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The effect of the debt ceiling on the possibility of a sovereign default of the United States

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ABSTRACT

This research measures the relationship between the debt ceiling and the probability of default of the United States. The debt ceiling is linked to the Monetary Uncertainty index, which is measured by the sovereign Credit default Swap prices of 1-, 5- and 10-year maturities. In May 2023, CDS prices have risen to an all-time high, showing the uncertainty and high risk of default. Next to this, this paper also checks for the optimal level of sovereign debt. The results show that the current level of debt is substantially above the optimal level and that the monetary uncertainty undoubtedly plays a significant role in the probability of default. Next to this, the Polarization and Trade Balance play an important role in determining the CDS Prices. The results imply that the level of debt and polarization should be decreased and policy makers should make a plan to repay the debt, not only by increasing the GDP Growth.

Keywords: Debt, Ceiling, Default, Monetary, US,

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CHAPTER 1 Introduction

In May 2023 the United States were in a dangerous political stalemate. At that moment, Kevin McCarthy, the House Speaker of the US, did not agree to raise the debt ceiling, as president Biden requested. The so called debt ceiling is the maximum amount of national debt the US is authorized by law to have. This political stalemate could have led to a debt crisis and even worse. If the debt ceiling would not be raised before mid-June, the US would have to default on its bonds (CNN, 2023). With hindsight, fortunately, they have come to an agreement. In 2011 there has been a close call of a sovereign default of the United States, as there was an agreement to raise the debt limit only two days prior to the day the government would not be able to fulfil its obligations. The threat of a default already resulted in a downgrade of the US rating and a large decrease in stock prices. We will investigate what effect the uncertainty of the debt ceiling will have on the sovereign default risk of the United States.

The relationship between debt uncertainty and sovereign default risk has been investigated earlier by Montes and Souza (2020), regarding the case of Brazil. By looking at the Credit Default Swap (CDS) rates, they found that an increase in debt uncertainty increased the CDS rates, reflecting the increased sovereign default probability. A Credit Default Swap should resemble the premium for taking the risk of having to pay obligation holders of a specific country in case of a default. Wang et al (2019), as well as Tomasz Piotr (2015) have considered what effect economic uncertainty would have on CDS rates. A higher economic uncertainty leads to higher CDS prices of public and private bonds. Furthermore there has been several research on the relationship of the optimal debt level and interest rate of companies, like by the paper of Stiglitz & Weiss (2018). This paper states that increased debt uncertainty of companies will lead to higher interest rates demanded by investors.

However, these papers only regard CDS indices at company-level, the effect of economic uncertainty on CDS indices or the relation of debt uncertainty and CDS prices on another country like Brazil. As far as I know, no other researcher has specifically looked at the effect of the increasing debt ceiling of the United States related to the probability its government could default on its obligations. Next to this, we also do not know the optimal level of public debt and interest rate for the United States, which could help to explain the credit default swap prices. This has only been investigated in general, but not specifically for the US today. Aiagary and McGrattan (1998) found that the general optimal debt/gdp ratio should be 50 percent and the optimal interest rate 4,4 percent. The main question of this paper will be: What effect does the debt ceiling of the United states have on the Credit Default Swap price of the one- five and 10-year US public bonds? We will have a look at different time horizons, because not all investors will have the same expectations of the impact of the public debt on the probability of a sovereign default.

The main objective of this paper will be to find the probability of a sovereign default of the United States.

This will be measured by the dependent variable of the Credit Default Swap prices of public US bonds. We will get this data from the database Eikon, which offers data about the worldwide financial markets. CDS prices and rates should reflect 73% of the risk of a possible default (Badoui et al, 2013). By using Stata, we will create two regressions.

The first regression will have the CDS prices as the dependent variable and the debt uncertainty as the independent factor. The debt uncertainty will measured by the ''Monetary uncertainty index'' which can be found on the website Policy Uncertainty. The debt uncertainty will also be measured by a variable of the amount of searches for ''debt ceiling'' on Google Trends. We will eventually choose the variable which has the highest explanatory and theoretical value. The second regression will have the real interest rate as the dependent variable. This will be a quadratic regression and will take the public debt as the first independent factor and the square of the public debt as the second factor. The public debt is defined as the level of national debt of the United States. The Fiscal data of the US department of Treasury provides real time data about the level of the American national Debt. The first derivative of this regression will give us the optimum level of debt and interest rate the United States should have.

For the first regression, which will have our main focus, we use the Polarization index , Trade Balance, GDP Growth and the real interest rate of the United States as our control variables. According to the literature GDP growth and the Trade Balance are important determinants of a sovereign default. The level of polarization is measured with the data of Voteview, which measures the different votes of senate and house members in the American politics. As polarization increases, the possibility of a debt crisis or shutdown increases, which also increases the risk of sovereign default. The real interest rate determines the risk premium for countries. The risk premium is related to the debt uncertainty, as investors demand a higher interest rate for a higher uncertainty. We will get these data from the St. Louis Bank. For the second regression, we will use the polarization index as a control variable.

To test for robustness of this research we will test for heteroskedasticity, autocorrelation and stationarity, because these are the most important tests for time series (Brooks 2019). This research is feasible because we have the data available on interest rates, Credit Default Swaps, sovereign debt and the debt ceilings of the US. We will check for the period from 2008-2023, to take into account the banking crisis of 2008, to include previous debt crises of 2011 and 2013 and the current starting debt crisis.

My prediction is, that we will see the prices and rates of Credit Default Swaps reflect the possibility of a default of the United States. This means CDS prices on the public bonds will spike during recessions and crises. I expect them to be close to historical debt crises levels in May 2023, presumably meaning the risk of a default is too high. The outcome of this paper will contribute to understanding the effect of the increasing debt of the United States on the possibility of a sovereign default by looking at the link of Credit Default Swaps. It will hopefully challenge the thought of impossibility of a sovereign debt crisis of the United states, help to find the optimal level of debt and prevent a sovereign default in the future.

The remainder of this paper is structured as follows. Section 2 will discuss the existing relevant literature and previous research on this topic. Section 3 will give an explanation about the used data and provide the descriptive statistics and a correlation matrix of the variables. Section 4 will describe the method we have used for the research. In Section 5 we will take a look at and discuss the results, In the last section we will draw a conclusion about what we can learn from the research and what this implies for policymakers and researchers.

CHAPTER 2 Theoretical Framework

2.1 Sovereign Default

2.1.1 General Overview

According to Standard and Poor (2021), a sovereign default, abbreviated as SD in this paper, is defined as a financial event in which the government is not able to pay its debt obligations in time or that has to issue new debt for less favourable terms. When a country has a to borrow more than 100 percent of its contributed quota to IMF, it is also considered to be in an SD. (Manasse et al. 2003). A sovereign default could eventually lead to a denied access to the financial markets. With a good credit record however, the lenders will first bargain about the debt reduction the country will get in order to be able to pay back the residual debt and interest payments. (Yue 2003).

Three significant examples of this financial event are the Argentine economic crisis of 2001, the Greek debt crisis of 2010 and the Russian Financial crisis of 1998. High levels of public debt in combination with for example an recession triggered an default on its obligations for these countries. Following the financial crisis in the United States of 2007, the high public debt level and the negative current balance of 9 percent of its GDP led to concerns among European investors. When cross border financial investments dried up, investors reassessed their investments and their growth prospects and the new chosen government of Greece chose to revise the GDP deficit from 6 to 12 percent, sovereign bond prices surged. Greece was shut out from the bond markets and other EU countries followed with a default, eventually resulting in a European sovereign debt crisis in 2010 (Lane 2012).

Quite often, defaults are triggered by other sovereign defaults. Likewise with Russia in 1998, which was largely influenced by the Asian currency crisis, which led to more speculation. In combination with fiscal imbalances and increased inflation this led to a default on obligations. The Ruble lost two-thirds of its value within three weeks. Fortunately the economy recovered quickly by increased oil income, an attractive exchange rate, sharp GDP growth and a loan from the IMF (Economics Observatory 2022). The Russian Default of 1998 in combination with the LTCM crisis and other external shocks triggered yet another huge default; the one of Argentina. After this country had overcome hyperinflation in 1989 and the Mexican crisis in 1995, these shocks led to a severe recession followed by a low GDP Growth and self-fulfilling concerns about the debt sustainability. Spreads rose and after deposit freeze imposed by the government, extra IMF loans and more political unrest a partial default followed, leading to a cut of 20 percent of its GDP (IMF 2003). From the news from 2023, we can infer Argentine still has difficulties repaying their debt today, showing the impact of such a default. (FT 2023).

According to Ams et al. (2019), who have investigated the sovereign default in general, there are different market instruments to create a default. The key findings extracted from this paper are the following: A government could choose to repudiate a part of the debt, choose to postpone payments for debt restructuring, link non-related government instruments to the bonds, or even choose to repay nothing at all. The choice of a default will of course influence future debt terms and have political implications. The government could also choose to partially default by increasing the total money supply given out by the central bank. It is a stylized fact that governments most of the time decide to partially default (Grossman & Van Huck 1985). This will devalue the total of public debt. However, this strategy has serious risks of creating a crisis or even possibly hyperinflation (Cochrane 2011, Davig et al. 2011). Another thing a government could try, is to reduce the public debt by increasing the General Domestic Product, denoted as GDP. However, according to Reinhart and Rogoff (2015), a debt overhang will lead to a 1.2 percent lower GDP growth. Lane (2012), who has investigated the EU sovereign debt crisis, mentions that it will be hard to increase the GDP growth with more than 2 percent on average and to reduce debt due to political environments and regulations.

A government defaulting on its obligations will lead to significant, but only short-term costs. The credit rating of the specific country will be lowered, but will increase quite soon after. Next to a lowered rating, a default could lead to a banking crisis because of lost confidence in the domestic banking sector, a loss of the assets of the bank because of government debt holdings and finally because of worsened creditor terms. There also seems to be an important relation of politics and SD. Because the costs of a default are high for the people in office, politicians are reluctant to decrease the debt or to default on the debt. However, this could lead to politicians delaying default which could lead to high costs of uncertainty and for the banking sector. (Borensztein and Panizza 2009)

2.1.2 The case of the United States

A debt crisis means a country is close to a unsustainable debt level. From 1790 until 2023, we have seen five debt crises in the United States. The Civil war in 1865, the first and second World War, the Great Depression and the Great Recession of 2011. These debt crises followed a sharp in increase of total debt. More recently the Covid Crisis has surged the total debt. (Ratchford 1947, Mendoza 2017, Federal Reserve Bank of St. Louis n.d.). In 2011 the US was four days close to not being able to pay its debts, as a result of a political stalemate which led to the debt ceiling not being raised. Based on the IMF, a country is in a debt crisis when it needs a ‘’non concessional’’ loan that is paid out that year (Manasse et al. 2003). With the US being close to a default, the risks and uncertainty resembled a debt crisis. Mendoza (2017) defines a debt crisis as a 5-percent or more year-on-year increase in the public debt ratio.

The discussion of a sovereign default is relevant for the United States, because they have been facing a debt crisis, as the debt ceiling was not raised until June 2023. The current macroeconomic challenges demand the US to increase its defence’ spendings and also the domestic current political and financial system seems to be unstable. With the United States being the largest world economy, it is generally assumed almost impossible for the US to default on its debt. Tax increases are regarded as unpopular and expenses are not likely to decrease. For the coming ten years, the Biden administration projects a growth in the national debt from 98 to 108 percent (White House 2023). This could raise the question if the debt is not growing unto unpayable heights for the challenging future. In the months up to June the Credit Default Swap prices have risen to unprecedented heights. Where we have seen peaks in the price of the 1-year swap of 75$ in 2008 and 2011, the price in the previous months has reached 160$ (Eikon 2023). Also the 5- and 10-year swap prices are close to their previous peaks. This shows how serious the current situation is.

If the United States would ever fully default, even if it would be brief, the impact would be enormous. A longer period of default would result in a decrease of stock prices by 45 percent, meaning a lot of pension funds are vanished and a lot of uncertainty across financial markets. The General Domestic product would decrease by 6 percent and 8 million people would lose their job. Also the government would not be able to pay all its obligations, like the Social security, meaning a lot of people are not able to pay their bills. Since the interest rate will also increase, borrowing will be expensive. (Council of Economic Advisors, White House 2023). As foreign investors consider the United States as a safe haven, 58 percent of the worldwide foreign exchange reserves is hold in dollars. Some countries are even fully reliant on the dollar as it is their national currency. A default of the US would lead to a sharp decrease of trustworthiness in the dollar and reduced investments, consumption and global GDP growth (PBS 2023). While the debt ceiling helps to restrict a government from excessively spending, the previous debt crises have shown that the public debt also can be a political tool, which can be regarded as dangerous, knowing the enormous consequences a default would have. When there are uncertain times with high government spendings, like the Covid Crisis, the debate starts again in the media and politics if the debt would be sustainable. While the debt ceiling is now raised until 2025, the question rises if the public debt is not getting unsustainable and if we will possibly face an even bigger debt crisis in 2025.

2.2 Determinants of Sovereign Default

2.2.1 Overview

A major seminal study for sovereign default determinants is the paper of Cantor and Packer (1996). With the rating criteria of the sovereign rating companies Moody's and Standard and Poor, they get to the following significant determinants of sovereign ratings: per capita income, GDP Growth, Inflation, External debt and indicators for economic development and the Default history of a country. The latter factor is also confirmed by Reinhart and Rogoff (2003). Despite all these interesting factors, they stated that the market is best in pricing the default risk. In a research for the determinants of SD of the European Monetary Union, Eichler and Maltritz (2013) found that creditors expect a default only because of solvency issues, not because of liquidity factors. This means that high indebtedness is not a problem for the long run. What matters is the GDP and debt growth, openness of country, due to external shocks, and the Trade balance. For the debt growth, the interest rate is an important predictor. According to Hilscher and Nobusch (2010), the terms of trade, related to the Trade balance mentioned above, is an important predictor. Afonso and Gomes (2011) have emphasized the difference between short- and long-term factors of sovereign debt credit ratings. This distinction can be made by looking at the average of factors as well as at the total value. It is important to look at the short and long run to get to the right policy. By modelling two regressions on the changes in sovereign credit ratings, they found that the GDP level and real growth, public debt level and government balance were the variables with short run impact. The level of external reserves, debt history, external debt are variables with significant long run impact on sovereign rating. Unlike previous literature from 2011, fiscal variables are more significant than assumed. According to their research, GDP growth and government balances were the most important variables. In the sections below, we will highlight the three most important determinants of SD according to the papers mentioned above, namely the Default history, GDP Growth and Trade balance. Because Eichler and Maltritz (2013) and Afonso and Gomes (2011) have emphasized the importance of long term solvency factors, I expect the determinants only to be significant if these have a negative trend and will not improve the next ten years. The US has a Default history of no defaults and a stable GDP growth.

Whether a country has defaulted or not has will certainly have an effect on the credit terms it will get from creditors. With a history of default, creditors and bond holders will demand a higher interest rate or even choose to not give out a loan. A higher interest rate or a more limited access to loans could be the start of a default because a country will not be able to pay back its loans and GDP growth will be reduced by a higher interest rate. The risk premia for countries with a default history are not likely to change (Lane 2012). Cruces and Trebesch (2013) mention that large investments losses, also called haircuts, potentially lead to higher bond yields and longer capital market exclusion, showing that the default history could be an important predictor of sovereign default and a sign that investors calculate a higher risk premium. Because the importance of the Default History is proved in much literature and the United States has had the best possible rating almost all the time we will not construct a hypothesis for this variable. It is highly likely that the history of no default reduces the current possibility of default.

2.2.2 GDP Growth (Hypothesis 1)

GDP, which stands for Gross Domestic Product, is defined as the monetary value of final goods and services that is bought by a country in a year. It is all the output measured within the borders of a country. GDP is considered to be important because it shows the size of an economy and how its growth can show how well a country is performing. Since 2012 the average global GDP growth rate is 3,4 percent. Higher GDP means more production, leading to more employment and income generated (Callen 2012). Higher income will mean a higher possibility of repaying the debt, improving the sovereign credit rating. As long as the GDP Growth keeps stable we should not worry about a default. But just like the Covid Crisis, unexpected events can occur, reducing the real GDP Growth.

Furceri and Zdzienicka (2012) have checked for the role of debt crises on GDP Growth. Since the debt ceiling of the US makes debt crises more common, this is an important relation to look at. A debt crisis on average lowers GDP growth with 10 percent after 8 years. This should worry policymakers about the risk of a default. The authors also mentions another important point. When the total debt/GDP ratio exceeds a given threshold of 70 percent, output lowers with 1.8 percent. Afonso and Gomes (2012) mention that a higher GDP is usually linked with more stable institutions and a higher Growth helps the government to repay its obligations. Gaillard (2009), which has elaborated on the papers of Afonso and Gomes and Cantor, which both state that GDP Growth is an important determinant, has empirically showed that the level of GDP is the most important factor for Moody's for determining the credit rating of a country.

Because the focus of policy makers, and also president Biden, is on increasing real GDP growth (White House 2023), we will specifically look at this variable. Because of the relevant literature and logic, we will expect an increase in GDP growth to have a negative effect on the probability of a sovereign default.

Hypothesis 1: *''An increase in the real GDP Growth will have a significant negative long run effect (-) on the probability of sovereign default of the United States''*

Please notice that a negative effect on the probability of sovereign default is positive regarding the sovereign credit rating of a country.

2.2.3 Trade Balance (Hypothesis 2)

The trade balance is defined as the difference between the sum of export and import of a country. A positive balance will mean a country is generating revenue with its trade. When we consider Trade Balance, we should consider the S curve, mentioned by Backus et al in 1992. The S-curve stands for the relation between the Trade balance and the terms of trade. Better terms of trade will deteriorate a country's trade balance and later on will actually improve its Trade Balance. The reason for this, are the higher prices of exported products, which means the demand for this products will be low first and the demand for import will be higher. Later on, a country will stimulate its export due to the higher revenues generated due to the higher export prices, resulting in a more positive trade balance. Because companies are reliant on certain imports and exports, it will take time to change a Trade balance. Eichler and Maltritz (2013) state that the Trade Balance is an important determinant of an SD, because it may serve as in indicator of high competition in the economy. More competition, generally means more profits. Afonso et al. (2011) also state the Current Account is really important, The Trade balance is a part of this. The US Trade balance is negative for a more than 30 years, and the negative balance keeps increasing. (FRED 2023)

Hypothesis 2: *''A positive Trade Balance will have a significant negative (-) long term effect on the probability of sovereign default of the United States''*

2.3 Monetary Uncertainty

2.3.1 Overview

Similarly like the Debt Uncertainty from the paper of Montes and Souza (2020), which measures the disagreement in expectations about public debt, we will take a look at the Monetary Uncertainty. According to Choi and Oh (2003), Monetary Uncertainty is defined as the volatility in the money supply from the central bank. Monetary Uncertainty means uncertainty about the monetary policy and the future monetary conditions. Since central banks have purchased large amounts of public debt after the financial crisis of 2011, we can state monetary policy and debt management are cointegrated nowadays (Zampolli 2012).

The discussion about monetary policy has evolved, particularly from 1980 with the introduction of the Vector Autoregression technique (VAR)(Rusnak et al. 2013). De Grauwe and Costa (2004) have conducted a meta-analysis on the effects of monetary policy by looking at empirical papers that discuss this topic. They have looked at the effects of monetary policy on price and output levels on the short, 1 year, and long term, 5 years. Papers nowadays make more use of the VAR, which helps to look at joint impact of several factors on prices and output, unlike one variable. In the past, by using a regression, the effect of only one variable was measured. Different techniques have led to different conclusions on the effect of monetary policy. De Grauwe and Costa (2004) have found that there are no differences in the effect between the EU and the US, as presumed, and that inflation makes the monetary policy less efficient. The use of the VAR produces much larger long term effects and produces the price puzzle, which means that a contraction in monetary policy leads to higher prices. Rusnak et al. (2013) have solved these puzzle by looking at 1000 datapoints from 70 previous researches, stating that a contraction will lead to a decrease in prices in the long run, but most researchers only look at the short run and that results are highly country-dependent.

A central bank has several instruments to execute monetary policy, like buying securities from or setting a minimum reserve requirements to commercial banks (Bofinger et al 2001). With their instruments they are able to influence total money supply and interest rates. By raising the total money supply they are able to raise inflation and lower the interest rate, which are favorable for managing the debt and increasing tax revenues (Bachetta et al 2018). When there is much uncertainty due to a debt crisis, it is also highly uncertain what the monetary policy will look like.

2.3.2 Public debt

When a government borrows more money than it generates, it creates public debt. The main instruments to increase revenues are increasing tax or public Debt. According to the Ricardian Equivalence both will equally attribute to an increase of wealth for the society (Barro 1979). However because of the excess burden of collecting taxes, there should be an optimal path of debt issuing. Bohn (1998) states that the US has a mean-reverting debt to GDP ratio, creating a primary surplus in times of high debt and vice versa. This is in contrast to Barro (1979), who states that tax smoothing is necessary for economic stability. While public debt helps to make investments, a too high debt reduces GDP growth and investment potential. Just like Bohn (1998), Ostry et al. (2015) are in favor of not rushing to reduce public debt, but to wait for financial good times to pay down parts of the debt.

Governments borrow in order to smooth tax or to make investments to create more economic growth. The money can be borrowed from domestic, household and banks, as well as foreign borrowers. The rate for which a government can borrow, also known as the treasury interest rate, is dependent on the amount of debt generated and creditworthiness. Overall, because the treasury interest rate is lower than the average GDP growth rate, a debt rollover, a situation in which the US can issue debt and lower the debt to GDP ratio at the same time, is feasible (Blanchard 2019). Nippani and Smith (2014), have showed that the US debt ceiling which has resulted in a shutdown has led to an increase of the short term treasury rate in 2013.

2.3.3 Monetary Uncertainty of the US (Hypothesis 3 & 4)

I expect the United States to be above the optimal debt. Because Reinhart and Rogoff (2015) have stated that a debt overhang will lead to lower GDP Growth, the United States should worry about the level of the debt, as I expect this effect to get even bigger when the debt keeps increasing. The Federal bank and the government have to find the optimal path to pay back debt in order to keep the GDP growing and the monetary uncertainty low. An increasing monetary uncertainty makes according to my hypothesis it more difficult to pay back the debt. The debt ceiling helps in preventing an excessively fast growing public debt, but also restricts the government in choosing the optimal debt repayment path. While Elder (1995) states that monetary uncertainty does not have a negative on real output, I expect it to be a problem for repaying the debt.

Hypothesis 3: ''A higher Monetary Uncertainty will have a significant positive (+) short- and long term effect on the probability of sovereign default of the United States''

In this research we will also take a look at the relationship between the treasury interest rate of different maturities and the level of the public debt of the United States to check if the debt is possibly to high at the moment. If this is the case, this is an important indicator of an unsustainable debt.

Hypothesis 4: "The current level of the sovereign debt of the United states is above the optimal level"

CHAPTER 3 Data

3.1 Sample

To measure the effect of monetary uncertainty on the probability of a sovereign default of the United states, we will use two regressions, further explained in the section 3.3 Methodology. We will look at the period of October 2008 until 2023, for which we have data available for all variables. The data consists of daily, monthly and quarterly measures. This period includes different important events like the banking crisis and a close call with a sovereign default of the US in 2011, which helps us to compare global and domestic political and economic situations over time. The different variables have a different amount and way of measuring, which will be explained in the next sections. For the different time horizons of the Credit Default Swap prices as well as for the Treasury Rate, we will use subscripts in the name.

3.2 Probability of Default – CDS Prices

In order to measure the probability of default, referred to as *''ProbDefault''*, we will use the Senior Credit Default Swap Prices on one-, five- and ten-year public bonds of the United States. According to Badoui et al (2013), Credit Default Swaps should resemble 73% of the default risk. The database Eikon, which offers real time data of the financial markets will offer us the prices from Oktober 2008 until May 2023. A credit default swap insures the buyer it will pay back its value in case of a default in exchange for a certain premium. In 2022 the total Credit Default Swap market was valued at 30 trillion (SPGlobal 2023). From the summary statistics we can observe the Credit Default Swap price increases for a longer maturity period. This makes sense, because a longer maturity period brings more uncertainty and demands a higher premium for the seller of the CDS. In total this variable has 3800 observations and corresponding means of 12, 20 and 28 dollar for the different horizons. All of them have a standard deviation of 12 dollar.

3.3 Treasury Interest Rate

The Treasury Interest rate, also known as the risk-free rate, will to referred to as *''TrRate''*. It represents the yield or interest rate on government securities, like Treasury bonds and bills. The rate is determined through auctions conducted by the U.S. department of Treasury. The Treasury Interested rate will be collected from the Treasury Government database for the period of 2008 until may2023. This variable is an important variable to look at, because it is the price of borrowing for the United States, which could tell us a lot about the sustainability of debt and perspectives for the economy. From Table 1 we can observe the corresponding mean and standard deviations for the different maturities of the Treasury Interest rate.

3.4 Determinants

3.4.1 Monetary Uncertainty

The dependent variable Monetary Uncertainty, referred to as ‘’*MonUnc’’,* will be constructed by looking at two different datasets. The first variable will be the ’Monetary uncertainty index’’ from the website Policyuncertainty.com which measures the uncertainty by looking at the Husted-Rogers-Sun MPU index created by Husted et al (2017). This index looks at keywords related to this variable in the New York Times, Wall Street Journal and the Washington Post. The index is created in cooperation with the FED. Next to this variable we will also look at the amount of searches for *‘’debt ceiling’’* on Google Trends. Because some variables got the value of <1, I transformed this number into 0,5 for these datapoints. Due to this, I expect the Husted Index to be more robust for errors than the Google Trends Index.
Because both variables are measured for a longer period. the mean is not an exact number. The Husted Index has a mean of 100 over the total period measured for 1985-2023. The Google Trends data is measured from 2004-2023 and has a maximum of 100 for data outside the used data over the month May 2023, reported on the first day of June. Our data reaches until 1 May of June 2023.

3.4.2 Public Debt

We use the public debt, referred to as ‘’*PubDebt’’* for the second regression. The public debt is the amount of debt the government of the United States has outstanding to domestic and foreign creditors. For this variable we have the data available for the given time period. The Fiscal data of the US department of Treasury provides real time data about the level of the American national Debt.
From the minimum and maximum we can see the debt has grown enormously the last 15 years. The debt is currently at its maximum, at 31,5 trillion dollar, because the US is not reducing the public debt, while the expenses have keep rising. The mean lies at 19,7 trillion dollar and the standard deviation is almost 6 billion. As the debt increases, it increases exponentially due to interest rates over an increasing amount of debt. The data for Public debt reaches from October 2008 until March 2023.

3.5 Control Variables

To control for our regressions we will use several control variables. These will be the GDP growth and an indicator for the Trade balance as well as for the Polarization. Also the interest rate will be an important control variable. This data will be collected from the FRED database of the St Louis bank. For the polarization index we will use the database of VoteView. We will collect data from 2008- May 2023. The Gross Domestic Product Growth, referred to as ''*GDPGrowth*'' and the Trade Balance variable, referred to as *''TradeBalance''* are important determinants of sovereign default according to the existing literature. The data of the GDP Growth reaches from July 2008 until 1 January 2023. The available data of Tradebalance reaches until the first of March of 2023.

Because of the current debate about the debt ceiling and increasing polarization in the United States, it would be interesting to also consider a polarization index, referred to as *''PolarIndex".* When there is more polarization, there will be more uncertainty about the existing debt ceiling and a possible government shutdown. The dataset Voteview creates a so-called Nominate-measure, which measures the ideological position of politicians by looking at their voting history on different issues. At last, we will also consider the Interest Rate, referred to as *''InterestRate'',* because it is important indicator for future investment opportunities and also the health of the banking sector. This variable has a mean and a standard deviation of .72 and 1.07 percent respectively, and is measured until the 5th of May.

3.6 Descriptive Statistics

Table 1

	E(COUNT)	E(SUM_W)	E(MEAN)	E(VAR)	E(SD)	E(MIN)	E(MAX)	E(SUM)
PROBDEFAULT_1Y	3800	3800	11.98933	149.6608	12.23359	1	149.23	45559.47
PROBDEFAULT_5Y	3800	3800	19.75554	148.5753	12.18915	5.46	90	75071.07
PROBDEFAULT_10Y	3800	3800	27.75244	150.3694	12.26252	8.69	92	105459.3
MONUNC_HUSTED	176	176	3.100084	296.5701	17.22121	0	111.0656	545.6147
MONUNC_GOOGLET	176	176	1.133523	11.19778	3.346309	0	33	199.5
PUBDEBT	3635	3635	1.97(10^13)	3.20(10^25)	5.65(10^12)	1.01(10^13)	3.15(10^13)	7.15(10^16)
TRRATE_1Y	3670	3670	.9170817	1.374869	1.172548	0	5.25	3365.69
TRRATE_5Y	3670	3670	1.71649	.7132905	.8445653	0	4.45	6299.52
TRRATE_20Y	3669	3669	2.8577	.7166944	.846578	.8	4.7	10484.9
TRRATE_1M	3669	3669	.6125375	1.189085	1.090452	0	6	2247.4
TRRATE_6M	3670	3670	.8224905	1.429012	1.195413	0	5.52	3018.54
GDPGROWTH	58	58	.0101445	.000354	.0188156	-.0882764	.0878811	.5883789
TRADEBALANCE	175	175	-48031.01	1.78e+08	13349.88	-102536	-25839	-8405426
POLARINDEX	5361	5361	.8513273	.000984	.0313684	.78591	.9074748	4563.966
INTERESTRATES	5361	5361	.720125	1.149407	1.072104	.04	5.08	3860.59

*The descriptive variables are elaborated in section 3.3 and 3.4.

3.7 Correlation Matrix

Table 2

	Prob Default_1Y	ProbDefault_5Y	ProbDefault_10Y	MonUnc_Husted	MonUnc_GoogleT	PubDebt	TRRate_1Y	TRRate_5Y	TRRate_20Y	TRRate_1M	TRRate_6M	GDP Growth	Trade Balance	Polar Index	Interest rates
PROBDEFAULT_1Y	1.000														
PROBDEFAULT_5Y	0.714**	1.000													
PROBDEFAULT_10Y	0.596**	0.954**	1.000												
MONUNC_HUSTED	0.181**	0.414**	0.391**	1.000											
MONUNC_GOOGLET	0.708**	0.366**	0.241**	-0.049	1.000										
PUBDEBT	-0.236**	-0.618**	-0.659**	-0.216**	-0.103	1.000									
TRRATE_1Y	0.269**	-0.105**	-0.205**	0.038	0.159*	0.501**	1.000								
TRRATE_5Y	0.288**	0.075**	-0.035**	0.088	0.126	0.109**	0.807**	1.000							
TRRATE_20Y	0.388**	0.514**	0.427**	0.161*	0.190**	-0.496**	0.240**	0.678**	1.000						
TRRATE_1M	0.263**	-0.142**	-0.238**	-0.038	0.190**	0.484**	0.960**	0.706**	0.169**	1.000					
TRRATE_6M	0.282**	-0.111**	-0.211**	0.014	0.183*	0.509**	0.994**	0.770**	0.213**	0.980**	1.000				
GDPGROWTH	-0.238	-0.252	-0.258*	-0.261**	0.013	0.277	-0.049	-0.058	-0.049	-0.012	-0.042	1			
TRADE BALANCE	0.137	0.405**	0.498**	0.094	-0.006	-0.808**	-0.314**	-0.093	0.277**	-0.236**	-0.300**	-0.235*	1.000		
POLARINDEX	-0.124**	-0.604**	-0.545**	-0.368**	0.107	0.830**	0.438**	0.058**	-0.544**	0.463**	0.455**	0.212	-0.517**	1.000	
INTEREST RATES	0.278**	-0.131**	-0.224**	-0.046	0.195**	0.463**	0.960**	0.709**	0.171**	0.991**	0.980**	0.004	-0.277**	0.455**	1.000

*p<0.1, ** p<0.05

From the correlation matrix we notice that the CDS prices with 5 and 10 -year maturities have a high correlation of 91.4%. The 1 and 5 year prices have a correlation of 71.4%. Between the 1- and 10- year prices, this correlation is much lower. Other high correlations are the 70.8% between CDS 1-Year prices and the Monetary Uncertainty of Google Trends and the high correlation for the interest rate and the Treasury rate of different maturities. Latter is quite logical, as the interest rate is constructed as a result of the Treasury rate. What is quite remarkable is that the CDS prices and the Pubdebt move in different directions. We would expect a rise in the CDS prices for a higher public debt. Lastly we would expect reverse relations between CDS prices and the variables of GDPGrowth, Polar Index and Tradebalance.

CHAPTER 4 Method

Regression 1:

$$ProbDefault = \beta 0 + \beta 1 MonUnc + ControlVariables + \varepsilon t$$

Regression 2:

$$TrRate = \beta 0 + \beta 1 PubDebt + \beta 2 PubDeb^2 + ControlVariables + \varepsilon t$$

In order to get to the regressions from above we will make use of the statistical software of Stata. This is a software package which helps for data analysis and statistical modelling. We will make use of a Time series regression model, because it is a fairly simple, but clear way of measuring the effect of one variable on the other. We will check for the relationship between the variables over time by looking at the correlation.

All the explanatory variables are directly taken from their database. In order to construct the GDPGrowth control variable we used the data of the GDP at different quarters for the United states and calculated the relative growth per quarter. The Polarization Index is calculated by looking at different Houses of the American parliament and taking the sum of the relative position of the republicans subtracted by the position of the democrats. The data is based on observations on each member of the different houses from 2008-2023 with their political position, calculated by VoteView. Each different House of Parliament has its corresponding Polarization Index. Based on the dates of these Houses the polarization indices are assigned to the correct dates. To make the database more clear, we have changed the end dates of the houses to the day prior to the beginning date of the next parliament. The variables TradeBalance, InterestRate, PubDebt and TRRate_y are constructed directly from their database.

Our first regression will take the CDS prices as the independent variable and a factor of the monetary uncertainty as the dependent variable. We will run this regression for different maturities of the Credit Default Swaps. Our second regression will take the treasury interest rate as the dependent variable. The factors of the regression will be the level of public debt and the square of the latter. Next to the regressions we will also look at the correlation between different variables to check for multicollinearity.. To test the regressions we will use tests supported by Brooks (2019), who has constructed assumptions to test their correctness.

CHAPTER 5 Results & Discussion

5.1 Tests before the analysis

Because both our regressions will be time series, we need to check for heteroskedasticity, autocorrelation and stationarity. To test for the assumptions for the regression we will use the theory of Brooks (2019). To test for heteroskedasticity, which means the variance of the error term would be fluctuating, we will conduct the White Test, which can be found in Table 3. The P-value for both
regressions is smaller than the significance level of 5 percent, which means that both regressions have homoscedastic errors and thus meet the second assumption of Brooks.

Table 3: Testing for constant error variance

WHITE TEST	REGRESSION 1	REGRESSION 2
TEST STATISTIC	24.18561	887.8904
CHI-SQUARED	7	8
P-VALUE	.0011	2.(10^-186)

For the third assumption of Brooks, which looks at correlation of the error term, we will use the Breusch-Godfrey test. Uncorrelated errors are needed to prevent autocorrelation in the regressions. In Table 4 we can see the results of the Breusch-Godfrey test. A low Chi-squared shows there is no, to little autocorrelation. When the probability of the test bigger than the Chi-squared is smaller than the significance level of 5 percent, we can reject the null hypothesis of no autocorrelation. We can thus conclude that Regression 1 has no autocorrelation. Regression 2 does have significant autocorrelation. This has the consequence that the errors of regression 2 are not valid anymore. This suggests that we should work with Newey West errors. When we apply the Newey West error, we get new standard errors. These new errors are incorporated in our final regression 2.

Table 4: Testing for uncorrelated errors

BREUSCH GODFREY TEST	REGRESSION 1	REGRESSION 2
LAGS (P)	1	1
CHI-SQUARED	0.000	2748.982
DEGREES OF FREEDOM	1	1
PROB > CHI2	1.000	0.000

To test for the stationarity of the independent variables of both regressions we will use the Dickey Fuller Test, which can be found in Appendix C in Table 8. From the results we can conclude that Regression 1 is non-stationary at the 1-, 5- and 10-percent significance level. Regression 2 is only stationary at a 1-percent significance level, but not on the 5- and 10-percent level. This seems contra-intuitive, why would should be careful with interpreting these results. We could have adjusted for the non-stationarity of both regressions by taking the relative differences of the Credit Default Swap Prices and Treasury Rates, but because the output of these new regressions only gives us insignificant results, we will take the first difference. Also transforming the explanatory variables of the regressions does not solve the problem, as is lowers the R-squared of the models substantially below the 10 percent, while the normal regressions deliver models with an R-squared of above the 70 percent. Having non-stationary regressions, means we have to be aware of a trend in the data.

5.2 Regression 1

5.2.1. Overview

In the table below we can observe the relation between the sovereign Credit Default Swap Prices of the United States, denoted as the Probability of Default on the three different time horizons on the Monetary Uncertainty Indices from Husted and Google Trends. While Model 4 has the highest explanatory value according to the R-squared, **we will continue our regression with the Husted Index**, because I expect this regression to be more robust, as explained in the data section. When we take a look at Table 1, we see that all observations are significant on the 5% level. The Prices start with the constant and increase with the corresponding value in the table when the Monetary Uncertainty increases by 1 point. For CDS of 1 Year the corresponding value is 0.204 with a standard error of .0999. For Table 2, the interpretation is quite similar, except that the explanatory variable corresponds to the Google Trends Index.

Table 5: Regression Probability Default on Husted or Google Trends Index (Monetary Uncertainty) on the different time horizons

	Model 1 (1Y)	Model 2 (5Y)	Model 3 (10Y)	Model 4 (1Y)	Model 5 (5Y)	Model 6 (10Y)
MONUNC_HUSTED	0.204**	0.342**	0.316**			
	(0.0999)	(0.0678)	(0.0671)			
MONUNC_GOOGLET				2.808**	1.065**	0.684**
				(0.252)	(0.244)	(0.249)
CONSTANT	12.02**	18.94**	26.77**	8.753**	18.16**	26.44**
	-1387	(0.941)	(0.932)	-1.040	-1.005	-1.026
N	125	125	125	125	125	125
R-SQ	0.033	0.171	0.153	0.502	0.134	0.058

Standard errors in parentheses (* p<0.1, ** p<0.05)

When we expand the Models 1-3 with the given control variables we get to the results of Table 4. From this table we can conclude that Model 8 has the highest explanatory value, regarding the R-squared of the Models 7-9. Because we want to have a look at the long term effects of the control variables, we will use model 9 as our definitive first regression. When we interpret this regression we can see a positive relation between the 10-Year Credit Default Swap, denoted as ProbDefault_5Y prices and the Monetary Uncertainty Index. When the Index increases with 1 point, the CDS price increases with 0.282 dollar. Apart from the TradeBalance, all other variables are negatively related to the ProbDefault_5Y. Only the constant, the Monetary Uncertainty Index and the Polarization Index are significant.

Table 6: Regression Probability Default on Husted Index (Monetary Uncertainty) with all control variables for the three given time horizons

	Model 7 (1Y)	Model 8 (5Y)	Model 9 (10Y)
MONUNC_HUSTED	0.214**	0.267**	0.282**
	(0.0695)	(0.0676)	(0.0719)
POLARINDEX	-64.71	-199.1**	-103.8**
	(45.25)	(44.02)	(46.87)
INTERESTRATES	-1.296	-1.714	-2.925*
	-1.532	-1.490	-1.586
TRADEBALANCE	0.142	0.113	0.310**
(divide corr. numbers by 1000)	(0.116)	(0.112)	(0.120)
GDPGROWTH	-34.10	-46.11	-32.73
	(53.87)	(52.41)	(55.80)
_CONS	72.05*	192.8**	129.4**
	(35.54)	(34.58)	(36.82)
N	42	42	42
R-SQ	0.453	0.719	0.665

Standard errors in parentheses (* p<0.1, ** p<0.05)

5.2.2 Hypothesis 1

With our first regression we wanted to have a look at the effect of GDPGrowth on the Credit Default Swap prices in the long term. From the literature we had learned that GDP Growth would be the most important determinant of sovereign credit ratings and default. While the result is not significant, we do see a negative effect of -32.73 for every extra percent in GDP Growth on the 10 Year Credit Default Swap prices. Because the results are not significant, we are not able to accept the first Hypothesis that there is a significant negative long term effect of GDPGrowth on the Probability of default. This means our results are not in line with the existing literature about this variable.

5.2.3 Hypothesis 2

For our second regression, we want to know if there is a significant negative long term effect of the TradeBalance on the Probability of default. When we look at our definitive first regression we do see the results for this variable are significant, but positive instead of negative. From the existing literature of Cantor and Packer (1996), as well as Afonso and Gomes (2012), we would expect a negative effect of the Trade balance on the probability of default. However, Afonso and Gomes also mentioned that solvency factors are more important than liquidity factors. While the US has a negative Trade Balance, it is expected to be capable to repay its debt on the long term. With this in mind, the negative trend of this variable should not be a problem.

5.2.4 Hypothesis 3

With our third hypothesis, which is the most important hypothesis of this paper, we wanted to check for a significant positive short and long term effect of a higher Monetary Uncertainty on the Credit Default Swap prices, which reflect the Probability of Default for the United States. When we take a look at Models 7 and 9, we observe significant effects of 0.214 and 0.282 for respectively the 1- and 10-Year CDS prices. This means that and increase of the Index by 1, which has a mean of 139, will lead to an increase of around 0.2 dollar in the Credit Default Swap prices. While this not may not seem that much, the large and standard deviation of the Index, which is 80, shows the size of a change in the Index. This means the Index will change the CDS prices by 16 dollars on average. The 1- and 10- CDS prices have a mean of respectively 12 and 28. We can thus accept our most important hypothesis and conclude that the debate about the debt ceiling is really important for the probability of default of the United States.

5.3 Regression 2

5.3.1. Overview

Table 7: Regression Of the Level of Public Debt on the Optimal Treasury Rate (Different Time Horizons)

	TrRate_1M	TrRate_6M	TrRate_1Y	TrRate_5Y	TrRate_20Y	TrRate_20Y with control variable"
PubDebt (Multiply by (10^-14)	4.92**	-6.70**	-10.6)**	-32.1**	-63.6**	-88.6**
	(1.76)	(1.92)	(1.92)	1.59	(1.19)	(2.60)
PubDebt_squared (Multiply by (10^-28)	8.06*	390**	479**	798**	133**	180**
	(4.13)	(4.49)	(4.49))	(3.73))	(2.79))	(5.28)
PolarIndex						11.86**
						(0.940)
CONSTANT	-0.754**	0.443**	0.943**	4.668**	9.779**	2.666**
	(0.178)	(0.193)	(0.193)	(0.161)	(0.120)	(0.555)
N	3616	3616	3616	3616	3616	3616
R-sq	0.235	0.275	0.274	0.123	0.537	0.560
OPTIMAL MINIMUM (IN TRILLION DOLLARS)	**-30.6**	**8,59**	**11,1**	**20,1**	**23,9**	**23,9**

(The optimal minimum is calculated by looking at the first and second derivatives of the corresponding regressions. The steps taken to get to this numbers can be found in Appendix A). '' Our final regression is adjusted for autocorrelation by using Newey West errors, which produce new standard errors for the regression.

For the second regression we have built several models for the different time horizons of the Treasury Rates and regressed it on the level of public debt and the latter squared. The motivation for a quadratic formula is that it helps us to find an optimum. Apart from the variables of the model for the 1-Month Treasury Rate all the other variables are significant on 5 percent. The calculations of the first and second derivatives can be found in Appendix A. Following these calculations, this regression helps us to find the optimal minimum level of public debt to get to the lowest Treasury rate for the different time horizons. Our assumption is that a lower treasury rate is better for the sustainability of the debt, as is decreases risk of an excessively high debt. While the optimum of the model for the 1-Month Treasury Rate is negative and thus not interpretable, the other models give more realistic optimums. As the time horizon of the Treasury Rate increases, the optimal minimum increases as well. This is logical as the Treasury Rate for a longer time period will be more stable and less dependent on fluctuations in economic and political circumstances. The Model with the 20-Year Treasury Rate also gives the highest R-squared, meaning this model has the highest explanatory value.

The model which adds the Polarization Index, shows a significant effect for the Polarization Index on the Treasury Rate and increases the R squared of the model. The polarization index is thus a variable to control for when we look at the relationship between the 20 Year Treasury Rate and the level of the public debt of the United States. Our final expression for regression 2 will thus the regression for the Tr Rate with the 20-year maturity. These results can be found in Table 5. When the Polarization index increases with 1, the Treasury rate with increase with 11,86 percent, which is quite a large increase and thus shows that the polarization influences the Treasury rate enormously. All the given variables are significant.

5.3.2 Hypothesis 4

For our fourth hypothesis we wanted to know if the current level of PubDebt is above the optimal level. Following regression two which looks at the Treasury Rate of 20 years, the optimal minimum level of debt would be 23,9 trillion Dollar. As the current debt is around 32 trillion, the debt is higher than the optimal minimum. Because we are not able to extract a maximum from the model unfortunately, we cannot state if the current debt is too high. What we can state is that the debt is above the optimal minimum with quite a big difference of around 8 trillion dollar. The results of the regression are significant, meaning we can thus interpret the results. It is important to state that the optimal debt will depend on other factors as well.

5.4 Discussion

Similar to the research of Montes and Souza (2020), which investigated a similar relationship in Brazil, our research shows that an in increase in Monetary Uncertainty leads to an increase in Sovereign Credit Default swap prices, which represents the probability of Default of the United States. The Google Trends regression of models 4-6 show that the debt ceiling also plays a significant role in prices our credit default swaps. According to the literature the variable GDPGrowth should be a really important determinant for the sovereign credit default prices. We do see that its impact increases for a higher maturity of the

ProbDefault and that is increases the R-squared of the models in which it is included, but the variable is insignificant, what we would definitely not expect it to be. As Lane (2012) mentioned; it is hard to keep the GDP Growth above the 2 percent. From our data we see that the average growth is 1.01% percent. It will thus be hard to create a debt rollover as proposed in some papers. For all the variables, the effect on the short and long term is different. While the effect of Monetary uncertainty is the highest on the 5-year CDS Prices and the InterestRates on the 1-year CDS prices, all the other factors increase in value for a longer maturity. This confirms that the long term factors are the most important, as states by Eichler and Maltritz (2013) and Afonso and Gomes (2011). As expected there is a positive relationship between the Treasury Interest rate and the level of Public debt. Only for a maturity of 20 Years this relationship is negative. Even though this is a long maturity, this is not what we would expect, as a higher debt usually increases the borrowing rate. The ever increasing public debt could support the statement made by Borensztein and Panizza (2009), that it is hard for politicians to decrease the level of debt.

CHAPTER 6 Conclusion

This paper investigated the effect of the current debt ceiling on the Probability of default of the United States. In May 2023 Credit Default Swap prices rose to record heights because of uncertainty about the debt ceiling being raised. Even though it is generally assumed that it is impossible for the United States to default on its debt, because of the global reliance on the dollar, the increase in prices shows an increase in concern among investors. According to Badoui et al (2013), Credit Default Swaps should resemble 73% of the default risk. In 2008 and 2011, when a default was close, prices have peaked at 75$ for the 1-year swap price. In May 2023 prices peaked at 160$. A debt ceiling not being raised would have immense consequences for the American people as well for the rest of the world. The United States would have to default, as it not possible to raise debts because of the ceiling. Stock prices would plummet and investments and trust in the global money system would see an immense decrease. With all the uncertainty in the world nowadays, it is important to manage the public debt of the United states to keep it sustainable. Because even the threat of a default, could have immense consequences.

The relationship in this paper is studied by looking at the relationship between the Monetary Uncertainty and Credit Default Swap Prices of different maturities. Because the debt ceiling does not have that many datapoints, we have linked it to a Monetary Uncertainty index and the Google Trends index for the search term of ‘’debt ceiling’’ in the United States. Uncertainty about a potential raise of the debt ceiling is quite similar to monetary uncertainty, as investors, individuals and businesses might be reluctant to invest and spend money. As Zampolli (2012) states; Monetary uncertainty and debt management are cointegrated nowadays. We investigated the relationship by looking at data from 2008 until 2023. With the variables from the relationship from above, the variables PubDebt, the Treasury rates of different maturities and by help of four control variables GDPGrowth, TradeBalance, a Polarization Index and the interest rate we constructed different models for two regressions. The first regression has the CDS prices as the dependent variable and the debt uncertainty as the independent factor. In our second regression we have constructed the effect of the PubDebt and Pubdebt-squared on the Treasury interest rate. With these two regression we are able to make conclusions about the effect of monetary uncertainty on the Probability of default of the United states and the optimal level of debt. By constructing different models with different combinations of the control variables and running them in Stata, we were able to get to two definitive regressions.

With our results, we can reject the first hypothesis about the significant effect of GDP Growth on the Credit Default Swap prices. However, because the theoretical framework has shown that other significant papers found that it to be really important, I would say these results are open to interpretation. The effect is correct, but unfortunately insignificant. With hindsight, it is possible that the GDP-level could have been a better determinant, regarding the significance of the results. As we have observed an increase in the negative balance of the Trade Balance of the United States, we would not expect it to be a problem for the short term, but only for the long term. In our results we found a positive and declining significant effect of the level of the TradeBalance for a longer maturity. This not what we expected, so we will reject the second hypothesis as well. However it could be explained by the fact that a negative Trade Balance shows that imports are high and this could mean higher investments or consumption domestically. Next to this, the terms of trade are not good for products that can be produced by other countries as well, as the price of the dollar is high already, because of the global demand for the currency. The main hypothesis of our paper, which is the third hypothesis about the significant effect of Monetary Uncertainty on the Probability of default on the short and long term is supported by the results of our paper. We can see this positive relation is supported by significant results from the Husted Index regression, as well as by regression with the Google Trends data, on short and long term, which makes the results highly likely to be true. As expected, the level of public debt differs substantially from the level of the optimal debt. Even though we were only able to find the minimum, we can still conclude that, without taking other variables in regard, the current level of debt is too high. We did not find proof for a potential debt rollover, for which we would need the GDPGrowth rate to be higher than the average Treasury Rate. While it is highly likely that the optimal level of public debt is reliant on much more variables, this regression gives us an indication that the debt is too high, given the R-squared of 56%.

From these results we can derive that there is a significant effect of the level of the debt ceiling and monetary uncertainty on the Credit Default Swap prices, which reflect the probability of default of the United States. It shows how relevant the debate and worries surrounding the debt ceiling. Next to this we can conclude that the level of Public debt is far above the optimal minimum level of debt. Overall is assumed that the debt is sustainable and could be overcome by an increase in GDP Growth and trust in the economic system. While it is confirmed that debt terms are constructed on trust in the solvency, rather than the liquidity factors of a country (Eichler and Maltritz 2013), the United States should be prepared for external shocks like the Covid crisis or a banking crisis that could trigger uncertainty about the solvency and GDP growth expectations. There is a significant effect of the Polarization Index on the 5 and 10 year maturity Credit Default Swap prices, which shows there is an important role to the House of Parliament and the two biggest political parties of the United States to keep on working together and to watch out with playing with the debt ceiling, regarding its possible disastrous consequences. Investors could take the determinants of this paper in regard, even though they are not all proven to be significant in this paper; the theoretical framework supports these determinants.

We did not investigate the direct link between possibility of default and the long term debt, just like Eichler and Maltritz (2013) investigated. This could be further be elaborated because it is important to make a distinction between the short and long term regarding policy making. A limitation of the results of this paper is that we observe a trend in the data. Because a log transformation or taking the first difference did not work, the future researcher who will analyse these data should try to improve this by finding a new solution, possibly by creating a whole new type of regression, like a quadratic one.

A future researcher could also try to find out why the GDPGrowth in this paper is not significant, even though we would expect this. For our regression we observe that the R-squared is only 46,1%. For our second regression this is 56%. Because our second regression only has one control variable, but still tells us a lot about the optimal level of debt, it would be interesting to expand it with extra control variables. This will provide useful and necessary knowledge about the determinants of the public debt. This will attribute to find the optimal way to repay the debt in order to get to get to the best policy to challenge the near and far future.

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APPENDIX A - First Derivatives Regression 2 to find the optimum level of PubDebt

In this section, we have worked out the different Models for constructing the second regression of this paper. There are constructed by looking at the the first and second derivatives of the models.

Model with the 1-Month Treasury Rate

- TrRate (1MO) = -.0.754 + 4.94*(10^-14)PubDebt + 8.06(10^-28)PubDebt_sq
- First derivative (TrRate (1MO) /Pubdebt) = 4.94(10^-14)+ 2 * 8.06(10^-28)PubDebt
- Second derivative (TrRate (1MO) /Pubdebt) = 2 * 8.06(10^-28) > 0 **(Minimum)**
- Optimum = First derivative (TrRate (1MO) /Pubdebt) = 0 gives PubDebt = 4.94(10^-14) / (-)1.612(10^-27)
  = (-)3.06(10^13) = (-)30,6 trillion Dollar

Model with the 6-Month Treasury Rate

- TrRate (6MO) = 0.443 – 6.70*(10^-14)PubDebt + 3.90 (10^-27)PubDebt_sq
- First derivative (TrRate (6MO) /Pubdebt) = – 6.70(10^-14) + 2*3.90 (10^-27)PubDebt
- Second derivative (TrRate (6MO) /Pubdebt) = 7.8(10^-27) > 0 **(Minimum)**
- Optimum = First derivative (TrRate (6MO) /Pubdebt) = 0 gives Pubdebt = (-) 6.70*(10^-14)/ (-) 7.8(10^-27) = 8.59(10^12)= 8,59 trillion Dollar.

Model with the 1-Year Treasury Rate

- TrRate (1Yr) = 0.943 – 1.06*(10^-13)PubDebt + 4.79(10^-27)PubDebt_sq
- First derivative (TrRate (1YR) /Pubdebt) = – 1.06(10^-13) + 2*4.79(10^-27)PubDebt
- Second derivative (TrRate (1Yr) /Pubdebt) = 9.58(10^-27) > 0 **(Minimum)**
- Optimum = First derivative (TrRate (1YR) /Pubdebt)= 0 gives Pubdebt = (-) 1.06(10^-13)/ (-) 9.58(10^-27) = 1.11(10^13) = 11,1 trillion Dollar.

Model with the 20-Year Treasury Rate

- TrRate (5YR) = 4.668 – 3.21*(10^-13)PubDebt + 7.98 (10^-27)PubDebt_sq
- First derivative (TrRate (5YR) /Pubdebt) = – 3.21(10^-13) + 2*7.98(10^-27)PubDebt
- Second derivative (TrRate (1Yr) /Pubdebt) = 15.96(10^-27) > 0 **(Minimum)**
- Optimum = First derivative (TrRate (5YR) /Pubdebt)= 0 gives Pubdebt = (-) 3.21(10^-13) / (-) 15.96(10^-27) =2.01(10^13) = 20,1 trillion Dollar.

Model with the 20-Year Treasury Rate

- TrRate (20YR) = 9.779 –6.36*(10^-13)PubDebt + 1.33(10^-26)PubDebt_sq
- First derivative (TrRate (20YR) /Pubdebt) = – 6.36*(10^-13) + 2*1.33(10^-26)PubDebt
- Second derivative (TrRate (20Yr) /Pubdebt) = 2.66(10^-26) > 0 **(Minimum)**
- Optimum = First derivative (TrRate (20YR) /Pubdebt)= 0 gives Pubdebt = (-) 6.36*(10^-13)/ (-) 2.66(10^-26) = 2.39(10^13) = 23.9 trillion Dollar.

APPENDIX B - Test for Stationarity

Table 8

Dickey–Fuller test for unit root Number of obs = 2,861	Dickey–Fuller test for unit root Number of obs = 3,039
Variable: TRRate_20Y Number of lags = 0	Variable: ProbDefault_10Y Number of lags = 0
H0: Random walk without drift, d = 0	H0: Random walk without drift, d = 0

	Test statistic	1%	5%	10%		Test statistic	1%	5%	10%
	Dickey–Fuller	-------- critical value ---------				Dickey–Fuller	-------- critical value ---------		
Z(t)	-2.878	-3.430	-2.860	-2.570	Z(t)	-4.652	-3.430	-2.860	-2.570

MacKinnon approximate p-value for Z(t) = 0.0479.	MacKinnon approximate p-value for Z(t) = 0.0001.

*Note that the found variables are negative. When the Test Statistic is larger than the given critical value, we can reject the Null hypothesis of non-stationarity