, 1999). Similarly, high private debt makes companies and consumers more vulnerable to interest rate changes, as increased costs of debt may reduce spending and investments, weakening corporate earnings. High interest rates or economic downturns can also raise default rates, impacting the financial sector and the stock market. On the other hand, central banks in countries with high private debt levels may be more cautious when it comes to raising interest rates, as they may want to avoid triggering a debt crisis or harming economic growth. This can result in a more gradual or accommodative monetary policy, which could support stock returns. I feel herein lies a relevant topic to research scientifically, because to my knowledge nobody has explored a research question similar to: "Does the effect of interest rates on stock returns differ between countries with varying levels of private and public sector debt?". My paper will also provide more recent findings regarding global interest rates effects on stock returns in general since Assefa et al. (2017) most recent data was from 2013, furthermore, I use a bigger sample that includes 60 countries. Results of this study could be relevant for policymakers who could take the results into consideration while setting interest rates or increasing/decreasing government debt levels. Investors could also use the results while trying to determine future stock returns in countries with differing amounts of public and private debt.

The research method of this paper will be akin to that of Assefa et al. (2017). Using cross-country panel data on 40 countries they utilise both a fixed effects panel regression and dynamic panel regression. To examine my research question, I will run a regression wherein quarterly stock returns is the dependent variable. The independent variables of interest are ones that potentially affect cash flow such as output growth (GDP growth), the state of world markets (MSCI Returns), and lastly the stance of change in domestic interest rates during each period for each country. My main data source for these variables is the database of DataStream Thomson Reuters, which have the data for all aforementioned variables up to the first quarter of 2023. I will group the researched countries two times. First, I will group them by the percentage of public debt to GDP, which includes the debt of the country's general government. And second by the percentage of private debt to GDP, which includes the debt of households and non-financial corporations in the country. Both will be split into three groups each. I will then use a fixed effects model with interaction variables to determine whether there is a difference in the effect of interest rate changes on stock returns between the groups. I look at public and private debt separately because these levels can greatly differ within countries. My observation period starts (akin to Assefa et al., 2017) in 2000 and ends after the first quarter of 2023.

I hypothesised that changes in domestic interest rates have a negative relationship with domestic stock returns and that this relationship was expected to be greater in countries with high public debt and / or private debt. Similar to previous empirical research I found a significant negative relationship between interest rate changes and the stock returns across my whole sample of countries. When I split the countries in groups based on debt however, I found that there seems to be no significant relationship between interest rate changes and stock returns in countries with high public debt. However there seems to be no significant difference in the way interest rate changes affect stock returns between groups based on the amount of private debt. When I split private debt into household debt and corporate debt, I see that in countries with low corporate debt, there seems to be an enhanced negative relationship between interest rate changes and stock returns.

The remainder of this paper is structured as follows: Section 2 discusses the relevant literature and previous research that has been done on the effect of interest rates on stock returns and public and private debt, Section 3 gives a description of the data and sample used in this study, Section 4 describes the methodology and models used for the research of my hypotheses, Section 5 shows the numerical results of my research and a discussion on the results found in my research, which is followed by a conclusion.

CHAPTER 2 Theoretical Framework

2.1 Interest rates

Interest rates are important things in finance and in economics, they signify either the cost of borrowing or the returns on someone's investment. They are often regarded as the "price of money" (Mishkin, 2018). So basically one can say that when someone loans money, they pay the other party interest, while when someone lends out their money or makes an investment, they receive interest. This interest you pay or earn is the price of the money you loan or that you have loaned out. When calculating interest rates, you can use the following basic formula: Interest rate = the amount of interest / (the principal amount * the time period). There are different types of interest rates, such as nominal, real, and effective rates which are all used in different situations when accounting for things like inflation or compounding interest. Compounding interest means that you gain interest on both the principal sum and the previously earned interest, which makes investment growth greater over time. An interest rate is usually written as an annual (or yearly) percentage.

Different types of interest rates serve different objectives. The interest rate that is on a loan usually signifies what a borrower has to pay to the lender. On the savings front, the rate stands for the yield one can expect, influencing the public's saving habits. When talking about bonds, which basically is debt issued by corporations or countries, the effective interest rate indicates the issuer's risk of repayment. The prices of bonds are negatively correlated with changes in interest rates. Mortgage rates determine the cost at which people or corporations can borrow to buy real estate, they play an important role on the affordability of and demand for housing as a whole. Central banks set the benchmark rates that are used as benchmarks for other interest rates (such as the savings and mortgage rates) and play a crucial role in employing monetary policy for a country or region. The U.S. FED does this using the Federal Funds Rate (FFR) and the European Central Bank with its Main Refinancing Operations Rate (MRO). Even though interest rates are often used to determine the discount rates in DCF models, they are not exactly identical to each other. The discount rate also takes things such as the risk associated with the investment, the type of asset and the time span of the cash flows of the asset at hand into account.

The study of interest rates has a vast history. Initially framed within moral and ethical fields, interest rates were formally studied by early economists in the 17th and 18th century such as John Locke in his letters (1691) and Adam Smith (1776) in his seminal book "The Wealth of Nations". After that in the late 19th and early 20th century, economists from the neoclassical school which included the likes of Alfred Marshall and Irving Fisher (1930) further expanded our understanding of interest rates, with Fisher describing the difference between nominal and real interest rates in his Fisher equation, that takes inflation into account. John Maynard Keynes (1936) emphasised the

interest rates' utility in monetary policy, particularly in how they could control economic activities such as savings, investment, and consumption. Influencing later economists like Milton Friedman (1963) who contended Keynes' ideas that interest rates could regulate inflation. Further seminal research on the role of interest rates in monetary policy was done by John B. Taylor who introduced the now quite famous Taylor Rule in 1993, which provides a formula for adjusting nominal interest rates based on changes in (expected) inflation, and economic output.

Innovations in the late 20th century, mainly from the field of finance, brought sophisticated models for dissecting interest rates by frontrunners like Black, Scholes, Merton (1973), and Vasicek (1977). Novel research on interest rates has mainly been done in the realm of behavioural economics, led by researchers like Richard Thaler (2015) and Robert J. Shiller (2000), who looked at the way psychological factors affected people's decisions involving interest rates.

The study of interest rates has become more complex and more diverse in recent times. In the present day the study of interest rates is heavily influenced by econometrics and quantitative models. At a macro level economist study interest rates to understand their impact on variables like investment, consumption, employment and inflation. Meanwhile monetary economics focuses more narrowly on the role of central banks in manipulating interest rates to achieve specific policy goals like inflation control or economic stabilisation. In financial economics interest rates come into play in prevalent asset pricing models, that incorporate interest rates when determining the prices of assets like stocks, bonds, and derivatives. The study also extends to banking and corporate finance, where understanding the term structure of interest rates is crucial for risk management and determining the cost of borrowing. More recently, behavioural economics has started exploring how psychological factors affect decision making about borrowing and investing in relation to interest rates. (Mishkin, 2018; Jha, 2011)

2.2 Interest rates and stock returns

The relationship between stock returns and interest rates has been studied for many years. Early on, asset pricing models like the Discounted Cash Flow (DCF) model from John Burr Williams (1938) were established. Presenting the idea that interest rates are pivotal in determining the present value of future cash flows. This model was further expanded on by Gordon and Shapiro in 1956, integrating the growth rate of dividends. The Capital Asset Pricing Model (CAPM), developed independently by Sharpe (1964), Lintner (1965), and Mossin (1966), is another foundational concept in this research area. CAPM introduces the "beta" (β) concept, representing a stock's volatility compared to the overall market (all model equations are present in Appendix A). An integral component of CAPM is the risk-free rate, typically embodied by returns on government bonds like U.S. treasuries. This rate, coupled with a stock's beta, influences the stock's price relative to interest rate shifts. Thus, CAPM shows that the dynamics between interest rates and stock prices are significantly influenced by the stock's market

volatility and the prevailing risk-free rate. The discount rate calculated by the CAPM model is often used in the DCF models.

Apart from having a direct influence on the price of stocks under the assumptions of these asset pricing models, interest rate changes can also influence stock prices in other, more indirect, ways. When central banks implement expansionary monetary policies to boost the economy, they often decrease interest rates. To combat inflation or an overheated economy, they might raise rates via contractionary policies. Such changes affect borrowing costs for both corporations and consumers. For example, higher interest can deter corporate investments and consumer borrowing, potentially leading to decreased consumer spending and corporate profits, which could reduce cash flow and thus stock prices according to the DCF model. The central bank's rate decisions provide insights into its views on inflation and economic growth, both of great importance to investors.

There have been many empirical studies to test whether the expected negative relationship between interest rate changes and stock returns is present in practice. Waud (1970) finds that decreasing (increasing) discount rates set by the Federal Reserve of the United States (FED) produce positive (negative) stock market reactions. Jensen and Johnson (1993) reported that stock returns were higher following interest rate reductions by the FED, even though these policies also conform to broader macroeconomic business cycles that affect stock returns. Blanchard (1981) noted that increasing the money supply lowers real interest rates, consequently positively impacting stock markets due to lowered corporate capital costs. Fama and Schwert (1977) also found a negative relationship between interest rates and stock returns, mainly due to its inflationary component. Domian et al. (1996) find that drops in interest rates are followed by 12 months of excess stock returns while increases have little effect, they argue that interest rate changes are used as proxies for changes in expected inflation. Thorbecke (1997) states that monetary policy exerts large effects on stock returns, particularly for smaller firms. Giovanni and Labadie (1991) found that nominal interest rates historically predicted stock returns in the United States. These findings are also supported by Ehrmann and Fratzscher (2004) who stated in their study that a tightening of monetary policy by 50 basis points immediately decreased U.S. stock returns by roughly 3% on the day of announcement. Furthermore, Bernanke and Reinhart (2004) suggested that low expected future interest rates can boost asset prices.

Many central banks including the European Central Bank and the Federal Reserve (FED) used Quantitative Easing (QE), after the global financial crisis starting in 2007, to influence interest rates by open market operations (OMO), which means that central banks buy government securities (such as bonds), which effectively increases the money supply, which in turn leads to lower interest rates. Although Kimura, Small (2006), and Kurihara (2006) observed minimal stock return shifts during Japan's QE phase, Krishnamurthy and Vissing-Jorgensen (2011) highlighted the positive impact of U.S. QE events on corporate risk premia (stock returns). Assefa et al. (2017) did research on the effect of interest rate changes on stock returns using panel data, they found that in developed countries that interest rates have a significant negative effect on stock returns, while they do not have a significant

effect in developing countries. Even though Flannery and James (2014) found stock returns of financial institutions to become greater when interest rates hike, I suspect a general negative effect of rate changes on stock returns. Hence, the first hypothesis is an anticipated negative relationship between stock returns and interest rate changes.

2.3 The role of public and private debt

As of now, not much research has been done that directly studies whether interest rate changes affect stock returns differently depending on how much debt there is in a country's economy. However, there has been research that could point to there being a difference in the impact of interest rate changes. Both the amount of public debt compared to a country's gross domestic product (GDP) and the amount of private debt as a percentage of its GDP could alter this relationship. The relationship could go through different channels.

2.3.1 Public debt

Looking at the literature on how public debt might affect the influence of interest rate changes on stock returns reveals some interesting points. Defined by the International Monetary Fund (IMF) as "the total stock of debt liabilities issued by the government sector", high public debt can significantly inflate debt servicing costs when interest rates rise. To address this, nations might reduce government spending. This can negatively affect the economy and businesses especially those that are dependent on government contracts and subsidies. As Keynes (1936) argued reduced government spending can slow economic growth, as it often results in less consumer spending by individuals who benefit from government programs or are employed in government-funded sectors, which in turn, might depress stock returns. This is a debated topic, however. Research from Belo and Yu (2013) found that high rates of government spending on public sector capital leads to higher future stock returns in the United States. Checherita-Westphal and Rother (2012) found that there is a relation between the amount of public debt and economic (GDP) growth in different nations in the euro area, they found that there is non-linear relationship, it is positive up to a government debt-to-GDP ratio of 90-100% and after that becomes negative. Researchers from The World Bank (2010) put the figure from which point more public debt is bad for economic growth at 77%. Similarly, Calderón and Fuentes (2013) found that there is a negative relationship between public debt and economic growth for countries in Latin America.

Rising taxes, which is another method to pay for high interest rates on debts for the government, can lower company profits and reduce disposable income for people, leading to decreased consumer spending and potential stock return declines. Jackson and Wisniewski (2020) and Liu (2023) highlighted the negative effects of increasing government debt-to-GDP ratios on stock

returns. Additionally, higher public debt can raise concerns about a nation's solvency and credibility. High global interest rates can prompt questions on whether governments can service their debts, potentially resulting in sovereign defaults. Research by Johri, Kahn and Sosa-Padilla (2022) suggests that surges in global interest rates elevate sovereign credit spreads, indicating heightened default risks. Andrade and Chhaochharia (2018) further noted that stock prices for companies that are more exposed to their government seem to be extra sensitive to changes of these sovereign credit spreads. Defaults can drastically impact domestic and global markets. Capital flight may be a result of this, prompting investors to liquidate assets, including stocks, which drives down their prices.

My second hypothesis is thus that I anticipate a difference in the relationship of interest rate changes and stock returns depending on the level of public debt in a country, with high public debt countries having a more pronounced negative relationship.

2.3.2 Private debt

Private debt, defined as the money borrowed by private businesses, households, and individuals, may also significantly influence the dynamic between interest rates and stock returns. High private debt indicates a great amount of borrowed funds circulating in an economy. When interest rates surge, it becomes costlier for businesses to finance or refinance debt, potentially reducing profits. Similarly, consumers with debts like mortgages or loans may see increased interest burdens, lowering their disposable income and subsequently diminishing consumer spending, which could lead to reduced stock returns (Gupta et al., 2022). High interest rates amid high private debt levels could lead to more financial instability. An increase could spark defaults within the private sector, undermining financial markets and potentially inducing broader economic downturns. Notably, recessions tend to be more severe in nations with high private debt (King, 1994). Such countries may also struggle with diminished growth after experiencing recessions (Uuskula et al., 2011). A critical point is that high private debt might limit the effectiveness of expansionary monetary policy. Rather than investing or spending during periods of low interest, entities might prioritise settling existing debt. Moreover, central banks might hesitate to elevate interest rates excessively because of concerns for financial unrest, potentially leading to business defaults, decreased consumer spending, and restrained business investment. Cecchetti et al. (2011) estimated the optimal household debt to GDP and corporate debt to GDP for economic growth, they found thresholds of 85% and 90% respectively. As household and corporate debt together make up most of the credit to the private sector, putting these percentages together (175%) could give an approximation of what an optimal threshold for private debt as a whole could look like.

At the company-specific level, examining the influence of debt on stock returns requires models such as the CAPM and the WACC. The WACC, conceptualised first by Miller and Modigliani

(1958), is a tool for determining a firm's average (after-tax) cost of capital, which is often used as the discount rate in DCF models. The WACC weighs the cost of equity (which is often calculated with the CAPM model) and the cost of debt. A company's proportion of debt to equity can significantly affect this calculation. An increase in a firm's debt may reduce the impact of the risk-free rates (often the interest rate on government bonds) on the WACC (discount factor) and thus stock returns. Furthermore, companies with more considerable debt often have higher volatility (β), which influences the cost of equity.

Empirical research on how debt-to-equity ratios influence stock returns mostly show a negative relationship. Higher debt-to-equity ratios appear to lower stock returns (Muradoglu and Whittington, 2001; Abdullah et al., 2018). Furthermore, private investment in general is expected to lower future stock returns (Cochrane (1991;1996), Cooper, Gulen, and Schill (2008)).

On a macro scale, countries with high private debt might witness a more pronounced negative effect of interest rate changes on stock returns. However, looking at individual companies a higher debt ratio may lead to a less significant relationship. These opposing effects may counteract each other, leading to an inconclusive impact of private debt as a whole. Thus, my third hypothesis states that the influence of interest rates on stock returns varies across different private debt levels, however, it being uncertain whether more private debt will strengthen or weaken the negative relationship.

CHAPTER 3 Data

3.1 Sample

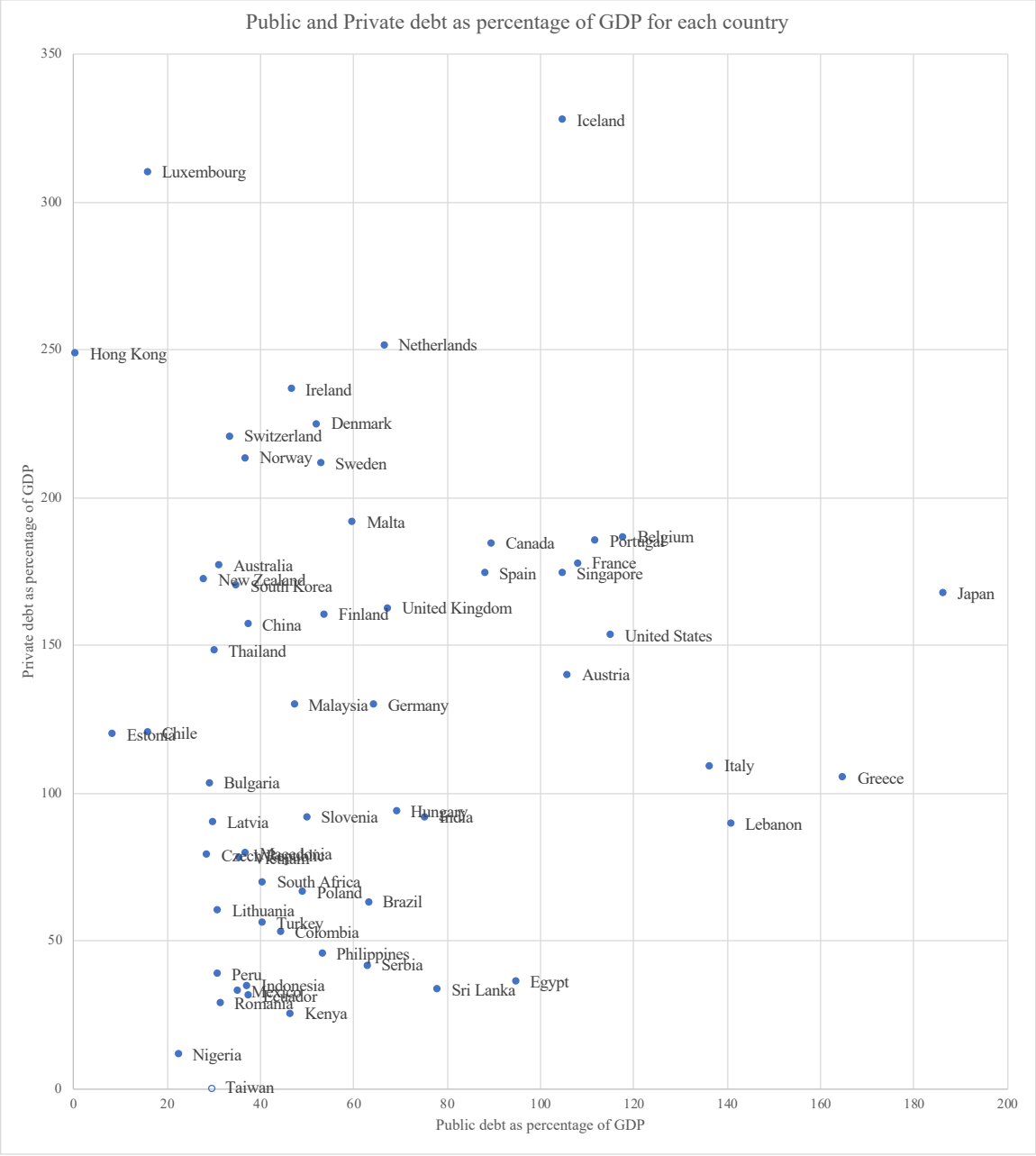
For the duration of the sample, I use a period from the first quarter of 2000 until the first quarter of 2023. I start at the year 2000 because in the 90's events like the launch of the Euro, the Asian crises and the fall of the Soviet Union could lead to big disruptions for many of the countries in the sample. The first quarter of 2023 is the cut-off because of no availability of data on interest rates, equity indices and debt figures for several countries in the sample beyond that date. The period of the sample is significantly longer than that of Assefa et al. (2017) and seems more complete in the sense that in this 22-year period, there have seen different macro-economic cycles. Most countries in the world experienced recessions in this period following the financial crises in 2007, but also extended periods of economic growth afterwards that were (at least) partially driven by the quantitative easing used by central banks around the world, which led to historically low interest rates across many parts of the world. In more recent times we have seen massive hikes in interest rates in response to high inflation following the Covid and Ukraine crises.

Several Arab stock exchanges were excluded from the sample due to religious guidelines limiting stock diversity and overexposure to volatile markets like oil. Additionally, some former socialist countries were omitted due to extreme return fluctuations post-regime changes (Assefa et al., 2017). I found benchmark stock market indices for 63 countries over (part of) the time period. For 62 of those countries 3-month short-term interest rates were available (Panama was excluded). Looking at the index performances of the countries in the sample I found a few outliers, due to hyperinflation the domestic stock market indices of Argentina and Venezuela grew over 46,000 and over 6 trillion percent respectively over the 22-year period. I end up with the following 60 countries for the sample; Australia, Austria, Belgium, Brazil, Bulgaria, Canada, Chile, China, Colombia, Czech Republic, Denmark, Ecuador, Egypt, Estonia, Finland, France, Germany, Greece, Hong Kong, Hungary, Iceland, India, Indonesia, Ireland, Italy, Japan, Kenya, Latvia, Lebanon, Lithuania, Luxembourg, Malaysia, Malta, Mexico, Morocco, Netherlands, New Zealand, Nigeria, Northern-Macedonia, Norway, Panama, Peru, Philippines, Poland, Portugal, Romania, Serbia, Singapore, Slovenia, South Africa, Spain, Sri Lanka, Sweden, Switzerland, Taiwan, Thailand, Turkey, United Kingdom, United States and Vietnam. For Morocco no data on public debt was available and for Taiwan no data on private debt was available, they are excluded while testing the second and third hypotheses.

To examine the relationship between interest rates and stock returns at varying debt levels, countries in the sample were categorised based on their public and private debt-to-GDP ratios. For public debt, thresholds were set at 31% (25^{th} percentile in the sample) for low debt and 77% (75^{th} percentile in the sample) for high debt, the latter being based on the figure, at which more public debt becomes strenuous on GDP growth, suggested by the World Bank (2010). For private debt, the thresholds were set at 61.1% (also 25^{th} percentile in the sample) and 176% (75^{th} percentile), in line

with calculations from Cecchetti et al. (2011). Given the 22-year duration of the study, the debt levels of many countries varied. Therefore, data was evaluated quarterly, categorising each country's quarter based on its debt level for that period, allowing countries to appear in multiple groups based on their changing debt levels over time.

Figure 1: This plot displays a country's average General Government debt to GDP percentage for the 2000-2022 period on the x-axis, the y-axis displays a country's average credit to private sector as percentage of GDP over the 2000-2022 period.



Note: The figures used in this plot are available in Appendix A Table A1.

3.2 Variables

3.2.1 Main variables

Stock Returns. Similar to Assefa et al. (2017), stock returns in this study are calculated as the discrete quarterly growth of the domestic stock index. This data is drawn from DataStream, where I identified the benchmark indices for 63 countries. It should be noted that these are not identical to the ones used by Assefa et al., as several of their indices are no longer updated. Quarterly data was preferred over the annual frequencies due to its ability to provide a more expansive and comprehensive set of data points. I also prefer a quarterly to monthly data as data for the independent variables are more readily available on a quarterly basis (think growth in GDP) and because of the fact that some effects of monetary policy on stock returns might have delays. Sources on all main variables can be found in Appendix C.

Interest Rate Changes. The principal independent variable employed is the variation in the short-term interest rate, depicted by the 3-month benchmark interest rate. Predominantly, the 3-month interbank rate is utilised for most countries. The preference for this rate stems from its widespread availability, its short-term maturity, and its practicality as a risk-free rate for 3-month investments. In situations where the interbank rate is not accessible, the most similar 3-month interest rate is chosen. It is also important to note that my expression for the interest rate changes is different from Assefa et al. (2017). I employ the absolute rate change (change in percentage points) instead of a growth percentage. This approach feels more intuitive to me as it aligns better with real-world views, cash flow models and central bank rate setting. It also negates the issue that due to extremely low interest rates within my sample an interest rate changes defined as a growth percentage produced many outliers. However, a robustness test (Appendix B Table B1 to B3) will be done with the variable expressed as a growth percentage.

Public Debt Level. This variable will be defined as the gross general government debt, as a percentage of the Gross Domestic Product (GDP) of the country. This provides the broadest definition of public debt on a quarterly basis available for all countries in the sample. While the majority of the public debt data comes from DataStream in quarterly figures, some figures are sourced from the International Monetary Fund (IMF) as they were absent from the DataStream database. As the data from the IMF was annual data up to 2022 instead of quarterly data, the yearly figures were used for every quarterly observation of that particular year and the figure for 2022 was also used for the first quarter of 2023 (which is also true for the private debt variable).

Private Debt Level. Measured as the credit to the non-financial private sector as a percentage of GDP, also offers the broadest definition of private debt that is available for most countries in my sample on a quarterly basis. The credit data includes all loans provided to non-financial corporations, households and non-profit institutions.

3.2.2 Control variables

Real GDP Growth. This control variable reflects the quarterly growth in Real Gross Domestic Product of a country. A strong economy, signified by positive GDP growth, generally indicates that companies within that country are performing positively. Thus, it is conceivable that stock returns are positively affected when an economy flourishes. When looking at data on both stock returns and real GDP growth in most countries over a period from 2000 to 2022, there seems to be a positive and quite big correlation between the two over most of the period (Rabener, 2023). May and Wade (2013) however found that financial markets can perform well even if there is weak economic growth if it is accompanied by an easing in monetary policy (which includes lower interest rates), they find a more significant correlation between equity returns and expected economic growth rather than actual economic growth. To correct for possible endogeneity of this variable suggested by Assefa et al. (2017) we run a dynamic panel regression (System Generalised Method of Moments) in Appendix A. This endogeneity could be prevalent due to changes in GDP and stock returns both being influenced consumer spending. (Gupta et al., 2022)

MSCI World Index Returns. Another control variable for this study is the quarterly returns of the Morgan Stanley Capital International (MSCI) World Index, which is used as a proxy for the world market. There is evidence that emerging markets around the world have become more and more integrated with each other (Bekaert & Harvey, 1995). Drummen and Zimmerman (1992) also found earlier that the world stock market explains a significant amount of the returns of European stocks and Assefa et al. (2017) found that there is a positive relationship between world market index returns in both developing and developed countries.

Changes in Real Effective Exchange Rate (REER). This variable gauges the quarterly change in a currency's strength against a basket of various global currencies. The REER can impact domestic stock returns because currency depreciation may boost domestic output and exports due to reduced prices, potentially increasing demand, while currency appreciation could have the opposite effect by raising prices and decreasing demand. This effect on demand might influence companies' revenues and costs and thus impacting stock returns. It is also possible that when there is rapid depreciation of a currency people flock to stock markets as an "inflation hedge" which would boost stock returns excessively. The REER employed in this study is the one described by Darvas (2012), their monthly figures were averaged into quarterly figures.

3.3 Characteristics

Table 1 provides descriptive statistics for the countries used in my sample. Over this study, average quarterly domestic stock returns were 1.91%. Northern Macedonia peaked in Q1 2005 with returns over 119%, while Iceland's lowest was -81% in Q4 2008 post-financial crisis. Average interest rates stood at 4%, with Romania's peak at 80.3% in Q1 2000 and the minimum being Switzerland's at -0.9% in Q2 2016. Average quarterly interest rate changes were -0.035%, with the most significant shifts in Romania (Q3 2000) and Sri Lanka (Q2 2022). Real GDP growth averaged 0.76% quarterly, with Peru experiencing the largest fluctuations in 2020 due to the pandemic. The MSCI world benchmark index returned 1.14% quarterly on average, with the lowest and highest quarterly returns being from Q1 2020 when the MSCI dropped 24.5% and the quarter after that (Q2 2020) bouncing back with a return of 24.1%. Public debt as a GDP percentage averaged 60.3%. Greece peaked at 267.09% in Q2 2021 while Hong Kong had periods with no public debt. Private debt to GDP averaged 126%, with extremes in New Zealand (the minimum in 2002) and Iceland (the maximum in 2009). By Q1 2023, public debt to GDP increased by 1.5 times since 2000, and private debt to GDP grew by around 1.6 times over the period.

In descriptive table 2 and 3 the sample are categorised on debt levels, looking at table 2 we can see that the low public debt group outperforms the other two with the highest average returns (2.306%). It also has the highest average interest rates (at 4.46%). In contrast, the high public debt group exhibits the lowest returns (1.537%), the lowest interest rates (2.69%), the smallest changes in interest rates (0.278%) and the lowest average growth of RGDP (0.501%), while having the highest public (120%) and private debt (155%) as percentages of GDP. REER changes are positive on average for the low (0.389%) and medium (0.249%) public debt groups but slightly negative for the high public debt group (-0.004%).

When divided on private debt levels in table 3, the low private debt group stands out with the highest returns (3.475%), interest rates (7.495%) and RGDP growth (0.928% quarterly). While the high private debt group has the lowest means for the afore mentioned variables (1.149%; 1.766%; 0.567%) and also the lowest REER change (-0.023%) and smallest absolute changes in interest rates (0.248%). Public debt levels remain fairly consistent across private debt categories.

I can further examine relationships between the variables in a pairwise correlation matrix. This matrix shows that stock returns are significantly correlated to interest rate changes (-0.095) growth in real GDP (0.052), MSCI returns (0.615), changes in REER (0.042) and Private debt (-0.076). While interest rate changes are significantly correlated with real GDP growth (0.043), changes in REER (-0.073), public (0.026) and private debt level (0.049). For further interesting correlations we can see that there is a positive but small correlation between the amount of private debt to GDP and the amount of public debt to GDP (0.143). The amount of public debt (-0.166) and private debt (-0.385) are quite strongly, negatively and significantly correlated with the height of interest rates in the

country, which means that countries with higher debt levels seem to have lower interest rates. Higher debt levels also seem to be correlated with lower quarterly growth in real GDP for both public (-0.076) and private (-0.085) debt.

Table 1: Descriptive Statistics of the Whole Sample

Variable	N	Mean	Std. Dev.	Min	Max
Returns	5473	1.914	12.202	-81.372	119.722
Interest Rates	5631	3.876	4.58	-.9	80.29
Rate Changes	5383	-.045	1.015	-16.896	10.93
RGDP growth	5579	.758	2.193	-26.24	30.19
MSCI returns	5580	1.14	8.86	-24.474	24.14
REER changes	5580	.223	3.349	-50.362	47.839
Public debt	5519	60.302	42.45	0	267.09
Private debt	5361	126.775	81.403	7.803	675.34

Note: Returns are the quarterly change in domestic stock indices. MSCI Returns are the quarterly changes in the MSCI world index. Interest Rates are the nominal 3-month domestic interest rates. Rate Changes is the nominal difference in the interest rate from quarter to quarter. REER change and RDGP growth is the quarterly growth of REER and Real GDP respectively. Public and Private debt are the General Government debt as percentage of GDP and the credit to the private sector as percentage of GDP. These are the descriptive statistics of the full sample of 60 countries. Descriptive statistics for every country individually can be found in Appendix A table.

Table 2: Means of Descriptive Statistics split on level of Public Debt

Variable Means	Low Public Debt	Medium Public Debt	High Public Debt
Returns	2.306	1.921	1.537
Interest Rates	4.46	4.104	2.69
Rate Changes	-.076	-.029	-.015
RGDP growth	.885	.819	.501
REER changes	.398	.239	-.004
Public debt	19.745	50.557	120.241
Private debt	125.382	116.042	154.715
Absolute Rate Changes	.556	.479	.283
Quarters (N)	1380	2767	1382

Note: Figures in this table are the means of the variables for the corresponding public debt group. The low public debt group has a general government debt-to-GDP ratio of less than 31.1%. The high debt group a ratio higher than 77.2%. The medium group sits in-between these thresholds. The Absolute Rate Changes the absolute value of the change in interest rates. Quarters is the number of quarters that fit into the restrictions of each public debt group.

Table 3: Means of Descriptive Statistics split on level of Private Debt

Variable Means	Low Private Debt	Medium Private Debt	High Private Debt
Returns	3.5	1.525	1.17
Interest Rates	7.404	3.297	1.752
Rate Change	-.172	-.002	-.016
RGDP growth	1.053	.706	.565
REER change	.436	.248	-.023
Public debt	47.211	65.963	64.28
Private debt	35.946	119.136	234.02
Absolute Rate Change	.873	.38	.249
Quarters (N)	1348	2788	1384

Note: Figures in this table are the means of the variables for the corresponding private debt group. The low public debt group has a credit to private sector to GDP ratio of less than 61%. The high debt group has a ratio higher than 176%. The medium group sits in-between these thresholds. The Absolute Rate Changes the absolute value of the change in interest rates. Quarters is the number of quarters that fit into the restrictions of each private debt group.

Table 4: Pairwise correlations between variables

Variables	(1) Returns	(2) Interest Rates	(3) Rate Changes	(4) RGDP Growth	(5) MSCI Returns	(6) REER Changes	(7) Public Debt	(8) Private Debt
(1) Returns	1.000							
(2) Interest Rates	-0.011	1.000						
	(0.427)							
(3) Rate changes	-0.095	-0.042	1.000					
	(0.000)	(0.002)						
(4) RGDP growth	0.052	0.021	0.043	1.000				
	(0.000)	(0.117)	(0.002)					
(5) MSCI returns	0.615	-0.107	-0.018	0.001	1.000			
	(0.000)	(0.000)	(0.183)	(0.954)				
(6) REER changes	0.042	0.046	-0.073	0.010	0.044	1.000		
	(0.002)	(0.001)	(0.000)	(0.453)	(0.001)			
(7) Public debt	-0.022	-0.166	0.026	-0.076	0.029	-0.045	1.000	
	(0.102)	(0.000)	(0.058)	(0.000)	(0.034)	(0.001)		
(8) Private debt	-0.076	-0.385	0.049	-0.085	0.021	-0.064	0.143	1.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.124)	(0.000)	(0.000)	

Note: Correlation coefficients are shown in the cells, p-value in parentheses. A p-value less than 0.05 generally suggests a statistically significant relationship between the paired variables.

CHAPTER 4 Methodology

4.1 Joint Fixed Effects

I am going to be using different methods to test my hypotheses. First off with a regular fixed effects model for panel data. As for the fixed effect models I am initially going to test the first hypothesis with this model:

$$\boldsymbol{StockReturns_{nt} = a_n + \beta_1 RateChanges_{nt} + \beta_2 RGDPgrowth_{nt} + \beta_3 MSCIreturns_t + \beta_m X_{nt}^m + \varepsilon_{nt}}$$

The dependent variable is the quarterly stock returns, with the n being the countries corresponding index and the t being the corresponding quarter. The independent variables are ones that can also impact stock returns by influencing free cash flow. $\boldsymbol{RGDPgrowth_{nt}}$ can influence stock returns because it incorporates spending by consumers and businesses and $\boldsymbol{MSCIreturns_t}$ can influence returns as it gauges the state of stock markets (and their economies) around the world, both are expected to have a positive beta, with the n representing the country again and the t being the growth in real GDP compared to the last quarter and the returns of the world index over the quarter respectively. As for $\boldsymbol{RateChanges_{nt}}$ the n is the corresponding interest rate for the country and the t represents the change in the interest rate over the corresponding quarter. The $\boldsymbol{X_{nt}^m}$ stands for the control variables I will use those including the change in REER and the percentage of public debt and the percentage of private debt-to-GDP.
The fixed effects model was chosen to control for time-invariant unobserved individual-specific effects that may affect the dependent variable. By doing so, this model accounts for any omitted variable bias stemming from variables that are constant over time but differ across panels.

4.3 Fixed Effects with Interaction Variables

To test the second and third hypotheses, whether the relationship of interest rates and stock returns changes depending on the debt levels, I am going to use a fixed effects model with interaction variables and a margins model. First, I alter the fixed effects model used earlier so that includes interaction variables for the level of Public and Private level debt, so it looks like this:

$$\begin{aligned}\boldsymbol{StockReturns_{nt}} &= \boldsymbol{a_n + \beta_1 RateChanges_{nt} + \beta_2 RGDPgrowth_{nt} + \beta_3 MSCIreturns_t + \beta_m X_{nt}^m} \\ &+ \boldsymbol{\beta_4 PublicDebtGroup_{nt} * Ratechanges_{nt} + \beta_5 PrivateDebtGroup_{nt}} \\ &* \boldsymbol{Ratechanges_{nt}} \\ &+ \boldsymbol{\beta_6 PublicDebtGroup\,(dummy) + \beta_7 PrivateDebtGroup\,(dummy) + \varepsilon_{nt}}\end{aligned}$$

This model extends the initial one by including two interaction terms to examine how interest rate changes impact stock returns across varying debt levels. The variables $\boldsymbol{PublicDebtGroup_{nt}}$ and $\boldsymbol{PrivateDebtGroup_{nt}}$ categorise public and private debt-to-GDP ratios, respectively. Both assign 0 for the middle group, 1 for the low group, and 2 for the high group. They investigate if the relationship between interest rates and stock returns shifts with the magnitude of public and private debt. If the interaction terms with $\boldsymbol{Ratechanges_{nt}}$ are significant, it indicates that stock return sensitivity to interest rates is different for low or high debt countries. The medium debt group serves as the baseline. Thus, for each interaction, we get two coefficients: one contrasting the low vs. medium groups and another contrasting the high vs. medium groups. A negative coefficient suggests a more negative relationship for that group relative to the medium group, and vice versa. In this regression, coefficients for the categorical debt groups (the dummy variables) indicate if belonging to either the low or high debt groups, compared to the medium group, influences stock returns.

After having run the previous model, I can use the 'margins' command in STATA to conduct post-estimation analysis and derive the marginal effects of interest rates on stock returns for every public and private debt group individually. This command takes the partial derivative of the predicted outcome with respect to the variable of interest, in this case, $\boldsymbol{Ratechanges_{nt}}$. Essentially, the margins command calculates how much, on average, the predicted stock returns would change for a one-unit increase in interest rates, holding all other variables constant. By specifying the at option for each debt group, one can differentiate how this relationship varies for entities with different levels of $\boldsymbol{PublicDebtGroup_{nt}}$ and $\boldsymbol{PrivateDebtGroup_{nt}}$. The results will provide a more nuanced understanding of the sensitivity of stock returns to interest rate fluctuations across various debt groups. Thus, the interpretation goes beyond the average effect in the fixed effects regression and gives insights into specific scenarios based on the debt profile of countries. I will get three coefficients for the public debt groups; the first coefficients will represent what a one unit in variable $\boldsymbol{Ratechanges_{nt}}$ (a 100 basis points increase in interest rates) does to stock returns for the group with low public debt, the second coefficient for the group with medium public debt and the third for the groups with high public debt. Then I do the same to get three coefficients for the private debt groups. Looking at these coefficients we can see how the effect of interest rates on stock returns differ between the groups.

Chapter 5 Results & Discussion

5.1 First hypothesis

The first fixed model results, displayed in Table 5, align with what is expected from classical asset pricing models: when interest rates, stock prices fall. The R^2 for the models are 0.406, 0407 and 0.427, which suggests that these models can explain between 40.6% to 42.7% of the variation in quarterly stock returns. This is a substantial fraction, yet there remains considerable variation left to be explained for what influences stock returns, possibly by things such as individual company performance and characteristics, market sentiment, global geopolitical events, industry-specific developments, and unexpected economic shocks. The R^2 of the model is lower for this model compared to the R^2 of a model with similar variables from Assefa et al. (2017) for their sample of developed countries (0.66), but higher than the R^2 for their sample of developing countries (just below 0.30).

From the results of Table 5, a few variables stand out. Interest rate changes negatively influence stock returns, consistent with findings from previous literature such as Assefa et al. (2017), who found a similar relationship even though their coefficients suggest a slightly stronger negative effect in developed countries. In the first 2 models increases in interest rates of 1 percentage point (100 basis points) is expected to decrease stock returns by around 1% (and 1.2% in the third model). Real GDP growth has a positive correlation with quarterly stock returns, even though this relationship seems to become insignificant when correcting for endogeneity in table A3 and A4 of Appendix A. MSCI returns coefficients indicate that domestic stock returns are very responsive to global market trends as an increase in MSCI returns by 1% lead to an increase of domestic stock returns by an average of 0.85%, this variable also has a high t-statistic of over 59 which indicates a very significant relationship. The effect of REER changes has mixed signs but is insignificant in the models. Public debt has a significant positive coefficient (0.026) and thus effect on stock returns in the model, which is interesting because in the descriptive table 2 we see that the group with high public debt has lower returns on average. Private debt has a significant negative effect on stock returns, when the private debt-to-GDP increases by 1% stock returns are expected to be around 0.04% lower, with household debt having a stronger negative effect than corporate debt.

To ensure my findings' reliability, I conducted robustness analyses. Initially, I changed the definition of interest rate changes. While my primary definition considers changes in percentage points, we examined the percentage change in rates, akin to Assefa et al. (2017). Additionally, I introduced a variable (Sigma) assessing stock return volatility over the last two years. Observing the results in Appendix B, rate changes remain negative and significant (Table B1 to B3). Furthermore, I modified rate definitions to address the uniform weight given to a 1 percentage point increase, making adjustments based on the initial interest rate (Table B4 & B5). This definition emphasises the

significance of changes for lower rates, which is in line with potentially diminishing marginal effect on stock returns. Results continue to highlight the negative effect of rate changes on returns and stay consistent with the findings of Table 5.

Table 5: Panel Fixed Effects Models

	(1) Returns	(2) Returns	(3) Returns
Interest Rate Changes	-1.011***	-0.997***	-1.187***
	(-8.02)	(-7.89)	(-8.46)
Real GDP growth	0.304***	0.304***	0.281***
	(5.14)	(5.12)	(4.61)
MSCI returns	0.840***	0.839***	0.862***
	(59.30)	(59.19)	(59.28)
REER change		0.0650	-0.0131
		(1.61)	(-0.30)
Public debt			0.0260***
			(3.17)
Private debt			-0.0338***
			(-8.40)
N	5355	5355	5039
R^2	0.406	0.407	0.427

Dependent variable is Returns. This table presents the results of three fixed effects regressions, analysing the impact of interest rate changes, GDP growth, MSCI returns, REER changes, and public and private debt levels on stock returns. Each column represents a separate model. *t* statistics in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Furthermore, in Appendix B Table B8 we can see that lags of 6 months and 12 months of interest rate changes variables also have significant effects on current stock returns, suggesting delayed effects of monetary policy on stock returns. I then diversified the sample, excluding the U.S. and U.K., due to their strong influence on the MSCI world index, this also yielded consistent outcomes (Table B9).

The results are similar to some prior studies on the relationship of interest rates and stock returns, for instance, I found the negative relationship that was also found by the likes of Assefa et al. (2017) Thorbecke (1997) and Fama and Schwert (1977). The estimates suggest a slightly less pronounced effect of interest rates on stock returns, which is possibly because of the fact that this model uses a larger sample of countries than similar studies. Similar to Domian et al. (1996) I found that the stock returns react more strongly to rate declines opposed to rises in interest rates (Table B18). Furthermore, we can see that the effect of interest rates on stock returns is quite heterogeneous and

differs from country to country (see Appendix Table A2). This could also be the reason for the REER variable being insignificant, as changes in REER affect the many countries in the sample in different ways, thereby cancelling the effect out over the whole sample, which is supported by the findings of Chue and Cook (2008). In the robustness check (Tables Appendix B1 to B3) with a different definition of rate changes we see a positive coefficient for REER changes, consistent with Assefa et al. (2017). The observations about public debt are consistent with literature from Belo and Yu (2013) who also found a positive coefficient, yet also present nuances potentially tied to the non-linear impacts described by researchers like Checherita-Westphal and Rother (2012). Furthermore, the negative relationship between private debt and stock returns is supported by micro-level studies, such as those from Muradoglu and Whittington (2001) and Abdulla et al. (2018).

In conclusion I cannot reject my first hypothesis, which stated that interest rates have a negative relationship with stock returns, based on these results.

5.2 Second and third hypothesis

Table 6 shows a significant difference in the impact of rate changes on stock returns when public debt is high as a percentage of GDP, but no significant difference in this relationship of rate changes and stock returns when countries are divided on private debt. We see that the model with the interaction variables for public and private debt groups has a slightly lower R^2 (0.412) than the most explanatory model that was used for the first hypothesis, which means that adding these interaction variables does not greatly help us in predicting the variability in stock returns as effectively as the primary model used for the first hypothesis. However, these interaction variables do give insight into the difference in how stock returns in countries with different debt levels react to interest rate changes.

Examining the margins Table 7 (model 3), we see that the coefficient for Rate Changes is the most negative in countries with medium public debt (-1.364), which is also more negative than the average coefficient for the low public debt group (-1.007) and the coefficient for the whole sample I calculated in Table 5 (which was around -1.19). The coefficient for the high public debt group is positive, very small (0.082) and also insignificant, which means a change in interest rates has no significant effect on stock returns in this group. The MSCI variable's role is pivotal, as outlined in Table 6; the distinction in how interest rate changes affect stock returns only emerges after adding the MSCI world index returns to the model. Looking at margins Table 8 we see that the rate changes coefficients for the low and medium private debt groups are negative and significant, and that the high private debt group only has a significant coefficient in model 3. Meaning that there is no significant relationship between stock returns and interest rate changes for high private debt countries in the first two models. However, the interaction term between rate changes and high private debt is insignificant, which means the difference in coefficients between the medium and high private debt groups is not statistically significant. Furthermore, we see that the dummy variables for private debt are significant

in Table 6. A country with high private debt has significantly lower returns than a medium private debt country, opposed to the significantly higher returns in low private debt countries.

To ensure robustness I ran the model again with slight variations. Removing Japan, given its distinct negative coefficient (Table A2), accentuated the variance between medium and high public debt groups (Table B10). Including an interaction variable denoting whether an economy is developed or not revealed a persistent significant effect of interest rate changes on the high public debt group compared to the medium group (Table B11). Adjusting debt thresholds, whether based on percentiles or standard deviation from the mean, retained consistent results, emphasising varying reactions in low, medium and high public debt groups (Table B12 and B13). The difference in the effect of rate changes on stock returns also stays prevalent in a dynamic panel regression instead of the fixed effect one (Appendix A Table A5). Lastly, we split the private debt variable into household and corporate debt, examining their individual effects. While certain countries were excluded due to data limitations, initial results showed insignificant coefficients for both variables (Table B16). However, a deeper analysis divided countries into three categories based on household and corporate debt levels (Table B17), revealing a notable negative relationship between rate changes and returns in nations with low corporate debt. In Appendix B Table B18 we see that when private debt is split into corporate and household debt the coefficient for countries with low corporate debt is very negative at (-1.4) which is the most pronounced effect we have seen in the fixed effect models, in those countries an increase of interest rates by 1 percentage point reduces stock returns by more than 1.4%.

In light of the theoretical framework, the results obtained were somewhat opposed to what was expected from my interpretation of the literature. Because of the negative effects of high public debt on economic growth and stock returns as described in the literature (Checherita-Westphal and Rother, 2012; The World Bank, 2010; and more), I expected to find that raises in interest rates would only make these negative effects worse. The fact that in countries with public debt this relationship seems non-existent could be explained by a few things. One reason, based on table 2, could be that interest rates in high public debt countries are substantially lower than those with medium or low public debt, however when rate changes have a different definition in the robustness tests the difference in relationships still prevails (although less pronounced). It is also plausible that countries with higher public debt are more globally integrated, as the significance in relationships only arises after introducing the MSCI variable. Returns in countries with high public debt are more correlated with returns of the world index and thus have higher β's (Appendix Table A2), which would mean a less pronounced effect of domestic risk-free rates on the discount factor from the CAPM model, and thus a less pronounced effect on stock returns. Findings of Lunde and Timmerman (2004) could provide another explanation. Countries with high public debt have lower economic growth and stock returns in the sample (table 2), and they found that in bear markets, which are characterised by weak economic growth and stock returns, interest rate changes do not affect stock returns very strongly.

Table 6: Panel Fixed Effects Model, including Interaction Variables for Debt Levels

	(1) Returns	(2) Returns	(3) Returns
Interest Rate Changes	-1.378***	-1.447***	-1.445***
	(-4.14)	(-5.64)	(-5.63)
Real GDP growth	0.293***	0.283***	0.283***
	(3.74)	(4.69)	(4.70)
MSCI returns		0.846***	0.845***
		(59.68)	(59.54)
REER change			0.0562
			(1.38)
Low Public * Rate Changes	0.603	0.354	0.357
	(1.57)	(1.20)	(1.21)
High Public * Rate Changes	0.985*	1.441***	1.446***
	(1.87)	(3.55)	(3.56)
Low Private * Rate Changes	-0.380	0.193	0.200
	(-1.02)	(0.67)	(0.70)
High Private * Rate Changes	0.727	0.163	0.134
	(1.01)	(0.29)	(0.24)
Low Public Debt (dummy)	-0.414	0.585	0.568
	(-0.72)	(1.31)	(1.28)
High Public Debt (dummy)	2.181***	0.537	0.587
	(2.83)	(0.90)	(0.98)
Low Private Debt (dummy)	1.837**	3.362***	3.340***
	(2.10)	(4.98)	(4.95)
High Private Debt (dummy)	0.0475	-1.075**	-1.067**
	(0.08)	(-2.28)	(-2.27)
N	5355	5355	5355
R^2	0.015	0.412	0.412

Dependent variable is Returns. Low Public Debt * Rate Changes, High Public Debt * Rate Changes, Low Private Debt * Rate Changes and High Private Debt * Rate Changes are interaction variables. The Low Public Debt dummy variable has value 1 if general government debt to GDP ratio is lower than 31.1%. The High Public Debt dummy variable has value 1 when general government debt to GDP ratio is higher than 77.2%. The Low Private Debt dummy variable has value 1 if private sector to GDP ratio is lower than 61%. The High Private Debt dummy variable has value 1 if private sector to GDP ratio is higher than 176%. Each column represents a separate model. *t* statistics in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 7: Marginal Effects of Rate Changes on Returns at Different Levels of Public Debt

Margins Public Debt	(1)	(2)	(3)
Interest Rate Changes			
Low Public Debt	-0.676**	-1.007***	-1.007***
	(-2.07)	(-3.99)	(-3.99)
Medium Public Debt	-1.279***	-1.360***	-1.364***
	(-4.29)	(-5.92)	(-5.93)
High Public Debt	-0.293	0.0800	0.0821
	(-0.64)	(0.22)	(0.23)
N	5196	5196	5196

Coefficients are marginal effects of Rate Changes on Returns for every Public Debt group for models 1, 2 and 3 from table 7. Calculated as the partial derivative of Rate Changes at Public Debt. *t* statistics in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 8: Marginal Effects of Rate Changes on Returns at Different Levels of Private Debt

Margins Private Debt	(1)	(2)	(3)
Interest Rate Changes			
Low Private Debt	-1.357***	-0.794***	-0.782***
	(-5.46)	(-4.13)	(-4.06)
Medium Private Debt	-0.977***	-0.987***	-0.982***
	(-3.31)	(-4.33)	(-4.31)
High Private Debt	-0.250	-0.824	-0.848*
	(-0.38)	(-1.64)	(-1.68)
N	5196	5196	5196

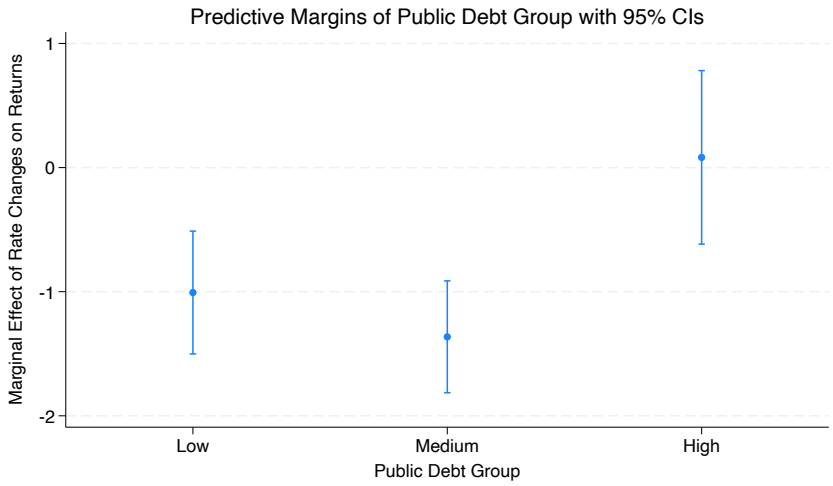
Coefficients are marginal effects of Rate Changes on Returns for every Private Debt group for models 1, 2 and 3 from table 7. Calculated as the partial derivative of Rate Changes at Private Debt. *t* statistics in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

As for private debt, I found no significant difference in the relationship between returns and rate changes. When breaking down private debt into household and corporate debt however, the former showed minimal effect, but countries with lower corporate debt displayed a significantly stronger negative relationship. Contrary to expectations, we believed that an increase in interest rates would hurt consumer spending more when consumers have high debts. This, in turn, was expected to lead to lower stock returns as per Gupta et al., (2022). However, high household debt did not make the negative impact of rate changes on stock returns stronger. The findings that low corporate debt leads to a stronger relationship between interest rates and stock returns is what is expected from the WACC equation from Miller and Modigliani (1958), a lower debt-to-equity ratio leads to a discount rate (and

thus stock price) that is more dependent on the cost of equity, which is partly determined by the risk-free rate (interest rates) in the CAPM model.

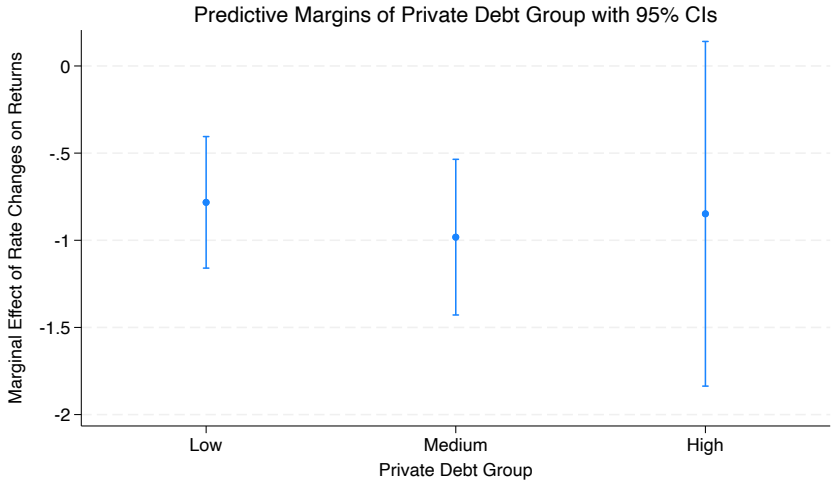
In conclusion I could only reject my second hypothesis, which stated the relationship between interest rate changes and stock returns varies by a country's public debt level, with high-debt countries showing a more pronounced negative correlation, partially based on these results. I can reject my third hypothesis that states that the relationship between interest rate changes and stock returns varies by a country's private debt level.

Figure 2: Marginal Effects of Rate Changes on Returns for Public Debt Groups with 95% Confidence Intervals (Data from Table 7)



Note: Visual representation of table 7. Point estimates represent the marginal effects of rate changes on returns. Vertical lines denote 95% confidence intervals. Made with STATA coefplot command.

Figure 3: Marginal Effects of Rate Changes on Returns for Private Debt Groups with 95% Confidence Intervals (Data from Table 8)



Note: Visual representation of table 8. Point estimates represent the marginal effects of rate changes on returns. Vertical lines denote 95% confidence intervals. Made with STATA coefplot command.

CHAPTER 6 Conclusion

In this thesis, I have looked at whether interest rate changes have an effect on stock returns for different countries and whether this effect differs depending on the public and private debt levels of these countries. Previous research and classic asset pricing models suggested that there is a definite connection between the benchmark interest rates and stock returns. There has also been research that suggests there being a difference between the effect of interest rate changes on stock returns depending on the public and private debt levels of countries, however until now there has been no direct study of this difference. So, the question that was studied for this thesis was: "How do interest rate changes affect stock returns, and does this effect differ depending on the level of public and private debt?"

To answer the research question, I have looked at panel data on quarterly domestic stock returns and benchmark interest rates for roughly 60 different countries. To test my hypotheses, I used fixed effects panel regressions and that also controlled for other macroeconomic variables. I found that interest rate changes have a negative and significant effect on stock returns in the groups with low and medium public debt levels and for all the groups split on private debt levels. However, for the group with high public debt I find a positive and insignificant variable.

This study therefore concludes that there is a significant relationship between stock returns and interest rate changes over the whole sample of 60 countries, on average a 1% (or 100 basis point) increase in the 3-month interest rate is expected to decrease stock returns by 1 percentage point. However, when the sample is split into groups based on public debt as a percentage of GDP, we can see that changes in interest rates are not expected to have a significant effect on stock returns for the group with high public debt (a general government debt to GDP level above 176%), while the returns of the MSCI world index becomes a more significant predictor for these countries. This finding is opposed to what is expected from macroeconomic theory but could either be explained on a micro-economic scale by using the CAPM model and the WACC or by looking at other characteristics of countries with high public debt levels such as low economic growth and stock returns in general. Furthermore, we find that countries with low levels of corporate debt (below 52% of GDP) significantly enhance the negative relationship between changes in the risk-free rate and stock returns. Which can be explained on the basis of the CAPM and WACC models.

With growing public debt levels around the world, which are expected to stay growing, these findings could mean that in the future the relationship of stock returns and interest rates might weaken due to this increase in sovereign debt. This has implications for policymakers and central bankers who might find that changing interest rate levels will be a less effective way to implement monetary policy when their public debt is high, which could also be seen as an encouragement to keep public debt at an appropriate level. The implications for investors could be that other factors such as the state of the

world market become more significant, instead of interest rate changes, in predicting stock returns when public debt levels are high.

Further research could look closer at the channels through which high public debt affects the relationship between interest rates and stock returns. As more countries are anticipated to have higher debt levels in the future, it would be intriguing for subsequent research to examine whether the findings of this study remain consistent when a greater number of countries are available to be included in this analysis.

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APPENDIX A Additional research, figures and tables

Equations mentioned in text:

$$P_0 = \frac{D_1}{(1+r)^1} + \frac{D_2}{(1+r)^2} + \ldots + \frac{D_n}{(1+r)^n}$$

(1) Discounted Cash Flow Model (DCF)

$$= \sum_{n=1}^{\infty} \frac{D_n}{(1+r)^n}$$

$$P_0 = \sum_{n=1}^{\infty} D_0 \frac{(1+g)^n}{(1+r)^n}$$

(2) Gordon-Growth Model

$$= \frac{D_1}{r-g}$$

The P_0 stands for the present value (the current price) of the stock, the *D* stands for the expected dividend per share at the end of time *n* and the *r* for the so-called required rate of return. In 1956 this model was expanded upon by Muron J. Gordon and Eli Shapiro to include the growth factor of the dividends represented by the letter *g*.

(3) Capital Asset Pricing Model (CAPM)

$$r = r_f + \beta\,(r_m - r_f)$$

The β is a measure of how much the asset (stock in this case) is expected to move relative to the overall market, r_m is the expected return rate of return of the overall market and r_f is the risk-free rate.

(4) WACC

$$WACC = \frac{E}{D+E} \cdot r_e + \frac{D}{D+E} \cdot r_d \cdot (1-t)$$

D is the total debt of a company, E is the total of shareholder's equity, t is the corporate tax rate, r_e is the cost of equity and r_d the cost of debt. The cost of debt (r_d) is often determined by averaging the yield to maturity for a company's outstanding debt (Investopedia).

$$WACC = \frac{E}{D+E} \cdot (r_f + \beta\,(r_m - r_f)) + \frac{D}{D+E} \cdot r_d \cdot (1-t)$$

(5) CAPM in WACC

$$= \frac{E}{D+E} \cdot (r_f(1-\beta) + \beta\, r_m) + \frac{D}{D+E} \cdot r_d \cdot (1-t)$$

$$= (r_f \cdot \frac{E}{D+E} \cdot (1-\beta) + \frac{E}{D+E} \cdot \beta\, r_m) + \frac{D}{D+E} \cdot r_d \cdot (1-t)$$

Table A1: Descriptive Means of every Country in the Sample Individually, from 2000Q1 to 2023Q1

Country	Quarterly Returns	Rate Changes	RGDP Growth	REER change	Public debt to GDP (%)	Private debt to GDP (%)	Interest Rates
Australia	1.21	-0.02	0.68	0.36	31	177	3.71
Austria	1.91	-0.01	0.39	0.10	106	140	1.47
Belgium	0.64	-0.01	0.41	0.11	118	186	1.47
Brazil	2.90	-0.09	0.58	0.25	63	63	11.67
Bulgaria	3.26	-0.02	0.90	0.58	29	103	2.10
Canada	1.29	0.00	0.50	0.11	90	184	2.17
Chile	2.15	0.08	0.87	0.08	16	120	3.50
China	1.98	0.00	2.03	0.35	38	157	3.34
Colombia	2.73	-0.03	0.96	-0.16	45	53	6.64
Czech Republic	1.75	0.01	0.62	0.75	29	79	2.24
Denmark	2.72	-0.01	0.37	0.04	52	225	1.70
Ecuador	2.20	-0.11	0.75	0.87	38	31	1.62
Egypt	4.40	-0.04	1.09	-0.22	95	36	9.23
Estonia	3.69	-0.02	0.85	0.53	9	120	2.01
Finland	0.42	-0.01	0.37	0.00	54	160	1.47
France	0.89	-0.01	0.33	-0.02	108	177	1.47
Germany	1.63	-0.01	0.30	-0.03	65	130	1.47
Greece	-1.67	-0.07	0.12	0.01	165	105	1.67
Hong Kong	0.74	-0.02	0.72	-0.11	1	248	1.78
Hungary	2.50	0.03	0.63	0.35	69	93	5.91
Iceland	2.02	-0.04	0.74	0.08	105	328	7.47
India	3.57	-0.03	1.52	0.36	76	92	7.13
Indonesia	3.17	-0.07	1.23	0.32	37	35	8.06
Ireland	1.24	-0.01	1.32	0.09	47	236	1.47
Italy	0.35	-0.01	0.11	0.06	137	109	1.47
Japan	0.98	0.00	0.18	-0.68	186	167	0.24
Kenya	0.19	-0.06	1.08	1.05	47	25	7.97
Latvia	3.26	-0.04	0.81	0.30	30	90	2.86
Lebanon	1.79	-0.08	0.30	3.65	141	89	5.46
Lithuania	3.42	-0.19	0.95	0.51	31	60	2.39
Luxembourg	0.96	-0.01	0.67	0.08	16	310	1.47

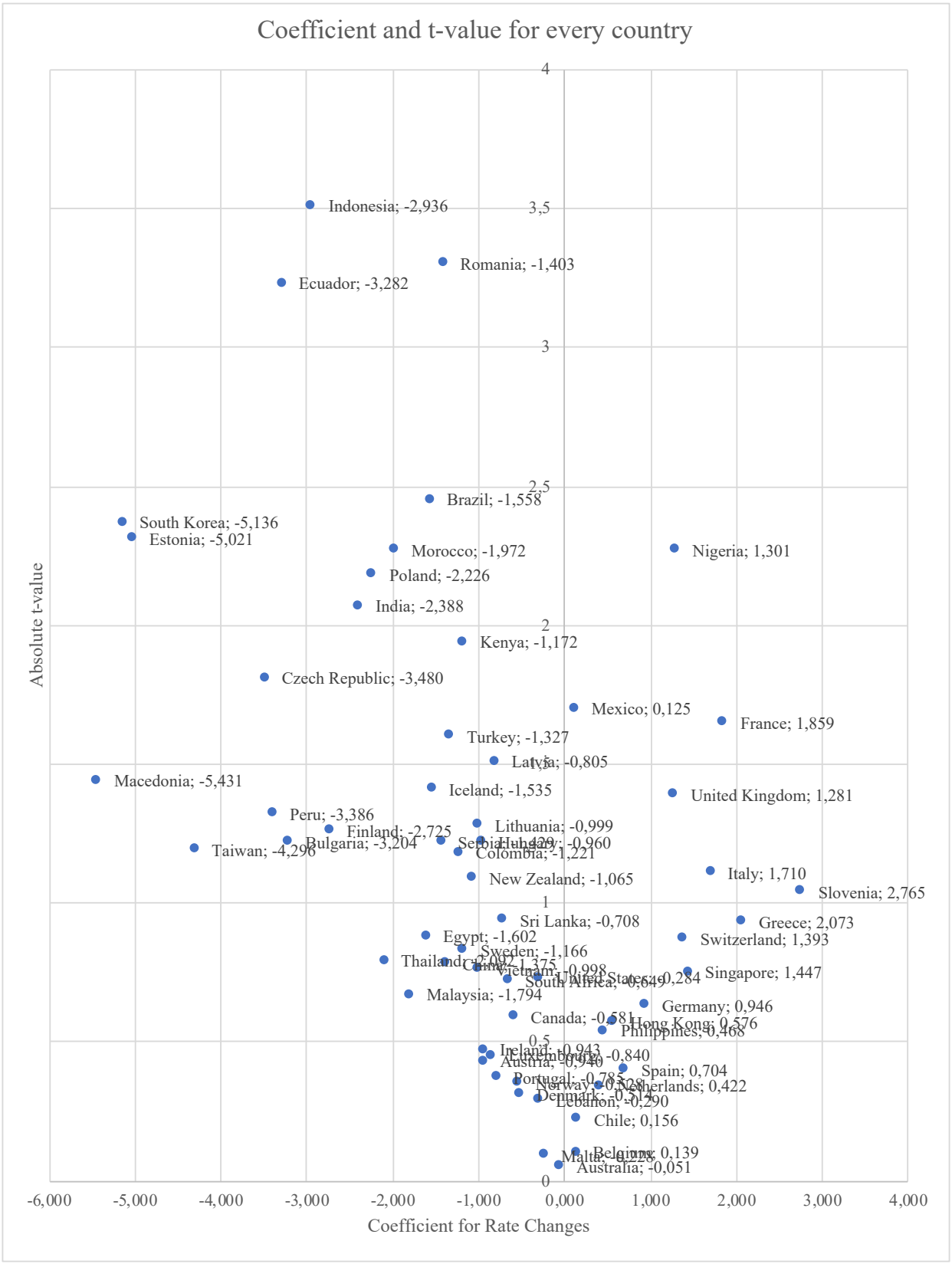
Country	Quarterly Returns	Rate Changes	RGDP Growth	REER change	Public debt to GDP (%)	Private debt to GDP (%)	Interest Rates
Malaysia	0.87	0.00	1.15	-0.08	47	130	3.11
Malta	0.45	-0.03	1.02	0.06	60	191	1.75
Mexico	2.68	-0.10	0.47	-0.07	35	33	7.38
Morocco	1.58	-0.07	0.89	-0.08			3.05
Netherlands	0.67	-0.01	0.39	0.12	67	251	1.47
New Zealand	1.23	-0.01	0.73	0.39	28	172	4.06
Nigeria	3.37	-0.13	1.24	1.02	23	11	9.65
Northern-Macedonia	4.24	-0.02	0.61	0.17	37	79	2.37
Norway	1.88	-0.03	0.41	-0.13	37	213	2.92
Peru	3.96	-0.05	1.09	0.19	31	38	3.52
Philippines	1.78	-0.04	1.22	0.25	53	45	3.91
Poland	1.88	-0.12	0.91	0.31	49	66	5.16
Portugal	-0.17	-0.01	0.27	0.06	112	185	1.47
Romania	4.63	-0.79	0.93	0.44	32	29	11.94
Serbia	-0.57	-0.24	0.84	0.03	63	41	6.45
Singapore	1.03	0.02	1.17	0.25	105	174	1.36
Slovenia	0.93	-0.06	0.63	0.04	50	92	1.83
South Africa	2.79	-0.04	0.58	-0.19	41	70	7.31
South Korea	1.63	-0.04	0.90	0.13	35	170	3.24
Spain	0.40	-0.01	0.41	0.12	88	174	1.47
Sri Lanka	3.60	0.13	0.85	0.21	78	33	10.70
Sweden	1.19	0.00	0.56	-0.26	53	211	1.40
Switzerland	0.71	-0.01	0.44	0.22	34	220	0.37
Taiwan	1.73	0.00	0.89	-0.11	30	0	0.72
Thailand	1.91	-0.03	0.83	0.26	30	148	2.33
Turkey	5.18	-0.08	1.26	-0.21	41	56	9.58
United Kingdom	0.40	-0.02	0.41	-0.22	68	162	2.44
United States	1.51	-0.01	0.50	0.21	115	153	1.93
Vietnam	4.64	-0.01	1.54	0.46	36	78	6.81

Table A2: Coefficient for rate changes for model 3 from table 5 and their respective t-values. Beta is the coefficient for a country's stock returns regressed on only the MSCI variable.

Country	Coef. for Rate Changes	t-value	Absolute t-value	Beta
Australia	-0.051	-0.05	0.05	0.715
Austria	-0.940	-0.43	0.43	1.107
Belgium	0.139	0.10	0.1	0.915
Brazil	-1.558	-2.45	2.45	1.081
Bulgaria	-3.204	-1.22	1.22	0.97
Canada	-0.581	-0.59	0.59	0.797
Chile	0.156	0.22	0.22	0.542
China	-1.375	-0.78	0.78	0.619
Colombia	-1.221	-1.18	1.18	0.651
Czech Republic	-3.480	-1.81	1.81	0.912
Denmark	-0.514	-0.31	0.31	0.838
Ecuador	-3.282	-3.23	3.23	-0.114
Egypt	-1.602	-0.88	0.88	1.045
Estonia	-5.021	-2.31	2.31	0.966
Finland	-2.725	-1.26	1.26	1.141
France	1.859	1.65	1.65	1.036
Germany	0.946	0.63	0.63	1.163
Greece	2.073	0.93	0.93	1.168
Hong Kong	0.576	0.57	0.57	0.923
Hungary	-0.960	-1.22	1.22	0.989
Iceland	-1.535	-1.41	1.41	0.899
India	-2.388	-2.07	2.07	1.066
Indonesia	-2.936	-3.51	3.51	0.872
Ireland	-0.943	-0.47	0.47	1.007
Italy	1.710	1.11	1.11	0.981
Japan	-18.686	-2.04	2.04	0.888
Kenya	-1.172	-1.94	1.94	0.529
Latvia	-0.805	-1.51	1.51	0.59
Lebanon	-0.290	-0.29	0.29	0.41
Lithuania	-0.999	-1.28	1.28	0.928
Luxembourg	-0.840	-0.45	0.45	1.208
Malaysia	-1.794	-0.67	0.67	0.57
Malta	-0.228	-0.09	0.09	0.436

Country	Coef. for Rate Changes	t-value	Absolute t-value	Beta
Mexico	0.125	-1.70	1.7	0.836
Morocco	-1.972	-2.27	2.27	0.365
Netherlands	0.422	0.34	0.34	1.011
New Zealand	-1.065	-1.09	1.09	0.501
Nigeria	1.301	2.27	2.27	0.611
Northern-Macedonia	-5.431	-1.44	1.44	0.818
Norway	-0.528	-0.35	0.35	1.026
Peru	-3.386	-1.32	1.32	1.038
Philippines	0.468	0.54	0.54	0.75
Poland	-2.226	-2.18	2.18	1.009
Portugal	-0.785	-0.37	0.37	0.793
Romania	-1.403	-3.30	3.3	0.858
Serbia	-1.429	1.22	1.22	0.988
Singapore	1.447	0.75	0.75	0.844
Slovenia	2.765	1.04	1.04	0.841
South Africa	-0.649	-0.72	0.72	0.732
South Korea	-5.136	2.37	2.37	0.962
Spain	0.704	0.40	0.4	0.878
Sri Lanka	-0.708	0.94	0.94	0.678
Sweden	-1.166	0.83	0.83	0.966
Switzerland	1.393	0.87	0.87	0.72
Taiwan	-4.296	1.19	1.19	0.914
Thailand	-2.092	0.79	0.79	0.95
Turkey	-1.327	1.60	1.6	1.129
United Kingdom	1.281	1.39	1.39	0.746
United States	-0.284	0.73	0.73	0.947
Vietnam	-0.998	0.76	0.76	0.957

Figure A1: Coefficients and Absolute t-values from Table A2 for every Country in the Sample (excluding Japan)



System Generalised Method of Moments

A dynamic panel data model will be run, I will employ a so-called System Method of Moments (SGMM) model from Blundell and Bond (1998) with the **xtabond2** regression command in STATA as described by Roodman (2009); Even though our data has quite a high number of observations for every country (89 on average), and is therefore more suited to a fixed effects model than a dynamic panel model (which is mainly used for panels with large N, small T), it could be an interesting test to do in my case. Using this dynamic panel model has several advantages over using a fixed effects panel regression. One of the biggest advantages of SGMM models is that they are specifically designed to address endogeneity issues, which might be prevalent within our regressors as the Real Growth in GDP is potentially an endogenous regressor. While fixed effects can control for time-invariant unobserved heterogeneity, it does not deal with endogeneity that arises from lagged dependent variables or other internal dynamics of the panel. This could make the normal fixed effects model biased. While fixed effects assumes that all regressors are uncorrelated with the error term (and thus exogenous), SGMM allows for certain regressors to be endogenous. By using lagged values of RGDP growth as instruments, the command tackles the endogeneity issue. The intuition is that while GDP might be endogenously determined with stock returns within a period, its past values can be considered exogenous and are still correlated with its current values. By using GMM and lagged values as instruments, the estimator takes the supposed reverse causation between RGDP growth and stock returns into account and provides consistent estimates even in the presence of such a "bidirectional" relationship. SGMM is also robust to certain patterns of heteroskedasticity and autocorrelation within individual countries.

$$\begin{aligned}\boldsymbol{StockReturns}_{nt} &= \boldsymbol{a}_n + \boldsymbol{\beta}_0\boldsymbol{Stockreturns}_{nt-1} + \boldsymbol{\beta}_1\boldsymbol{RateChanges}_{nt} + \boldsymbol{\beta}_2\boldsymbol{RGDPgrowth}_{nt} \\ &+ \boldsymbol{\beta}_3\boldsymbol{MSCIreturns}_t + \boldsymbol{\beta}_m\boldsymbol{X}_{nt}^{m} + \boldsymbol{\varepsilon}_{nt}\end{aligned}$$

$$\begin{aligned}\boldsymbol{StockReturns}_{nt} &= \boldsymbol{a}_n + \boldsymbol{\beta}_0\boldsymbol{Stockreturns}_{nt-1} + \boldsymbol{\beta}_1\boldsymbol{RateChanges}_{nt} + \boldsymbol{\beta}_2\boldsymbol{RGDPgrowth}_{nt} \\ &+ \boldsymbol{\beta}_3\boldsymbol{MSCIreturns}_t + \boldsymbol{\beta}_m\boldsymbol{X}_{nt}^{m} + \boldsymbol{\beta}_4\boldsymbol{PublicDebtGroup}_{nt} * \boldsymbol{Ratechanges}_{nt} \\ &+ \boldsymbol{\beta}_5\boldsymbol{PrivateDebtGroup}_{nt} * \boldsymbol{Ratechanges}_{nt} \\ &+ \boldsymbol{\beta}_6\boldsymbol{PublicDebtGroup}\,(\boldsymbol{dummy}) + \boldsymbol{\beta}_7\boldsymbol{PrivateDebtGroup}\,(\boldsymbol{dummy}) + \boldsymbol{\varepsilon}_{nt}\end{aligned}$$

Similar to Assefa et al. (2017) I will use stock market returns and RGDP growth as the "gmm-style" variables based on Roodman (2009), one time with 2 lags and once with 3 lags as robustness check. To avoid having too many instruments, which leads to overfitting and biased coefficients, we reduce the number of lags such that the final number of instruments used is very close to the number of cross-section units (60 countries in my case). The results are available in tables A3, A4, A5 and A6.

When employing the SGMM models we see that the RGDP growth variable becomes insignificant in all models, presumably from taking reverse causality in account. We also see that the Interest Rate Changes coefficients become larger when we consider the RGDP growth variable as endogenous. These findings are both consistent with what Assefa et al. (2017) found in their dynamic panel regression. Furthermore, we see that the lagged variable of Stock Returns is also significant in all of table A3, while sometimes becoming significant in tables A4, A5 and A6. Stock returns of the last quarter have a small and positive relationship with current returns. Finally, we also see that the difference in the effect of interest rate changes on stock returns is still prevalent when considering RGDP growth as an endogenous variable. In all my cases, specification tests are found to be satisfactory by the Hansen-J tests of validity of instruments.

Table A3: Dynamic Panel SGMM Model: using 2 lags for RGDP Growth and Stock Returns

	(1)	(2)	(3)
	Returns	Returns	Returns
Stock Returns (lag1)	0.0888**	0.0900**	0.0783*
	(2.28)	(2.30)	(1.83)
Interest Rate Change	-1.423**	-1.542**	-3.267**
	(-2.17)	(-2.23)	(-2.48)
Real GDP Growth	0.177	0.231	0.0567
	(0.61)	(0.75)	(0.18)
MSCI returns	0.724***	0.734***	0.784***
	(16.71)	(16.45)	(19.32)
REER changes		-0.337	0.453
		(-0.54)	(0.85)
Public debt			0.189*
			(1.68)
Private debt			-0.0621*
			(-1.91)
_cons	0.615**	0.637**	-2.979
	(2.27)	(2.29)	(-0.37)
N	5303	5303	4990
Hansen-J	57.88	57.31	53.41
N of instruments	59	59	59

t statistics in parentheses. Assessing the Impact of Lagged Returns, Interest Rate Changes, GDP Growth, and MSCI Returns. The table showcases coefficients from a dynamic panel regression, estimated using the generalised method of moments (GMM). 2 lags for RGDP growth and Stock Returns. The Hansen-J statistic provides a test of the validity of our instruments, with the total count capped at 59 to avoid overidentification.
* p<0.1, ** p<0.05, *** p<0.01

Table A4: Dynamic Panel SGMM Model: using 3 lags for RGDP Growth and Stock Returns

	(1) Returns	(2) Returns	(3) Returns
Stock Returns (lag1)	0.0654	0.0658	0.0889*
	(1.36)	(1.35)	(1.79)
Interest Rate Change	-2.386**	-2.311**	-4.866***
	(-2.49)	(-2.50)	(-3.72)
Real GDP Growth	0.388	0.348	0.170
	(1.18)	(1.15)	(0.52)
MSCI returns	0.667***	0.661***	0.728***
	(15.39)	(14.42)	(16.72)
REER changes		0.230	-0.122
		(0.42)	(-0.25)
Public debt			0.234**
			(2.05)
Private debt			-0.0581*
			(-1.75)
_cons	0.539*	0.523*	-6.315
	(1.89)	(1.75)	(-0.73)
N	5303	5303	4990
Hansen-J	57.45	57.69	53.84
N of instruments	59	59	59

t statistics in parentheses. Assessing the Impact of Lagged Returns, Interest Rate Changes, GDP Growth, and MSCI Returns. The table showcases coefficients from a dynamic panel regression, estimated using the generalised method of moments (GMM). 3 lags for RGDP growth and Stock Returns. The Hansen-J statistic provides a test of the validity of our instruments, with the total count capped at 59 to avoid overidentification.
* p<0.1, ** p<0.05, *** p<0.01

Table A5: Debt Levels and Interest Rate Dynamics Impacting Stock Returns: A GMM Analysis using 2 lags for Stock Returns and RGDP growth. The model highlights how public and private debt, especially when interacting with interest rate changes, influences stock returns.

	(1) Returns	(2) Returns	(3) Returns
Stock Returns (lag1)	0.197***	0.0697	0.0697
	(2.59)	(1.35)	(1.35)
Interest Rate Change	-10.14**	-5.806*	-5.812*
	(-2.40)	(-1.88)	(-1.88)
Real GDP growth	-0.399	0.0449	0.0402
	(-1.10)	(0.14)	(0.13)
Low Public Debt (dummy)	-13.21	-16.33	-16.57
	(-1.05)	(-1.21)	(-1.34)
High Public Debt (dummy)	21.65	-12.34	-12.25
	(0.90)	(-0.65)	(-0.63)
Low Public * Rate Changes	12.11**	1.102	1.179
	(1.99)	(0.23)	(0.26)
High Public * Rate Changes	27.97**	22.29*	22.35*
	(2.34)	(1.72)	(1.70)
Low Private Debt (dummy)	14.03	40.09*	40.07*
	(0.61)	(1.82)	(1.81)
High Private Debt (dummy)	-9.116	10.72	10.57
	(-0.52)	(0.74)	(0.71)
Low Private * Rate Changes	-5.967	-0.912	-0.879
	(-1.15)	(-0.20)	(-0.19)
High Private * Rate Changes	-17.47*	-10.12	-10.37
	(-1.79)	(-1.04)	(-1.08)
MSCI returns		0.772***	0.769***
		(12.46)	(11.10)
REER change			0.0588
			(0.10)
N	5146	5146	5146
Hansen-J	55.06	48.61	48.19
N of instruments	59	59	59

t statistics in parentheses. Debt thresholds the same as table 6. 2 lags for RGDP growth and Stock Returns. The Hansen-J statistic provides a test of the validity of our instruments, with the total count capped at 59 to avoid overidentification.
* p<0.1, ** p<0.05, *** p<0.01

Table A6: Debt Levels and Interest Rate Dynamics Impacting Stock Returns: A GMM Analysis using 3 lags for Stock Returns and RGDP growth. The model highlights how public and private debt, especially when interacting with interest rate changes, influences stock returns.

	(1) Returns	(2) Returns	(3) Returns
Stock Returns (lag1)	0.179**	0.0909*	0.0909*
	(2.19)	(1.76)	(1.74)
Interest Rate Change	-4.753	-4.038	-4.047
	(-1.26)	(-1.29)	(-1.30)
Real GDP growth	-0.0703	-0.209	-0.213
	(-0.18)	(-0.55)	(-0.58)
Low Public Debt (dummy)	1.316	-10.69	-10.91
	(0.08)	(-0.88)	(-0.93)
High Public Debt (dummy)	43.13*	-9.050	-8.768
	(1.90)	(-0.44)	(-0.41)
Low Public * Rate Changes	6.854	-0.0421	0.0860
	(1.01)	(-0.01)	(0.02)
High Public * Rate Changes	10.52*	12.71**	12.73**
	(1.77)	(2.11)	(2.10)
Low Private Debt (dummy)	-14.89	39.68*	39.36*
	(-0.69)	(1.84)	(1.75)
High Private Debt (dummy)	-28.10	12.21	11.83
	(-1.56)	(0.91)	(0.83)
Low Private * Rate Changes	-7.201*	-0.646	-0.590
	(-1.74)	(-0.18)	(-0.16)
High Private * Rate Changes	-16.95	-6.923	-7.258
	(-1.37)	(-0.75)	(-0.75)
MSCI returns		0.721***	0.717***
		(12.52)	(10.71)
REER change			0.0968
			(0.16)
N	5146	5146	5146
Hansen-J	55.73	49.82	48.79
N of instruments	59	59	59

t statistics in parentheses. Debt thresholds the same as table 6. 3 lags for RGDP growth and Stock Returns. The Hansen-J statistic provides a test of the validity of our instruments, with the total count capped at 59 to avoid overidentification. * p<0.1, ** p<0.05, *** p<0.01

Table A7: Marginal Effects at Different Levels of Public and Private Debt

Combined Margins			
	Low Private	Medium Private	High Private
Interest Rate Changes			
Low Public	-0.864***	-1.133***	-0.944*
	(-3.58)	(-4.21)	(-1.73)
Medium Public	-1.130***	-1.399***	-1.210**
	(-5.58)	(-5.73)	(-2.31)
High Public	0.219	-0.0507	0.138
	(0.60)	(-0.13)	(0.25)
N	5355	5355	5355

Coefficients are marginal effects of Rate Changes on Returns for every combination of Public Debt and Private Debt groups for model 3 from table 6. *t* statistics in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

APPENDIX B Robustness Tests

In this appendix the full results for the robustness checks from section 5 will be shared (starting on page x). To make sure our results are robust and do not depend too much on the specificity of the variables, the sample or the groupings chosen I do some robustness analyses.

First off, I will use different definitions of interest rate changes for our regressions. The definition of interest rate changes I have used so far is the rate changes in percentage points, when the variable rate changes has a value of 1 it means an increase of interest rate by 1 percentage point (or 100 basis points). I gave arguments in the data section for why I found this to be the most suitable definition for rate changes for this study. However, it has the drawback that an increase of 1 percentage point is always weighted equally, whether interest rates go from 1% to 2% or from 19% to 20%. As we saw earlier in the descriptive statistics the interest rates in countries with high private or public debt are usually lower than those in countries with low or medium debt levels, so that could be a reason returns react differently to changes in interest rates. That is why I also run the test with two other definitions of rate changes. The first one is the percentual change in interest rates, an increase of interest rates from 1% to 2% is a 100% increase in the interest rate and will give the value 100 for the variable rate changes, this is also the way Assefa et al. (2017) defined rate changes and so the outcome of this model is comparable to their results. For comparison reasons I also add a variable (Sigma) that gauges the volatility of stock returns over the last 2 years in this regression, they used the 24-month time varying standard deviation, while I use time varying standard deviation over the last 8 quarters due to availability. When we look at the results of these regressions in Appendix B tables B1 to B3, we see that for the joint group rate changes are still negative and significant. In the table that includes interaction variables we also see positive and significant coefficients for the variable that compares the effects of rate changes on stock returns between medium public debt and high public debt groups. The added sigma variable is insignificant in all the models.

I also use another definition of rate changes that combats the problem that a 1 percentage point is always weighed equally regardless of the height of the interest rates. This definition takes the interest rate and makes it a multiple, a 1% interest rate gets a value of 1.01 and a 2% interest rate a value of 1.02, when interest rates go from 1% to 2% the variable rate changes gets the value of ((1.02 - 1.01)/1.01) *100 = 0.99. The values of this definition of rate changes are almost identical to the original ones for changes when interest rates are low but are smaller when interest rates are high. For example, an increase from interest rates from 19% to 20% gets a value of ((1.20 - 1.19) / 1.19) *100 = 0.84. This means that this variable weighs the same absolute change in interest rates more for countries with lower interest rates, which is what is also expected in financial markets where I believe interest rate changes have a diminishing marginal effect on stock returns. I call this adjusted relative

interest rate change "Rate 100" in the tables. Looking at the results (Table B4 & B5) we still see a significant negative effect of interest rate changes on stock returns. Looking at the fixed effects regression with interaction variables we also now see a significant positive coefficient for the *Low Public * Rate Changes* variable, which means that in the low public debt group the effect of interest rates on stock returns also differs significantly from the medium public debt group. The effect of interest rate changes on stock returns is less negative in the low public debt group compared to the high public debt group (just like that of the *High Public * Rate Changes* variable).

For further robustness checks I altered the countries in the sample a few times. First, I removed the United States and the United Kingdom because the MSCI world index returns are for a large part compromised of their domestic stocks (Table B9). Running the regressions without these two countries does not alter the coefficients for the MSCI variable coefficients or the other coefficients significantly. Looking at the coefficients for Rate Changes on Stock Returns for the countries individually in Appendix A we can see that Japan is a clear outlier, it has a significant coefficient of -18.686 which means that for every one percentage point increase (decrease) in interest rates, stock returns decrease (increase) by 18.686 percentage points. This is probably due to its very low interest rate over the period. If we remove Japan from the sample, we see an even bigger difference for the effect of rate changes on returns between the group with medium public debt and high public debt, the difference might have been subdued earlier due to the presence of Japan which has an extremely negative coefficient while also being in the high public debt group (Table B10). We also check for robustness by adding an extra interaction variable to the interaction model that checks for whether the country has a developed economy is developed according to FTSE (Table B11). Looking at the results we see that the interaction variable has a positive sign, but is only significant in the model without the MSCI variable. Furthermore, we still see the significant effect of interest rate changes on returns for the high public group compared to the medium public debt group.

Our findings are also robust to changing the thresholds for high and low public and private debt (Table B12 & B13). If we set the thresholds at the 33rd and 66th percentile instead of the thresholds being the 25th and the 75th percentile, which gives threshold for public debt of 36.9% and 66.5% for public debt and thresholds for private debt of 80.2% and 157%, we do not get significantly different results from our original regressions. Neither do the results change significantly when I narrow the definition of low and high debt by making the lower threshold the mean minus one standard deviation and the higher threshold the mean plus one standard deviation. When we set the high debt groups as the default groups (value 0) we can see that the coefficient for Low Public * Rate Changes is also significant in the third model, which means there is a significant difference in the way interest rates behave between the low public debt group and the high public debt group (Table B14).

As an extra test we split the private debt interaction variable into two interaction variables, one that represents the level of household (and non-profit corporation) debt as percentage of GDP and another the debt of non-financial corporations as a percentage of GDP. The private debt to GDP figure is basically the sum of these two variables. I split the countries on both household debt and corporate debt into two groups. A country with less than 85% household debt to GDP will be in the low household debt group, countries that have a ratio that is higher than that will be in the high household debt group. Countries with a corporate debt ratio to GDP under 90% will be put in the low corporate debt group and with a ratio above that will be assigned to the high corporate debt group (Table B15). These thresholds are from which debt to GDP ratio extra debt is expected to hurt economic growth (Cecchetti et al., 2011). The reason I do this is because it could be possible that the dynamic between interest rates and stock returns is impacted differently by corporate debt than by household debt, which cannot be observed when they are summed up in one variable as "private debt to GDP". Unfortunately, not all countries in our sample report household debt and corporate debt separately, thus for this test the following countries are not included: Ecuador, Egypt, Kenya, Lebanon, Nigeria, Philippines, Serbia and Vietnam (on top of previously excluded Morocco and Taiwan). When we look at the results in table of Appendix B, we see that for both the interaction variables for household debt and corporate debt the coefficients are positive but insignificant. This means that there is no significant difference in the way interest rates affect stock returns in the group with high corporate debt compared to the group with low corporate debt or the group with high household debt compared to low household debt. I run the model a second time but now with 3 groups for each variable, a low, medium and high group, based on the 25^{th} and 75^{th} percentile (which gives thresholds of 25.18% and 72.3% for household debt and thresholds 52% and 112.65% for corporate debt). Now we see that the interaction variable for the low corporate debt group has a significant and negative coefficient (-2.08). Looking at the margins table in Appendix B table B16 and B17 we can see that in countries with low corporate debt levels (under 52.45%) a one percentage point (100 basis point) increase in interest rates stock returns are expected to decrease with 3.29%, which is the strongest negative relationship that has been encountered in this study.

As we have seen in Appendix A the RGDP variable becomes insignificant when treated as endogenous, therefore we run our model from table 6 one time without the RGDP variable in table B15. All the tables are displayed on the following pages.

Table B1: Fixed Effects Model with Growth Definition of Interest Rate Change

	(1) Returns	(2) Returns	(3) Returns	(4) Returns
ΔInterest Rate	-0.00925***	-0.00952***	-0.00967***	-0.00939***
	(-2.96)	(-3.05)	(-2.99)	(-2.97)
Real GDP Growth	0.297***	0.297***	0.263***	0.251***
	(4.97)	(4.96)	(4.28)	(4.17)
MSCI returns	0.842***	0.841***	0.862***	0.857***
	(59.02)	(58.89)	(58.82)	(57.42)
REER changes		0.0907**	0.0138	0.00905
		(2.24)	(0.31)	(0.20)
Public debt			0.0263***	0.0264***
			(3.18)	(3.09)
Private debt			-0.0341***	-0.0338***
			(-8.42)	(-7.87)
Sigma				0.0285
				(1.09)
_cons	0.649***	0.631***	3.474***	3.081***
	(4.80)	(4.65)	(5.35)	(4.14)
N	5328	5328	5018	4622
R^2	0.401	0.401	0.420	0.432

This is the same model as table 5, but with the ΔInterest Rate variable instead of the absolute rate change. A one percent growth in interest rates leads to a decrease in stock returns by roughly -0.01%. The Sigma variable is the volatility of domestic stock returns of the last 8 quarters. *t* statistics in parentheses.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table B2: Fixed Effects Model with Growth Definition of Interest Rate Change and inclusion of Sigma and Crisis variable similar to Assefa et al. (2017)

	(1) Returns	(2) Returns	(3) Returns	(4) Returns
ΔInterest Rate	-0.00996***	-0.0102***	-0.00943***	-0.00991***
	(-3.19)	(-3.27)	(-3.09)	(-3.14)
Real GDP Growth	0.272***	0.272***	0.252***	0.231***
	(4.53)	(4.53)	(4.27)	(3.81)
MSCI returns	0.828***	0.827***	0.823***	0.844***
	(56.18)	(56.04)	(54.19)	(54.18)
Crisis	-1.853***	-1.866***	-1.858***	-1.447***
	(-3.78)	(-3.81)	(-3.84)	(-2.88)
REER changes		0.0926**	0.0684*	0.0106
		(2.28)	(1.66)	(0.24)
Sigma			0.0403	0.0370
			(1.55)	(1.40)
Public debt				0.0208**
				(2.38)
Private debt				-0.0328***
				(-7.61)
_cons	0.832***	0.814***	0.319	3.363***
	(5.80)	(5.66)	(1.06)	(4.49)
N	5328	5328	4918	4622
R^2	0.402	0.403	0.415	0.433

Crisis variable has value 1 if quarter is in period 2007Q4 to 2009Q1, 0 otherwise. *t* statistics in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table B3: Fixed Effects Model with Interaction Variables for Public and Private Debt, with Growth Definition of Interest Rate Change

	(1) Returns	(2) Returns	(3) Returns	(4) Returns
ΔInterest Rate	-0.0124	-0.0157**	-0.0159**	-0.0160***
	(-1.52)	(-2.51)	(-2.54)	(-2.60)
Real GDP growth	0.281***	0.271***	0.271***	0.260***
	(3.58)	(4.45)	(4.46)	(4.36)
Low Public Debt (dummy)	-0.466	0.556	0.530	0.214
	(-0.80)	(1.24)	(1.18)	(0.46)
High Public Debt (dummy)	2.223***	0.561	0.639	0.455
	(2.87)	(0.94)	(1.06)	(0.73)
Low Public * Rate Changes	0.00763	0.00990	0.00988	0.00973
	(0.74)	(1.25)	(1.25)	(1.26)
High Public * Rate Changes	0.00104	0.0125*	0.0125	0.0136*
	(0.11)	(1.65)	(1.64)	(1.83)
Low Private Debt (dummy)	2.200**	3.647***	3.610***	3.876***
	(2.51)	(5.39)	(5.33)	(5.24)
High Private Debt (dummy)	0.0475	-1.081**	-1.068**	-0.686
	(0.08)	(-2.28)	(-2.25)	(-1.35)
Low Private * Rate Changes	-0.0175	0.00391	0.00416	0.00364
	(-1.25)	(0.36)	(0.38)	(0.34)
High Private * Rate Changes	0.00483	0.00208	0.00200	0.00217
	(0.55)	(0.31)	(0.30)	(0.33)
MSCI returns		0.855***	0.854***	0.850***
		(58.76)	(58.59)	(57.15)
REER change			0.0534	0.0540
			(1.29)	(1.29)
Sigma				0.00736
				(0.28)
N	5169	5169	5169	4769
R^2	0.007	0.408	0.408	0.418

This is the same model as table 6, but with the ΔInterest Rate variable instead of the absolute rate change. *t* statistics in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table B4: Fixed Effects Model with Adjusted Relative Definition of Interest Rate Changes

	(1) Returns	(2) Returns	(3) Returns
Interest Rate 100	-0.989***	-0.974***	-1.076***
	(-7.23)	(-7.11)	(-7.36)
Real GDP Growth	0.303***	0.302***	0.275***
	(5.10)	(5.09)	(4.51)
MSCI returns	0.840***	0.839***	0.862***
	(59.20)	(59.08)	(59.12)
REER changes		0.0697*	-0.00698
		(1.72)	(-0.16)
Public debt			0.0259***
			(3.16)
Private debt			-0.0339***
			(-8.40)
_cons	0.595***	0.580***	3.401***
	(4.42)	(4.31)	(5.27)
N	5355	5355	5039
R^2	0.405	0.405	0.425

This is the same model as table 5, but with the adjusted relative interest rate change (Rate 100) variable instead of the absolute rate change. *t* statistics in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table B5: Fixed Effects Model with Interaction Variables for Public and Private Debt, Adjusted Relative Definition of Interest Rate Changes

	(1) Returns	(2) Returns	(3) Returns
Rate100	-1.700***	-1.744***	-1.740***
	(-4.72)	(-6.28)	(-6.26)
Real GDP growth	0.295***	0.284***	0.285***
	(3.77)	(4.71)	(4.71)
Low Public Debt (dummy)	-0.384	0.617	0.597
	(-0.67)	(1.39)	(1.34)
High Public Debt (dummy)	2.197***	0.549	0.607
	(2.85)	(0.92)	(1.01)
Low Public * Rate Changes	0.998**	0.731**	0.731**
	(2.48)	(2.35)	(2.35)
High Public * Rate Changes	1.040*	1.544***	1.552***
	(1.77)	(3.41)	(3.43)
Low Private Debt (dummy)	1.876**	3.409***	3.383***
	(2.15)	(5.05)	(5.01)
High Private Debt (dummy)	0.0562	-1.066**	-1.057**
	(0.09)	(-2.26)	(-2.24)
Low Private * Rate Changes	-0.143	0.497	0.504
	(-0.36)	(1.62)	(1.64)
High Private * Rate Changes	1.012	0.387	0.352
	(1.32)	(0.65)	(0.59)
MSCI returns		0.853***	0.853***
		(59.00)	(58.86)
REER change			0.0416
			(1.01)
_cons	0.666*	-0.200	-0.215
	(1.71)	(-0.67)	(-0.72)
N	5196	5196	5196
R^2	0.014	0.413	0.413

This is the same model as table 6, but with the adjusted relative interest rate change (Rate 100) variable instead of the absolute rate change. *t* statistics in parentheses* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table B6: Fixed Effects Model with Interaction Variable for Rate Decline or Rate Hike.

	(1) Returns	(2) Returns	(3) Returns
Rate Changes	-0.474**	-0.465**	-0.644***
	(-2.10)	(-2.06)	(-2.61)
Real GDP Growth	0.333***	0.331***	0.302***
	(5.54)	(5.50)	(4.87)
MSCI returns	0.864***	0.863***	0.884***
	(59.36)	(59.21)	(59.04)
Rate Decline * Rate Change	-0.908***	-0.900***	-0.958***
	(-2.85)	(-2.83)	(-2.67)
REER changes		0.0611	0.00384
		(1.37)	(0.08)
Public debt			0.0289***
			(3.36)
Private debt			-0.0344***
			(-8.42)
N	4880	4880	4617
R^2	0.430	0.430	0.448

This is the same model as table 5, but augmented by an interaction variable for rate decline/hike. Rate Decline has value 1 if rate change has a negative value, and 0 if rate change has a positive value. *t* statistics in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table B7: Marginal Effects of Interest Rate Hikes and Interest Rate Declines on Stock Returns separated.

	(1) Stock Returns	(2) Stock Returns	(3) Stock Returns
Rate Changes			
Rate Hike	-0.474**	-0.465**	-0.644***
	(-2.10)	(-2.06)	(-2.61)
Rate Decline	-1.382***	-1.365***	-1.602***
	(-7.68)	(-7.57)	(-7.65)
N	4880	4880	4617

Coefficients are marginal effects of Rate Changes on Returns from table B6, an increase in interest rates of 1 percentage point leads to lower stock returns by 0.465% to 0.644%. A decrease of interest rates by 1 percentage point leads to an increase of interest rates by 1.365% to 1.602%. *t* statistics in parentheses* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table B8: Fixed Effects Model with Inclusion of Lagged Versions of Variable Interest Rate Change

	(1) Returns	(2) Returns	(3) Returns
Interest Rate Change	-1.109***	-1.098***	-1.287***
	(-7.65)	(-7.57)	(-8.49)
Interest Rate Change (lag1)	0.0157	0.0112	-0.00838
	(0.10)	(0.07)	(-0.05)
Interest Rate Change (lag2)	-0.691***	-0.704***	-0.643***
	(-4.64)	(-4.72)	(-4.19)
Interest Rate Change (lag3)	0.115	0.114	0.148
	(0.78)	(0.78)	(0.99)
Interest Rate Change (lag4)	-0.393***	-0.398***	-0.361***
	(-2.89)	(-2.93)	(-2.63)
Real GDP Growth	0.279***	0.278***	0.267***
	(4.75)	(4.73)	(4.41)
MSCI returns	0.842***	0.841***	0.862***
	(59.63)	(59.50)	(59.41)
REER changes		0.0569	-0.00858
		(1.40)	(-0.19)
Public debt			0.0226***
			(2.71)
Private debt			-0.0310***
			(-7.47)
_cons	0.502***	0.490***	3.136***
	(3.71)	(3.61)	(4.70)
N	5105	5105	4811
R^2	0.426	0.427	0.446

This is the same model as table 5, but augmented by a lagged variations of interest rate changes. We see that the 2nd and 4th leg of the variable are significant. A change in rate changes 6 or 12 have negative effects on present day stock returns. *t* statistics in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table B9: Fixed Effects Model (with and without interaction variables) with Exclusion of the United Kingdom and the United States from the sample

	(1) Returns	(2) Returns	(3) Returns	(4) Returns
Rate Changes	-1.019***	-1.004***	-1.456***	-1.453***
	(-7.93)	(-7.79)	(-5.55)	(-5.54)
Real GDP growth	0.318***	0.317***	0.297***	0.297***
	(5.17)	(5.16)	(4.74)	(4.74)
MSCI Returns	0.840***	0.839***	0.854***	0.853***
	(57.33)	(57.21)	(57.07)	(56.93)
REER Changes		0.0679		0.0399
		(1.64)		(0.94)
Low Public Debt (dummy)			0.581	0.562
			(1.28)	(1.24)
High Public Debt (dummy)			0.699	0.764
			(1.08)	(1.17)
Low Public * Rate Changes			0.353	0.356
			(1.17)	(1.18)
High Public * Rate Changes			1.422***	1.428***
			(3.39)	(3.40)
Low Private Debt (dummy)			3.361***	3.337***
			(4.90)	(4.86)
High Private Debt (dummy)			-1.148**	-1.142**
			(-2.36)	(-2.35)
Low Private * Rate Changes			0.205	0.212
			(0.70)	(0.72)
High Private * Rate Changes			0.200	0.171
			(0.35)	(0.30)
_cons	0.599***	0.584***	-0.205	-0.221
	(4.30)	(4.19)	(-0.66)	(-0.71)
N	5169	5169	5010	5010
R^2	0.399	0.399	0.406	0.407

This is the same model as table 5 & 6, but without US or UK in the sample. *t* statistics in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table B10: Fixed Effects Model with Interaction Variables and Exclusion of Japan from the sample

Japan	(1) Returns	(2) Returns	(3) Returns
Rate Changes	-1.379***	-1.447***	-1.443***
	(-4.14)	(-5.62)	(-5.60)
Real GDP growth	0.294***	0.284***	0.284***
	(3.73)	(4.66)	(4.66)
Low Public Debt (dummy)	-0.400	0.585	0.559
	(-0.69)	(1.31)	(1.25)
High Public Debt (dummy)	2.170***	0.537	0.617
	(2.81)	(0.90)	(1.03)
Low Public * Rate Changes	0.604	0.355	0.360
	(1.57)	(1.19)	(1.21)
High Public * Rate Changes	0.987*	1.452***	1.460***
	(1.87)	(3.56)	(3.58)
Low Private Debt (dummy)	1.833**	3.360***	3.326***
	(2.09)	(4.96)	(4.91)
High Private Debt (dummy)	0.198	-1.059**	-1.051**
	(0.32)	(-2.19)	(-2.17)
Low Private * Rate Changes	-0.379	0.190	0.201
	(-1.02)	(0.66)	(0.70)
High Private * Rate Changes	0.736	0.178	0.134
	(1.02)	(0.32)	(0.24)
MSCI Returns		0.853***	0.852***
		(58.24)	(58.06)
REER Changes			0.0569
			(1.35)
_cons	0.673*	-0.190	-0.210
	(1.73)	(-0.63)	(-0.70)
N	5103	5103	5103
R^2	0.015	0.411	0.412

This is the same model as table 6, but without Japan in the sample. *t* statistics in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table B11: Fixed Effects Model with Interaction Variables for Public and Private Debt and Interaction Variable for Developed Economy

Developed	(1) Returns	(2) Returns	(3) Returns
Rate Changes	-1.633***	-1.536***	-1.530***
	(-4.76)	(-5.80)	(-5.78)
Real GDP growth	0.284***	0.280***	0.280***
	(3.63)	(4.64)	(4.64)
Low Public Debt (dummy)	-0.424	0.580	0.565
	(-0.74)	(1.30)	(1.27)
High Public Debt (dummy)	2.037***	0.488	0.536
	(2.64)	(0.82)	(0.90)
Low Public * Rate Changes	0.666*	0.376	0.378
	(1.74)	(1.27)	(1.28)
High Public * Rate Changes	0.966*	1.433***	1.439***
	(1.84)	(3.53)	(3.54)
Low Private Debt (dummy)	1.903**	3.383***	3.363***
	(2.18)	(5.01)	(4.98)
High Private Debt (dummy)	0.0402	-1.076**	-1.069**
	(0.07)	(-2.29)	(-2.27)
Low Private * Rate Changes	-0.170	0.265	0.269
	(-0.45)	(0.91)	(0.92)
High Private * Rate Changes	-0.321	-0.200	-0.213
	(-0.40)	(-0.32)	(-0.34)
Developed * Rate Changes	2.123***	0.735	0.710
	(2.99)	(1.34)	(1.29)
MSCI Returns		0.853***	0.852***
		(58.96)	(58.84)
REER Changes			0.0330
			(0.80)
N	5196	5196	5196
R^2	0.017	0.414	0.414

This is the same model as table 6, but augmented by an interaction variable for developed economy (value 1 when developed, 0 otherwise). *t* statistics in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table B12: Fixed Effects Model with Interaction Variables for Public and Private Debt, with the 33rd and 66th percentile as thresholds for low and high debt.

3366	(1) Returns	(2) Returns	(3) Returns
Rate Changes	-1.341***	-1.447***	-1.451***
	(-3.05)	(-4.26)	(-4.28)
Real GDP growth	0.309***	0.293***	0.293***
	(3.97)	(4.88)	(4.88)
Low Public Debt (dummy)	-0.516	0.451	0.431
	(-0.95)	(1.07)	(1.03)
High Public Debt (dummy)	2.094***	0.484	0.525
	(2.73)	(0.82)	(0.88)
Low Public * Rate Changes	0.766*	0.389	0.396
	(1.95)	(1.29)	(1.31)
High Public * Rate Changes	1.328**	1.631***	1.643***
	(2.43)	(3.87)	(3.89)
Low Private Debt (dummy)	1.152	2.052***	2.038***
	(1.48)	(3.43)	(3.40)
High Private Debt (dummy)	0.360	-1.146**	-1.132**
	(0.54)	(-2.22)	(-2.19)
Low Private * Rate Changes	-0.688*	0.0138	0.0262
	(-1.68)	(0.04)	(0.08)
High Private * Rate Changes	0.336	-0.0540	-0.0823
	(0.49)	(-0.10)	(-0.16)
MSCI Returns		0.852***	0.851***
		(59.32)	(59.19)
REER Changes			0.0382
			(0.93)
N	5246	5246	5246
R^2	0.016	0.414	0.414

Same table as model 6, but The Low Public Debt dummy variable has value 1 if general government debt to GDP ratio is lower than 36.9%. The High Public Debt dummy variable has value 1 when general government debt to GDP ratio is higher than 66.5%. The Low Private Debt dummy variable has value 1 if private sector to GDP ratio is lower than 80.2%. The High Private Debt dummy variable has value 1 if private sector to GDP ratio is higher than 157%. *t* statistics in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table B13: Fixed Effects Model with Interaction Variables for Public and Private Debt, with Mean minus and plus one Standard Deviation as thresholds for low and high debt.

SD	(1) Returns	(2) Returns	(3) Returns
Rate Changes	-1.231***	-1.309***	-1.303***
	(-4.82)	(-6.65)	(-6.61)
Real GDP growth	0.320***	0.302***	0.302***
	(4.11)	(5.03)	(5.03)
Low Public Debt (dummy)	-1.674*	-0.502	-0.500
	(-1.93)	(-0.75)	(-0.75)
High Public Debt (dummy)	1.751**	0.0388	0.0780
	(2.13)	(0.06)	(0.12)
Low Public * Rate Changes	0.402	0.228	0.220
	(0.68)	(0.50)	(0.48)
High Public * Rate Changes	0.613	1.685***	1.692***
	(1.05)	(3.76)	(3.77)
Low Private Debt (dummy)	2.271**	3.055***	3.017***
	(2.50)	(4.36)	(4.29)
High Private Debt (dummy)	-0.105	-1.460***	-1.455***
	(-0.15)	(-2.70)	(-2.69)
Low Private * Rate Changes	-0.0379	0.244	0.247
	(-0.10)	(0.87)	(0.88)
High Private * Rate Changes	-0.417	-0.208	-0.231
	(-0.48)	(-0.31)	(-0.34)
MSCI Returns		0.853***	0.852***
		(59.56)	(59.44)
REER Changes			0.0325
			(0.79)
N	5246	5246	5246
R^2	0.014	0.415	0.415

Same table as model 6, but The Low Public Debt dummy variable has value 1 if general government debt to GDP ratio is lower than 17.85%. The High Public Debt dummy variable has value 1 when general government debt to GDP ratio is higher than 102.75%. The Low Private Debt dummy variable has value 1 if private sector to GDP ratio is lower than 45.51%. The High Private Debt dummy variable has value 1 if private sector to GDP ratio is higher than 208.12%. *t* statistics in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table B14: Fixed Effects Model with Interaction Variables for Public and Private Debt, with high debt levels as the base (0).

	(1) Returns	(2) Returns	(3) Returns
Rate Changes	0.249	0.122	0.0890
	(0.35)	(0.22)	(0.16)
Real GDP growth	0.307***	0.289***	0.289***
	(4.00)	(4.88)	(4.88)
Low Public Debt (dummy)	-2.614***	0.00581	-0.0940
	(-2.79)	(0.01)	(-0.13)
Medium Public Debt (dummy)	-2.195***	-0.560	-0.638
	(-2.87)	(-0.95)	(-1.07)
Low Public * Rate Changes	-0.377	-1.087***	-1.090***
	(-0.71)	(-2.64)	(-2.65)
Medium Public * Rate Changes	-0.793	-1.354***	-1.360***
	(-1.57)	(-3.46)	(-3.48)
Low Private Debt (dummy)	2.124**	4.736***	4.693***
	(2.05)	(5.90)	(5.84)
Medium Private Debt (dummy)	-0.0497	1.066**	1.054**
	(-0.08)	(2.28)	(2.25)
Low Private * Rate Changes	-0.943	0.0954	0.153
	(-1.37)	(0.18)	(0.29)
Medium Private * Rate Changes	-0.749	-0.184	-0.140
	(-1.04)	(-0.33)	(-0.25)
MSCI Returns		0.847***	0.846***
		(59.75)	(59.62)
REER Changes			0.0559
			(1.38)
N	5355	5355	5355
R^2	0.016	0.413	0.413

The Low Public Debt dummy variable has value 1 if general government debt to GDP ratio is lower than 31.1%. The Medium Public Debt dummy variable has value 1 when general government debt to GDP ratio is higher than 31.1% but lower than 77.2%. The Low Private Debt dummy variable has value 1 if private sector to GDP ratio is lower than 61%. The Medium Private Debt dummy variable has value 1 if private sector to GDP ratio is higher than 61% but lower than 176%. *t* statistics in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table B15: Fixed Effects Model with Interaction Variables for Public and Private Debt, without RGDP variable

	(1) Returns	(2) Returns	(3) Returns
Rate Changes	-1.251***	-1.320***	-1.315***
	(-3.96)	(-5.41)	(-5.39)
Low Public Debt (dummy)	-0.368	0.615	0.594
	(-0.66)	(1.41)	(1.36)
High Public Debt (dummy)	2.180***	0.539	0.617
	(2.84)	(0.91)	(1.04)
Low Public * Rate Changes	0.396	0.237	0.239
	(1.11)	(0.86)	(0.87)
High Public * Rate Changes	0.746	1.307***	1.312***
	(1.47)	(3.34)	(3.35)
Low Private Debt (dummy)	2.028**	3.504***	3.470***
	(2.34)	(5.21)	(5.16)
High Private Debt (dummy)	-0.0948	-1.154**	-1.142**
	(-0.16)	(-2.46)	(-2.44)
Low Private * Rate Changes	-0.216	0.184	0.198
	(-0.62)	(0.68)	(0.73)
High Private * Rate Changes	0.919	0.288	0.244
	(1.29)	(0.52)	(0.44)
MSCI Returns		0.847***	0.846***
		(59.57)	(59.44)
REER Changes			0.0560
			(1.37)
_cons	0.900**	0.0168	-0.00510
	(2.40)	(0.06)	(-0.02)
N	5355	5355	5355
R^2	0.012	0.409	0.409

Same as table 6, but without the RGDP variable. *t* statistics in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table B16: Fixed Effects Model with Interaction Variables for Public, Household and Corporate Debt, 2 groups for the Household and Corporate debt.

	(1) Returns	(2) Returns	(3) Returns
Rate Changes	-1.531***	-1.534***	-1.617***
	(-6.75)	(-6.51)	(-6.82)
Real GDP Growth	0.237***	0.233***	0.231***
	(4.06)	(4.04)	(3.95)
MSCI returns	0.891***	0.886***	0.891***
	(61.21)	(61.03)	(61.19)
REER changes	0.0828*	0.0911*	0.0768
	(1.67)	(1.86)	(1.55)
Low Public Debt (dummy)	0.755*	0.822*	0.722
	(1.70)	(1.86)	(1.63)
High Public Debt (dummy)	0.144	0.116	0.275
	(0.24)	(0.20)	(0.46)
Low Public * Rate Changes	-0.404	-0.420	-0.369
	(-1.21)	(-1.26)	(-1.10)
High Public * Rate Changes	0.735	1.628***	0.651
	(1.33)	(4.00)	(1.17)
High Household Debt (dummy)	-1.507***		-1.356**
	(-2.79)		(-2.48)
High Household * Rate Changes	0.266		-0.0272
	(0.43)		(-0.04)
High Corporate Debt (dummy)		-1.388***	-1.188**
		(-2.68)	(-2.27)
High Corporate * Rate Changes		0.171	0.546
		(0.42)	(1.19)
N	4214	4267	4214
R^2	0.487	0.483	0.488

The High Household Debt dummy variable has value 1 when household debt to GDP ratio is higher than 85%. The High Corporate Debt dummy variable has value 1 if corporate sector to GDP ratio is higher than 90%. This table excludes Ecuador, Egypt, Kenya, Lebanon, Nigeria, Philippines, Serbia and Vietnam (on top of previously excluded Morocco and Taiwan) from the sample. *t* statistics in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table B17: Fixed Effects Model with Interaction Variables for Public, Household and Corporate Debt, 3 groups for the Household and Corporate debt.

	(1) Returns	(2) Returns	(3) Returns
Rate Changes	-1.201***	-1.111***	-1.054***
	(-4.18)	(-3.89)	(-3.39)
Real GDP Growth	0.212***	0.222***	0.205***
	(3.71)	(3.88)	(3.59)
MSCI returns	0.891***	0.887***	0.890***
	(62.46)	(62.13)	(62.41)
REER changes	0.0473	0.0458	0.0425
	(0.99)	(0.96)	(0.89)
Low Public Debt (dummy)	0.514	0.872**	0.569
	(1.16)	(1.98)	(1.28)
High Public Debt (dummy)	0.267	0.136	0.336
	(0.46)	(0.23)	(0.57)
Low Public * Rate Changes	-0.402	-0.440	-0.484
	(-1.19)	(-1.33)	(-1.42)
High Public * Rate Changes	1.632***	1.733***	1.695***
	(3.95)	(4.22)	(4.08)
Low Household Debt (dummy)	2.943***		2.596***
	(5.58)		(4.73)
High Household Debt (dummy)	-1.624***		-1.230**
	(-2.90)		(-2.10)
Low Household * Rate Changes	-0.436		-0.0451
	(-1.32)		(-0.11)
High Household * Rate Changes	-0.135		-0.130
	(-0.24)		(-0.21)
Low Corporate Debt (dummy)		2.081***	1.136
		(2.79)	(1.47)

(See next page)

High Corporate Debt (dummy)		-1.621***	-1.165**
		(-3.41)	(-2.35)
Low Corporate * Rate Changes		-0.722**	-0.658*
		(-2.26)	(-1.67)
High Corporate * Rate Changes		-0.294	-0.234
		(-0.57)	(-0.40)
_cons	-0.00615	0.151	-0.0176
	(-0.02)	(0.48)	(-0.05)
N	4360	4360	4360
R^2	0.489	0.487	0.490

Same as table 6, but with private debt split up into household and corporate debt. The Low Household Debt dummy variable has value 1 if general government debt to GDP ratio is lower than 25.18%. The High Public Debt dummy variable has value 1 when general government debt to GDP ratio is higher than 72.3%. The Low Private Debt dummy variable has value 1 if private sector to GDP ratio is lower than 52%. The High Private Debt dummy variable has value 1 if private sector to GDP ratio is higher than 122.22%. This table exclused Ecuador, Egypt, Kenya, Lebanon, Nigeria, Philippines, Serbia and Vietnam (on top of previously excluded Morocco and Taiwan) from the sample. *t* statistics in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table B18: Marginal Effects of Interest Rate Changes on Stock Returns based on Household Debt and Corporate Debt

	Household debt	Corporate debt
Interest Rate Changes		
Low Debt	-0.966***	-1.413***
	(-2.92)	(-3.89)
Medium Debt	-0.921***	-0.755***
	(-3.39)	(-2.81)
High Debt	-1.052*	-0.989**
	(-1.92)	(-2.05)
N	4360	4360

Coefficients are marginal effects of Rate Changes on Returns for every Household and Corporate Debt group for model 3 from table B17. Calculated as the partial derivative of Rate Changes at Household Debt and Corporate Debt respectively. *t* statistics in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

APPENDIX C Data Sources & STATA Code

List of indices and benchmark interest rates by country with DataStream index name and code

Country	Stock Market Indices	Code	Interest Rates	Code
Australia	ASX ALL ORDINARIES 1971 > - PRICE INDEX	AUSTOLD	AU 3-MONTH OR 90-DAY RATES AND YIELDS, INTERBANK RATES NADJ	AUMIR076R
Austria	AUSTRIAN TRADED INDEX - PRICE INDEX	ATXINDX	OE 3-MONTH OR 90-DAY RATES AND YIELDS, INTERBANK RATES NADJ	OEOIR076R
Belgium	BEL 20 - PRICE INDEX	BGBEL20	BG 3-MONTH OR 90-DAY RATES AND YIELDS, INTERBANK RATES NADJ	BGOIR076R
Brazil	BRAZIL BOVESPA - TOT RETURN IND	BRBOVES	BRAZIL CDB (UP TO 30 'DEAD' - MIDDLE RATE) / BRAZILIAN REAL 3 MON	BRL3MID
Bulgaria	BULGARIA SE SOFIX - PRICE INDEX	BSSOFIX	BL 3-MONTH OR 90-DAY RATES AND YIELDS, INTERBANK RATES NADJ	BLMIR076R
Canada	S&P/TSX COMPOSITE INDEX - PRICE INDEX	TTOCOMP	CN 3-MONTH OR 90-DAY RATES AND YIELDS, INTERBANK RATES NADJ	CNMIR076R
Chile	S&P/CLX IGPA CLP INDEX - PRICE INDEX	IGPAGEN	CL 3-MONTH OR 90-DAY RATES AND YIELDS, INTERBANK RATES NADJ	CLMIR076R
China	SHANGHAI SE COMPOSITE - PRICE INDEX	CHSCOMP	CH 3-MONTH OR 90-DAY RATES AND YIELDS, INTERBANK RATES NADJ	CHMIR076R
Colombia	COLOMBIA-DS Market - PRICE INDEX	TOTMKCB	CB 3-MONTH OR 90-DAY RATES AND YIELDS, INTERBANK RATES NADJ	CBMIR076R
Czech Repub	PRAGUE SE PX - PRICE INDEX	CZPXIDX	CZ 3-MONTH OR 90-DAY RATES AND YIELDS, INTERBANK RATES NADJ	CZOIR076R
Denmark	OMX COPENHAGEN (OMXC20) - PRICE INDEX	DKKFXIN	DK 3-MONTH OR 90-DAY RATES AND YIELDS, INTERBANK RATES NADJ	DKOIR076R
Ecuador	ECUADOR BVG - PRICE INDEX	ECUBVGI	ECUADOR INTERBANK WEIGHTD AVG. RTE - MIDDLE RATE	EDIBMWA
Egypt	EGYPT EGX 30 - PRICE INDEX	EGCSE30	EGYPT INTERBANK 3M CAIRO - OFFERED RATE	EGIBK3M
Estonia	OMX TALLINN (OMXT) - PRICE INDEX	ESTALSE	EO 3-MONTH OR 90-DAY RATES AND YIELDS, INTERBANK RATES NADJ	EOOIR076R
Finland	OMX HELSINKI (OMXH) - PRICE INDEX	HEXINDX	FN 3-MONTH OR 90-DAY RATES AND YIELDS, INTERBANK RATES NADJ	FNOIR076R
France	FRANCE CAC 40 DS-CALC. - PRICE INDEX	FRCAC4Z	FR 3-MONTH OR 90-DAY RATES AND YIELDS, INTERBANK RATES NADJ	FROIR076R
Germany	DAX PERFORMANCE - PRICE INDEX	DAXINDX	BD 3-MONTH OR 90-DAY RATES AND YIELDS, INTERBANK RATES NADJ	BDOIR076R
Greece	GREECE-DS Market - PRICE INDEX	TOTMKGR	GR 3-MONTH OR 90-DAY RATES AND YIELDS, INTERBANK RATES NADJ	GROIR076R
Hong Kong	HANG SENG - PRICE INDEX	HNGKNGI	HONG KONG INTERBANK 3M - OFFERED RATE	HKIBF3M
Hungary	BUDAPEST (BUX) - PRICE INDEX	BUXINDX	HN 3-MONTH OR 90-DAY RATES AND YIELDS, INTERBANK RATES NADJ	HNOIR076R
Iceland	OMX ICELAND ALL SHARE - PRICE INDEX	ICEXALL	IC 3-MONTH OR 90-DAY RATES AND YIELDS, INTERBANK RATES NADJ	ICOIR076R
India	NIFTY 500 - PRICE INDEX	ICRI500	MUMBAI INTERBANK THREE MONT'DEAD' - MIDDLE RATE / IN 3-MONTH	INMIR076R
Indonesia	IDX COMPOSITE - PRICE INDEX	JAKCOMP	ID 3-MONTH OR 90-DAY RATES AND YIELDS, INTERBANK RATES NADJ	IDMIR076R
Ireland	ISEQ ALL SHARE INDEX - PRICE INDEX	ISEQUIT	IR 3-MONTH OR 90-DAY RATES AND YIELDS, INTERBANK RATES NADJ	IROIR076R
Italy	ITALY-DS Market - PRICE INDEX	TOTMKIT	IT 3-MONTH OR 90-DAY RATES AND YIELDS, INTERBANK RATES NADJ	ITOIR076R
Japan	NIKKEI 225 STOCK AVERAGE - PRICE INDEX	JAPDOWA	JAPAN INTERBANK JPY 3M - OFFERED RATE	JPIBK3M
Kenya	KENYA NAIROBI SE (NSE20) - PRICE INDEX	NSEINDX	KN TREASURY BILL RATE - 91 DAYS NADJ	KNMSHORT
Latvia	OMX RIGA (OMXR) - TOT RETURN IND	RIGSEIN	LV 3-MONTH OR 90-DAY RATES AND YIELDS, INTERBANK RATES NADJ	LVMIR076R
Lebanon	LEBANON BLOM - PRICE INDEX	LBBLOMI	LB TREASURY BILLS- 3 MONTHS: YIELD NADJ	LBMMTBYLR
Lithuania	OMX VILNIUS (OMXV) - TOT RETURN IND	LNVILSE	LN 3-MONTH OR 90-DAY RATES AND YIELDS, INTERBANK RATES NADJ	LNMIR076R
Luxembourg	LUXEMBOURG SE LUXX - PRICE INDEX	LXLUXXI	LX 3-MONTH OR 90-DAY RATES AND YIELDS, INTERBANK RATES NADJ	LXOIR076R
Macedonia	MACEDONIAN SE MBI 10 - PRICE INDEX	MCMBI10	MK INTERBANK RATE - SKIBOR 3M NADJ	MKSKIB3M
Malaysia	FTSE BURSA MALAYSIA KLCI - PRICE INDEX	FBMKLCI	MALAYSIA INTERBANK 3 MONTH - MIDDLE RATE	MYIBK3M
Malta	MALTA SE MSE - PRICE INDEX	MALTAIX	MA TREASURY BILL RATE - 3 MONTH NADJ	MAGBILL3.
Mexico	MEXICO IPC (BOLSA) - PRICE INDEX	MXIPC35	MX 3-MONTH OR 90-DAY RATES AND YIELDS, INTERBANK RATES NADJ	MXOIR076R
Morocco	MOROCCO ALL SHARE (MASI) - PRICE INDEX	MASIIDX	RFV MOROCCAN DIRHAM 3M DEPOSIT - MIDDLE RATE	MCDEP3M
Netherlands	AEX INDEX (AEX) - PRICE INDEX	AMSTEOE	NL 3-MONTH OR 90-DAY RATES AND YIELDS, INTERBANK RATES NADJ	NLOIR076R
New Zealand	NEW ZEALAN-DS Market - PRICE INDEX	TOTMKNZ	NZ 3-MONTH OR 90-DAY RATES AND YIELDS, INTERBANK RATES NADJ	NZMIR076R
Nigeria	NIGERIA ALL SHARE - PRICE INDEX	NIGALSH	NG TREASURY BILL RATE: 91 DAY NADJ	NGMMVTBNR
Norway	OSLO SE OBX - PRICE INDEX	OSLOOBX	NW 3-MONTH OR 90-DAY RATES AND YIELDS, INTERBANK RATES NADJ	NWOIR076R
Peru	S&P/BVL LIMA SELECT 25 - PRICE INDEX	PESELEC	PERU INTERBANK OFFER 3M (ASBANC) - MIDDLE RATE	PEBOR3M
Philippines	PHILIPPINE SE I(PSEi) - PRICE INDEX	PSECOMP	PHILIPPINE TREASURY BILL 91D - MIDDLE RATE	PHTBL3M
Poland	WARSAW GENERAL INDEX - TOT RETURN IND	POLWIGI	PO 3-MONTH OR 90-DAY RATES AND YIELDS, INTERBANK RATES NADJ	POOIR076R
Portugal	PORTUGAL PSI-20 - PRICE INDEX	POPSI20	PT 3-MONTH OR 90-DAY RATES AND YIELDS, INTERBANK RATES NADJ	PTOIR076R
Romania	ROMANIA BET (L) - PRICE INDEX	RMBETRL	RM 3-MONTH OR 90-DAY RATES AND YIELDS, INTERBANK RATES NADJ	RMMIR076R
Serbia	BELGRADE BELEX 15 - PRICE INDEX	BELEX15	RFV SERBIAN DINAR 3M DEPOSIT - MIDDLE RATE	TRSD3MD
Singapore	SINGAPORE-DS DS-MARKET EX TMT - PRICE INDEX	TOTXTSG	SINGAPORE IBK SIBOR 3M DELAYED - MIDDLE RATE	SISGD3M
Slovenia	SLOVENIAN BLUE CHIP (SBI TOP) - PRICE INDEX	SLOETOP	SJ 3-MONTH OR 90-DAY RATES AND YIELDS, INTERBANK RATES NADJ	SJOIR076R
South Africa	FTSE/JSE ALL SHARE - PRICE INDEX	JSEOVER	SA 3-MONTH OR 90-DAY RATES AND YIELDS, INTERBANK RATES NADJ	SAMIR076R
South Korea	KOREA SE COMPOSITE (KOSPI) - PRICE INDEX	KORCOMP	KO 3-MONTH OR 90-DAY RATES AND YIELDS, INTERBANK RATES NADJ	KOMIR076R
Spain	MADRID SE GENERAL (IGBM) - PRICE INDEX	MADRIDI	ES 3-MONTH OR 90-DAY RATES AND YIELDS, INTERBANK RATES NADJ	ESOIR076R
Sri Lanka	COLOMBO SE ALL SHARE - PRICE INDEX	SRALLSH	SRI LANKA TREASURY BILL 3 MONTH - MIDDLE RATE	SRTBL3M
Sweden	OMX STOCKHOLM 30 (OMXS30) - PRICE INDEX	SWEDOMX	SD 3-MONTH OR 90-DAY RATES AND YIELDS, INTERBANK RATES NADJ	SDMIR076R
Switzerland	SWISS MARKET (SMI) - PRICE INDEX	SWISSMI	SW 3-MONTH OR 90-DAY RATES AND YIELDS, INTERBANK RATES NADJ	SWOIR076R
Taiwan	FTSE TWSE TAIWAN 50 - PRICE INDEX	TAISE50	TAIWAN INTERBANK 3M - OFFERED RATE	TWIBK3M
Thailand	THAILAND-DS Market - PRICE INDEX	TOTMKTH	THAILAND INTERBANK 3 MTH (BB) - OFFERED RATE	THBBIB3
Turkey	BIST NATIONAL 100 - PRICE INDEX	TRKISTB	TURKEY INTERBANK 3M - MIDDLE RATE	TKIBK3M
United Kingd	FTSE 100 - PRICE INDEX	FTSE100	UK 3-MONTH OR 90-DAY RATES AND YIELDS, INTERBANK RATES NADJ	UKOIR076R
United States	S&P 500 COMPOSITE - PRICE INDEX	S&PCOMP	US 3-MONTH OR 90-DAY RATES AND YIELDS, INTERBANK RATES NADJ	USMIR076R
Vietnam	HOCHIMINH SE VIETNAM INDEX - PRICE INDEX	HCMNVNE	VIETNAM INTERBANK 3M - OFFERED RATE	VNIBK3M

List of sources for Public and Private debt figures with DataStream index name and code. When data was unavailable on DataStream figures were used from the IMF Global Debt Database (2022).

Country	Public Debt to GDP	Code	Private Debt to GDP	Code
Australia	AU GENERAL GOVERNMENT - DEBT, GROSS (%GDP) NADJ	AUXGGG%.R	AU CREDIT-TO-GDP RATIO(ACTUAL DATA)-CDT TO PRIV NONFINL SCT N	AUBGAPR.R
Austria	OE GENERAL GOVERNMENT - DEBT, GROSS (%GDP) NADJ	OEXGGG%.R	OE CREDIT-TO-GDP RATIO(ACTUAL DATA)-CDT TO PRIV NONFINL SCT N	OEBGAPR.R
Belgium	BG GENERAL GOVERNMENT - DEBT, GROSS (%GDP) NADJ	BGXGGG%.R	BG CREDIT-TO-GDP RATIO(ACTUAL DATA)-CDT TO PRIV NONFINL SCT N	BGBGAPR.R
Brazil	BR GENERAL GOVERNMENT - DEBT, GROSS (%GDP) NADJ	BRXGGG%.R	BR CREDIT-TO-GDP RATIO(ACTUAL DATA)-CDT TO PRIV NONFINL SCT N	BRBGAPR.R
Bulgaria	BL GENERAL GOVERNMENT - DEBT, GROSS (%GDP) NADJ	BLXGGG%.R	IMF	
Canada	CN GENERAL GOVERNMENT - DEBT, GROSS (%GDP) NADJ	CNXGGG%.R	CN CREDIT-TO-GDP RATIO(ACTUAL DATA)-CDT TO PRIV NONFINL SCT N	CNBGAPR.R
Chile	CL GENERAL GOVERNMENT - DEBT, GROSS (%GDP) NADJ	CLXGGG%.R	CL CREDIT-TO-GDP RATIO(ACTUAL DATA)-CDT TO PRIV NONFINL SCT N	CLBGAPR.R
China	CH GENERAL GOVERNMENT - DEBT, GROSS (%GDP) NADJ	CHXGGG%.R	CH CREDIT-TO-GDP RATIO(ACTUAL DATA)-CDT TO PRIV NONFINL SCT N	CHBGAPR.R
Colombia	IMF		CB CREDIT-TO-GDP RATIO(ACTUAL DATA)-CDT TO PRIV NONFINL SCT N	CBBGAPR.R
Czech Repub	CZ GENERAL GOVERNMENT - DEBT, GROSS (%GDP) NADJ	CZXGGG%.R	CZ CREDIT-TO-GDP RATIO(ACTUAL DATA)-CDT TO PRIV NONFINL SCT N	CZBGAPR.R
Denmark	DK GENERAL GOVERNMENT - DEBT, GROSS (%GDP) NADJ	DKXGGG%.R	DK CREDIT-TO-GDP RATIO(ACTUAL DATA)-CDT TO PRIV NONFINL SCT N	DKBGAPR.R
Ecuador	IMF		IMF	
Egypt	IMF		IMF	
Estonia	IMF		IMF	
Finland	FN GENERAL GOVERNMENT - DEBT, GROSS (%GDP) NADJ	FNXGGG%.R	FN CREDIT-TO-GDP RATIO(ACTUAL DATA)-CDT TO PRIV NONFINL SCT N	FNBGAPR.R
France	FR GENERAL GOVERNMENT - DEBT, GROSS (%GDP) NADJ	FRXGGG%.R	FR CREDIT-TO-GDP RATIO(ACTUAL DATA)-CDT TO PRIV NONFINL SCT N	FRBGAPR.R
Germany	BD GENERAL GOVERNMENT - DEBT, GROSS (%GDP) NADJ	BDXGGG%.R	BD CREDIT-TO-GDP RATIO(ACTUAL DATA)-CDT TO PRIV NONFINL SCT N	BDBGAPR.R
Greece	GR GENERAL GOVERNMENT - DEBT, GROSS (%GDP) NADJ	GRXGGG%.R	GR CREDIT-TO-GDP RATIO(ACTUAL DATA)-CDT TO PRIV NONFINL SCT N	GRBGAPR.R
Hong Kong	HK GENERAL GOVERNMENT - DEBT, GROSS (%GDP) NADJ	HKXGGG%.R	HK CREDIT-TO-GDP RATIO(ACTUAL DATA)-CDT TO PRIV NONFINL SCT N	HKBGAPR.R
Hungary	HN GENERAL GOVERNMENT - DEBT, GROSS (%GDP) NADJ	HNXGGG%.R	HN CREDIT-TO-GDP RATIO(ACTUAL DATA)-CDT TO PRIV NONFINL SCT N	HNBGAPR.R
Iceland	IC GPD: CGOVT NADJ	ICQPGDEER	IMF	
India	IN GENERAL GOVERNMENT - DEBT, GROSS (%GDP) NADJ	INXGGG%.R	IN CREDIT-TO-GDP RATIO(ACTUAL DATA)-CDT TO PRIV NONFINL SCT N	INBGAPR.R
Indonesia	ID GENERAL GOVERNMENT - DEBT, GROSS (%GDP) NADJ	IDXGGG%.R	ID CREDIT-TO-GDP RATIO(ACTUAL DATA)-CDT TO PRIV NONFINL SCT N	IDBGAPR.R
Ireland	IR GENERAL GOVERNMENT - DEBT, GROSS (%GDP) NADJ	IRXGGG%.R	IR CREDIT-TO-GDP RATIO(ACTUAL DATA)-CDT TO PRIV NONFINL SCT N	IRBGAPR.R
Italy	IT GENERAL GOVERNMENT - DEBT, GROSS (%GDP) NADJ	ITXGGG%.R	IT CREDIT-TO-GDP RATIO(ACTUAL DATA)-CDT TO PRIV NONFINL SCT N	ITBGAPR.R
Japan	JP GENERAL GOVERNMENT - DEBT, GROSS (%GDP) NADJ	JPXGGG%.R	JP CREDIT-TO-GDP RATIO(ACTUAL DATA)-CDT TO PRIV NONFINL SCT NA	JPBGAPR.R
Kenya	KN GENERAL GOVERNMENT - DEBT, GROSS (%GDP) NADJ	KNXGGG%.R	IMF	
Latvia	IMF		IMF	
Lebanon	IMF		IMF	
Lithuania	IMF		IMF	
Luxembourg	IMF		LX CREDIT-TO-GDP RATIO(ACTUAL DATA)-CDT TO PRIV NONFINL SCT N	LXBGAPR.R
Macedonia	IMF		IMF	
Malaysia	MY GENERAL GOVERNMENT - DEBT, GROSS (%GDP) NADJ	MYXGGG%.R	MY CREDIT-TO-GDP RATIO(ACTUAL DATA)-CDT TO PRIV NONFINL SCT N	MYBGAPR.R
Malta	IMF		IMF	
Mexico	MX GENERAL GOVERNMENT - DEBT, GROSS (%GDP) NADJ	MXXGGG%.R	MX CREDIT-TO-GDP RATIO(ACTUAL DATA)-CDT TO PRIV NONFINL SCT N	MXBGAPR.R
Morocco	N/A		N/A	
Netherlands	NL GENERAL GOVERNMENT - DEBT, GROSS (%GDP) NADJ	NLXGGG%.R	NL CREDIT-TO-GDP RATIO(ACTUAL DATA)-CDT TO PRIV NONFINL SCT N	NLBGAPR.R
New Zealand	NZ GENERAL GOVERNMENT - DEBT, GROSS (%GDP) NADJ	NZXGGG%.R	NZ CREDIT-TO-GDP RATIO(ACTUAL DATA)-CDT TO PRIV NONFINL SCT N	NZBGAPR.R
Nigeria	NG GENERAL GOVERNMENT - DEBT, GROSS (%GDP) NADJ	NGXGGG%.R		
Norway	NW GENERAL GOVERNMENT - DEBT, GROSS (%GDP) NADJ	NWXGGG%.R	NW CREDIT-TO-GDP RATIO(ACTUAL DATA)-CDT TO PRIV NONFINL SCT N	NWBGAPR.R
Peru	IMF		IMF	
Philippines	PH GENERAL GOVERNMENT - DEBT, GROSS (%GDP) NADJ	PHXGGG%.R	IMF	
Poland	PO GENERAL GOVERNMENT - DEBT, GROSS (%GDP) NADJ	POXGGG%.R	PO CREDIT-TO-GDP RATIO(ACTUAL DATA)-CDT TO PRIV NONFINL SCT N	POBGAPR.R
Portugal	PT GENERAL GOVERNMENT - DEBT, GROSS (%GDP) NADJ	PTXGGG%.R	PT CREDIT-TO-GDP RATIO(ACTUAL DATA)-CDT TO PRIV NONFINL SCT N	PTBGAPR.R
Romania	RM GENERAL GOVERNMENT - DEBT, GROSS (%GDP) NADJ	RMXGGG%.R	IMF	
Serbia	IMF		IMF	
Singapore	SP GENERAL GOVERNMENT - DEBT, GROSS (%GDP) NADJ	SPXGGG%.R	SP CREDIT-TO-GDP RATIO(ACTUAL DATA)-CDT TO PRIV NONFINL SCT N	SPBGAPR.R
Slovenia	SJ GENERAL GOVERNMENT - DEBT, GROSS (%GDP) NADJ	SJXGGG%.R	IMF	
South Africa	SA GENERAL GOVERNMENT - DEBT, GROSS (%GDP) NADJ	SAXGGG%.R	SA CREDIT-TO-GDP RATIO(ACTUAL DATA)-CDT TO PRIV NONFINL SCT N	SABGAPR.R
South Korea	KO GENERAL GOVERNMENT - DEBT, GROSS (%GDP) NADJ	KOXGGG%.R	KO CREDIT-TO-GDP RATIO(ACTUAL DATA)-CDT TO PRIV NONFINL SCT N	KOBGAPR.R
Spain	ES GENERAL GOVERNMENT - DEBT, GROSS (%GDP) NADJ	ESXGGG%.R	ES CREDIT-TO-GDP RATIO(ACTUAL DATA)-CDT TO PRIV NONFINL SCT N	ESBGAPR.R
Sri Lanka	IMF		IMF	
Sweden	SD GENERAL GOVERNMENT - DEBT, GROSS (%GDP) NADJ	SDXGGG%.R	SD CREDIT-TO-GDP RATIO(ACTUAL DATA)-CDT TO PRIV NONFINL SCT N	SDBGAPR.R
Switzerland	SW GENERAL GOVERNMENT - DEBT, GROSS (%GDP) NADJ	SWXGGG%.R	SW CREDIT-TO-GDP RATIO(ACTUAL DATA)-CDT TO PRIV NONFINL SCT N	SWBGAPR.R
Taiwan	TW GENERAL GOVERNMENT - DEBT, GROSS (%GDP) NADJ	TWXGGG%.R	N/A	
Thailand	TH GENERAL GOVERNMENT - DEBT, GROSS (%GDP) NADJ	THXGGG%.R	TH CREDIT-TO-GDP RATIO(ACTUAL DATA)-CDT TO PRIV NONFINL SCT N	THBGAPR.R
Turkey	TK GENERAL GOVERNMENT - DEBT, GROSS (%GDP) NADJ	TKXGGG%.R	TK CREDIT-TO-GDP RATIO(ACTUAL DATA)-CDT TO PRIV NONFINL SCT N	TKBGAPR.R
United Kingd	UK GENERAL GOVERNMENT - DEBT, GROSS (%GDP) NADJ	UKXGGG%.R	UK CREDIT-TO-GDP RATIO(ACTUAL DATA)-CDT TO PRIV NONFINL SCT N	UKBGAPR.R
United States	US GENERAL GOVERNMENT - DEBT, GROSS (%GDP) NADJ	USXGGG%.R	US CREDIT-TO-GDP RATIO(ACTUAL DATA)-CDT TO PRIV NONFINL SCT N	USBGAPR.R
Vietnam	IMF		IMF	

```
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keep if PublicG == 0
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eststo clear
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xtreg Returns RateA GDP MSCI i.PublicG##c.RateA i.PrivateG##c.RateA, fe
margins, dydx(RateA) at(PrivateG=(1 0 2)) post
esttab using marginsprivate1.rtf, star(* 0.10 ** 0.05 *** 0.01) replace
xtreg Returns RateA GDP MSCI REERD i.PublicG##c.RateA i.PrivateG##c.RateA, fe
margins, dydx(RateA) at(PrivateG=(1 0 2)) post
esttab using marginsprivate2.rtf, star(* 0.10 ** 0.05 *** 0.01) replace

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xtreg Returns RateA GDP MSCI i.PublicG##c.RateA i.PrivateG##c.RateA, fe
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eststo: xtreg Returns RateD GDP MSCI REERD, fe
eststo: xtreg Returns RateD GDP MSCI REERD Publicdebt Privatedebt, fe
eststo: xtreg Returns RateD GDP MSCI REERD Publicdebt Privatedebt Sigma, fe
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eststo clear
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eststo: xtreg Returns RateD GDP MSCI i.Period REERD, fe
eststo: xtreg Returns RateD GDP MSCI i.Period REERD Sigma, fe
eststo: xtreg Returns RateD GDP MSCI i.Period REERD Sigma Publicdebt Privatedebt, fe
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eststo clear
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eststo: xtreg Returns RateD GDP MSCI i.PublicG##c.RateD i.PrivateG##c.RateD, fe
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eststo: xtreg Returns Rate100 GDP MSCI REERD, fe
eststo: xtreg Returns Rate100 GDP MSCI REERD Publicdebt Privatedebt, fe
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esttab using fixedeffectsinteractionG2.rtf, star(* 0.10 ** 0.05 *** 0.01) r2 replace
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eststo: xtreg Returns RateA GDP MSCI i.PublicG4##c.RateA i.PrivateG4##c.RateA, fe
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esttab using fixedeffectsinteractionG4.rtf, star(* 0.10 ** 0.05 *** 0.01) r2 replace
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eststo: xtreg Returns RateA GDP MSCI REERD i.PublicG3##c.RateA i.PrivateG3##c.RateA, fe
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eststo clear
eststo: xtreg Returns RateA GDP MSCI REERD i.PublicG##c.RateA i.HHG##c.RateA, fe
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eststo: xtreg Returns RateA GDP MSCI REERD i.PublicG##c.RateA i.HHG##c.RateA
i.CorpG##c.RateA, fe
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i.CorpG2##c.RateA, fe
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eststo clear
margins, dydx(RateA) at(HHG2=(1 0 2) post
esttab using marginsHHG.rtf, star(* 0.10 ** 0.05 *** 0.01) replace

xtreg Returns RateA GDP MSCI i.Growth#c.RateA, fe
margins, dydx(RateA) at(Growth=(0 1)) post
esttab using marginsGrowth1.rtf, star(* 0.10 ** 0.05 *** 0.01) replace
xtreg Returns RateA GDP MSCI REERD i.Growth#c.RateA, fe
margins, dydx(RateA) at(Growth=(0 1)) post
esttab using marginsGrowth2.rtf, star(* 0.10 ** 0.05 *** 0.01) replace
xtreg Returns RateA GDP MSCI REERD Publicdebt Privatedebt i.Growth#c.RateA, fe
margins, dydx(RateA) at(Growth=(0 1)) post
esttab using marginsGrowth3.rtf, star(* 0.10 ** 0.05 *** 0.01) replace

eststo clear
```

```
eststo: xtreg Returns RateA RateA_lag RateA_lag2 RateA_lag3 RateA_lag4 GDP MSCI, fe
eststo: xtreg Returns RateA RateA_lag RateA_lag2 RateA_lag3 RateA_lag4 GDP MSCI REERD, fe
eststo: xtreg Returns RateA RateA_lag RateA_lag2 RateA_lag3 RateA_lag4 GDP MSCI REERD
Publicdebt Privatedebt, fe
esttab using fixedeffectslags.rtf, star(* 0.10 ** 0.05 *** 0.01) r2 replace


eststo clear
eststo: xtabond2 Returns L.Returns RateA GDP MSCI, gmm(L2.GDP L2.Returns, lag(. 28) collapse)
robust
eststo: xtabond2 Returns L.Returns RateA GDP MSCI REERD, gmm(L2.GDP L2.Returns, lag(. 28)
collapse) robust
eststo: xtabond2 Returns L.Returns RateA GDP MSCI REERD Publicdebt Privatedebt, gmm(L2.GDP
L2.Returns, lag(. 28) collapse) robust
esttab using bond2lags.rtf, replace starlevels(* 0.1 ** 0.05 *** 0.01) r2 stats(N hansen)

eststo clear
eststo: xtabond2 Returns L.Returns RateA GDP MSCI, gmm(L3.GDP L3.Returns, lag(. 28) collapse)
robust
eststo: xtabond2 Returns L.Returns RateA GDP MSCI REERD, gmm(L3.GDP L3.Returns, lag(. 28)
collapse) robust
eststo: xtabond2 Returns L.Returns RateA GDP MSCI REERD Publicdebt Privatedebt, gmm(L3.GDP
L3.Returns, lag(. 28) collapse) robust
esttab using bond3lags.rtf, replace starlevels(* 0.1 ** 0.05 *** 0.01) r2 stats(N hansen)


eststo clear
eststo: xtabond2 Returns L.Returns RateA GDP i.PublicG##c.RateA i.PrivateG##c.RateA,
gmm(L2.GDP L2.Returns, lag(. 28) collapse) robust
eststo: xtabond2 Returns L.Returns RateA GDP MSCI i.PublicG##c.RateA i.PrivateG##c.RateA,
gmm(L2.GDP L2.Returns, lag(. 28) collapse) robust
eststo: xtabond2 Returns L.Returns RateA GDP MSCI REERD i.PublicG##c.RateA
i.PrivateG##c.RateA, gmm(L2.GDP L2.Returns, lag(. 28) collapse) robust
esttab using bond2lagsint.rtf, replace starlevels(* 0.1 ** 0.05 *** 0.01) r2 stats(N hansen)

eststo clear
eststo: xtabond2 Returns L.Returns RateA GDP i.PublicG##c.RateA i.PrivateG##c.RateA,
gmm(L3.GDP L3.Returns, lag(. 28) collapse) robust
eststo: xtabond2 Returns L.Returns RateA GDP MSCI i.PublicG##c.RateA i.PrivateG##c.RateA,
gmm(L3.GDP L3.Returns, lag(. 28) collapse) robust
eststo: xtabond2 Returns L.Returns RateA GDP MSCI REERD i.PublicG##c.RateA
i.PrivateG##c.RateA, gmm(L3.GDP L3.Returns, lag(. 28) collapse) robust
esttab using bond3lagsint.rtf, replace starlevels(* 0.1 ** 0.05 *** 0.01) r2 stats(N hansen)
```