# Stagnating Business Investment in The Netherlands and Germany: Causes and Consequences

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Tanvi Patil

Student number: 5213169

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**Graduation committee**

Chairperson         : Dr. ir. U. Pesch, Ethics and Philosophy of Technology
First Supervisor    : Dr. S.T.H. Storm, Economics of Technology and Innovation
Second Supervisor   : Dr. ir. U. Pesch, Ethics and Philosophy of Technology

# Executive summary

Economic growth, especially after the financial crisis of 2008, has been declining in many OECD nations. Declining economic growth has negative effects including a lower rate of productivity growth, stagnating standards of living, and increases in income inequality. Many economists believe that stagnating fixed business investment is one of the key causes of the observed secular decline in economic growth. Hence, it is important to understand what drives business investment and how we can help to raise it, thereby, improving the economic growth. This objective is relevant to the "Management of Technology (MOT)" programme at Delft University of Technology which is aimed at understanding technology from the perspective of corporations to increase customer satisfaction, improve firm profitability and productivity. An important insight of the MOT programme is that economic growth, productivity growth and technological progress are important to achieve corporate goals. Firms make investments in various fixed (tangible) and intangible assets. Thus, the objective of this thesis which is to understand the determinants of fixed investment that affects economic growth, is important not only for policymakers but also for corporations, shareholders, and workers.

There is a large literature on stagnating business investment and 'investment-less' growth for the U.S. economy. But even if many economies of the European Union (E.U.) are also experiencing stagnating business investment, the economic literature on this problem is relatively small. In this thesis, we have analyzed the determinants of stagnating business investment in the European economies of the Netherlands and Germany using an accelerator-type model augmented with variables that measure financial constraints, business environment, labour market and network sectoral regulations. According to IMF (2015), the accelerator-type model fits the economies that were not strongly affected by the European debt crisis of 2010-2012. The Dutch and German economies were relatively shielded from the debt crisis compared to South-European economies. Hence, we have geographically scoped the thesis to the Dutch and German economies. The empirical investigation is done for a period of 28 years from 1994-2021.

Our results show that fixed business investment as a share of GDP in the Netherlands is mainly affected by demand growth, financial constraints, uncertainty and energy prices. In case of Germany, fixed business investment is mainly affected by unemployment rate, term spreads, energy prices and regulations of the network sectors. We see that while demand is found to be statistically significant in explaining decline in business investment in the Netherlands, it is not found to be statistically significant in case of Germany. We found that business investment can be stimulated by increase in demand (in the Netherlands), real net profits of the firms, network sector regulations or by a decrease in uncertainty, energy prices, term spreads and unemployment rates considering both the Dutch and German economies. An increase in the fixed component of intangible investment or a decrease in the level of financialization can also help in boosting business investment for these two economies.

Based on the empirical findings and literature, we looked into what lessons we can derive from a policy-making perspective. We believe that expansionary macroeconomic policies can most likely help both the Dutch and German economies to stimulate business investment. For instance, policies that are aimed at

increasing the social safety net by providing health, unemployment or insurance benefits can most likely help in stimulating household demand. Corporate tax policies that support businesses in realizing greater net profits can also stimulate business investment by increasing corporate investment demand. Improving the investment environment by proper governance, regulation and maintenance of legal rights encourage businesses to undertake more investments. Efforts can also be directed at reducing the bank lending spreads within different E.U. economies. In case of Germany, we can think of implementing expansionary fiscal policies targeted at reducing over-reliance of exports, improving net imports and optimizing the fiscal balance. Policies targeted at maintaining effective and secure employment can also help the economic growth of Germany. These policies can be implemented within the framework of various mandatory pacts and treaties like the Stability and Growth Pact (SGP) or the Maastricht Treaty by aiming for balanced budget deficit or leveraging debt-servicing from future generations in exchange of various public and social stocks / benefits.

Finally, this thesis concludes by offering reflections on for further research. For instance, we identify relevant firm-level variables that could be included in the empirical analysis and we highlight different measures for robustness checks that could be profitably used in future research.

# Contents

# Chapter 1: Introduction

During the past decades, economic growth in many OECD countries has been declining, as is shown in Figure 1 (Rachel and Summers, 2019). This is a problem, because a decrease in economic growth lowers the growth of jobs and incomes for households, as was seen especially after the 2008 financial crisis (Ollivaud and Turner, 2015). It also leads to low total factor productivity growth and a stagnation in output per worker. Productivity growth is important for improvement in living standards because high growth in productivity allows people to have better living standards without the need to work extra hours (Stone, 2017). Declining growth can also affect the level of globalization and trade. This could also spell trouble for business and investments as credit-constraints may be imposed in light of shrinking economic growth (Malmaeus and Alfredsson, 2017).

Economic growth remains important for bringing about increases in living standards, especially in a context in which a drastic redistribution of income in favour of the lowest-income groups is not (politically) possible. Economic growth is associated with higher tax revenues for the government which can be used for socially and environmentally desirable investment. Economic growth at the same time leads to higher resource use, higher waste generation and higher $CO_2$ emissions; in these respects, economic growth is not unproblematic. However, higher economic growth (in principle) allows greater investment of firms in improving resource use, waste reduction and decarbonization – and in this sense, economic growth could support a transition to a more sustainable economy.

In a more short-run perspective, economic growth is also important from the perspective of corporations. Strong GDP growth signals a strong economy and firms make investments and undertake projects that generate further employment (Callen, 2020). Thus, strong economic growth can also enable firms to better finance these projects and investments via efficient debt servicing.

The EU area was hit hard by the financial crisis of 2008 that originated in the United States. The real GDP contracted by - 4% in 2009, the highest contraction in European history (Spidla, 2009). However, even after almost a decade after the crisis, the European economy does not show many positive signs of recovery. In fact, many economists stated that the Eurozone is experiencing long-term economic stagnation, referred to as secular stagnation [1] (Summers 2014, Hamilton 2015).

Economists agree that the economic stagnation is – at least partly- caused by a decline in business investment ('net fixed capital formation', defined in subsequent section). Thus, a key cause of the 'secular stagnation' of real GDP growth is the stagnation of business investment (see Gutierrez and Philippon 2017,

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[1] Secular stagnation is characterized by various factors like low natural rate of interest, low GDP growth, slow population growth, ageing population, a low inflation (Tomeczek, 2020). We can see these set of conditions in most of western Europe countries. Secular stagnation is also characterized by increased inclination to save and a decreased inclination in investment (Summers, 2016). However, we do not see excess household savings for the European Union between 2008 – 2019. OECD.org defines household savings as "the net household net disposable income plus the adjustment for the change in pension entitlements less household final consumption expenditure". Although the savings peaked during the covid-19 pandemic in 2020, there was no excessive savings trend seen in the decade after the crisis of 2008 when the economy was considered to be in secular stagnation.

Bussière, Ferrara and Milovich 2015). Investment is important to boost the potential of growth of the E.U. countries (European Commission, 2017). Empirical literature has found a significant and positive relationship between business investment and economic growth (Meyer and Sanusi, 2019). However, rates of investment have declined all over the E.U. since the financial crisis struck. Although a gradual recovery is taking place, the investment rates in the E.U. are still below their long-term average rates (European Commission, 2017). According to European Commission (2014), weak business investment is the main factor for weak economic recovery of the E.U. Hence, to explain the stagnation of real GDP growth, we have to understand the causes of declining business investment.



## Neutral Rate of Interest and GDP Growth for OECD Members

Aggregated data for member countries of the OECD

Real GDP growth

Neutral rate of interest

Source: Researchers' calculations using data from the Organisation for Economic Co-operation and Development
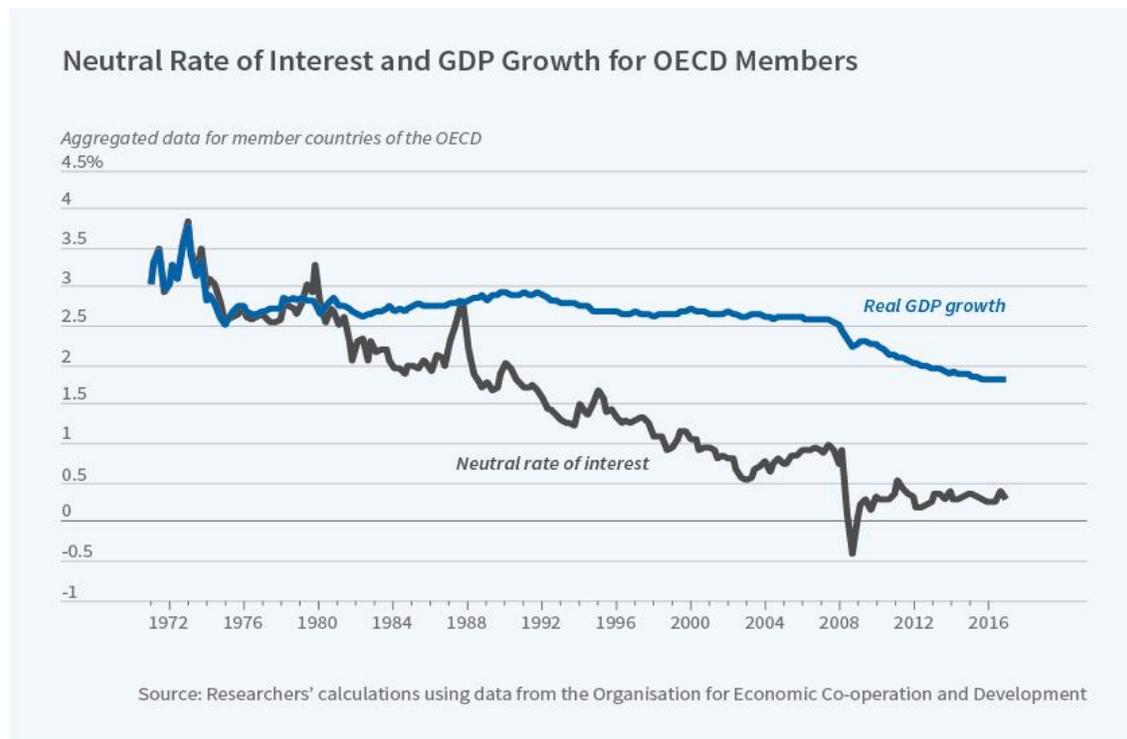
Figure 1. The rate of interest vs GDP growth for OECD Members

For this thesis we decided to choose two European countries – The Netherlands and Germany - to investigate which factors have contributed to the problem of stagnating private business investment in these economies, before and after the crisis of 2008. The motivation for choosing these countries will be explained subsequently in Section 1.2. We will scope the definition of business investment that we use in this thesis in Section 3.3.

Going forward, we will start with defining the issue at hand, then we will analyze the literature and finally perform an empirical and a theoretical investigation to identify the drivers of weak business investment in the Netherlands and Germany (during 1994-2021). Finally, we will reflect on what our findings mean from a policy-making perspective.

## 1.1. Background and Problem Definition

Gutierrez and Philippon (2017) have highlighted the stagnation in business investment in the United States (U.S.). A similar decline in net fixed investment can be observed for the European Union (E.U.) during 1995-2021 (based on data from the Eurostat database). The declining trend in net fixed investment has – arguably – contributed to the stagnation of real GDP growth. We can see the stagnating and declining GDP growth for the Netherlands and Germany during our period of analysis 1994-2021 in Figures 2 and 3. We can see that the GDP growth is showing a declining trend for both the Netherlands and Germany, with the Netherlands showing a steeper decline as compared to Germany. As we saw in the earlier section, such a decline in economic growth (GDP growth) leads to a plethora of problems like stagnating incomes, stagnating consumption, rising unemployment and so on (see Bank of England, 2020). In Chapter 2, we will review the relationship between economic growth and business investment for the Netherlands and Germany to understand the importance of stimulating business investment as a means to ensure economic growth.



Figure 2. Real GDP growth for the Netherlands (1994-2021)
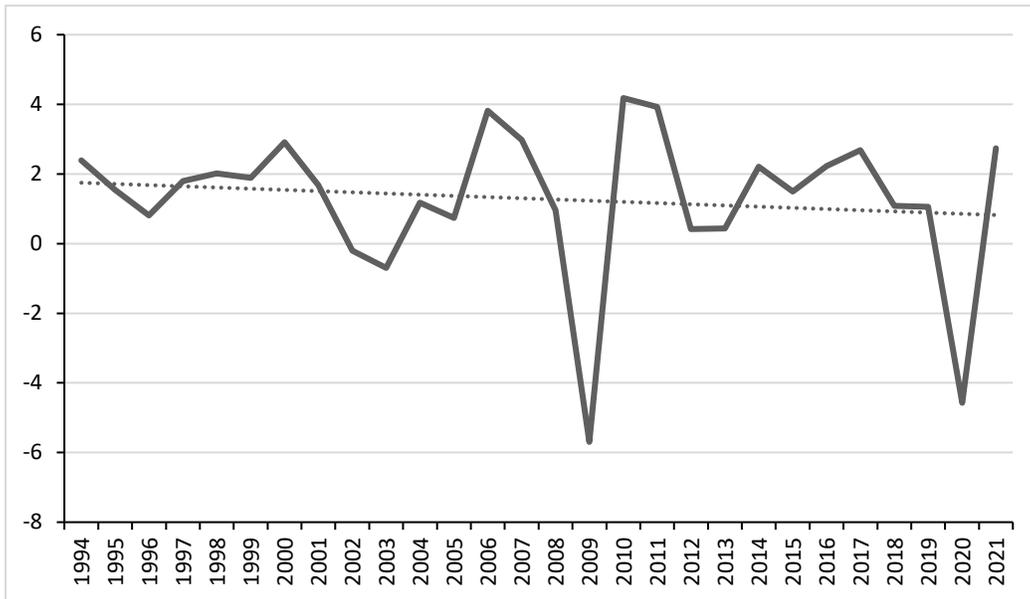
*Source*: AMECO database.

Figure 3 Real GDP growth for Germany (1994-2021).

*Source*: AMECO database.

Fixed business investment is a major component of economic (GDP) growth. However, the fixed investment component of GDP is declining for the Netherlands and Germany (based on data from the AMECO database). Since 2000, the fixed capital investment in Germany is lower as compared to other Eurozone countries[2] and most of the lack in business investment in Germany can be attributed to weak business investment of the private sector (Lindner, 2014).

To many economists, the stagnation of business (fixed) investment is puzzling for various reasons. A first reason concerns the cost of borrowing for corporations. Interest rates have been low for a long time, and especially following the financial crisis of 2008. For the Eurozone, for example, based on data from Euro Area Statistics, the composite cost of long-term borrowing (nominal rates) for corporations in January 2003 was 4,54% and this nominal interest rate dropped to 1,48% in September 2021. If we consider the Netherlands, the composite cost of borrowing for firms dropped from 4,40% in 2003 to 0,93% in 2021. These interest rates are based on the MFI (Monetary Financial Institutions) indicators of Euro area. A similar trend is observed in all EU countries. A lower cost of borrowing is normally held to make it more attractive for companies to borrow and make investments. But fixed business investment in the E.U. has been declining even after the cost of borrowing came down to very low levels. Stagnant business investment in E.U. thus constitutes a puzzle in the light of the (historically very) low interest rates.

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[2] Eurozone countries include Austria, Belgium, Finland, France, Germany, Ireland, Italy, Luxembourg, the Netherlands, Portugal and Spain.

A second puzzle arises when we consider the measure of profitability known as Tobin's Q. Tobin's Q is defined as the ratio of the stock market value of a corporation to its replacement cost of assets (Investopedia, 2021). A high Tobin's Q (greater than 1) means that the firm is overvalued in the market and a low Tobin's Q (between 0 to 1) means that the firm is undervalued in the market. Tobin's Q is generally argued to make it easier and cheaper for firms to borrow from banks, because the high value of the collateral (i.e., the firm's assets) reduces the credit risk for banks. Thus, it would follow that if firms on average have a high Tobin's Q, the investment rate should also be high, because due to their high market valuation it is easy to borrow at low cost. However, Gutierrez and Philippon (2017) show that business (fixed) investment in the United States has been declining from 2000 onwards in spite of the Tobin's Q being high. This is a second reason why the stagnation of business investment is puzzling in general.

In light of these factors, stagnating private business investment, which has been a major factor causing a decline in aggregate demand (IMF, 2015), is a cause of concern for macroeconomists and policymakers. Weak private business investment is also an issue in the European Union (E.U.) countries. Although in some of the member countries, the level of GDP and the employment rate are higher than they were before the crisis of 2008, the rate of investment continues to be below the level of the pre-crisis period (European Commission, 2017). Business investment has reduced sharply in many OECD economies from 2008 through 2014 and is lower by 20% as compared to the pre-crisis forecasted values (Bussière, Ferrara and Milovich, 2015). An increase in fixed business investment means that the production capacity of an economy is increasing. The reduction and stagnation of business investment is an issue, because it affects not only short-term economic growth, but also long-term economic growth (Bussière, Ferrara and Milovich, 2015). This is because in the short term, business investment is impacted by demand. Thus, if the demand is high then there is higher utilization of existing production capacities. In the long term, business investment is driven by productivity growth. Lower business investment contributes to lower productivity growth, because the new capital goods (machines) installed embody the latest technologies and hence are more productive than the already installed capital goods. Stagnating fixed investment therefore leads to a stagnation of (embodied) technological progress. The stagnation of business fixed investment has been carefully studied in numerous papers for the U.S. economy (see Gutierrez and Philippon 2017, Furman 2015, Alexander and Eberly 2016).

Dottling, Gutierrez and Philippon (2017) have analyzed the issue of weak fixed private investment in both the US and EU member economies from 1995 onwards. They argue that the potential reasons that have caused weak business investment are different for US and EU member economies. Furthermore, they attribute the stagnating business investment in EU member states to factors like financial constraints on corporations, weak expected demand, weak expected cash flows and decreased asset values. Whereas for US, they state that factors like depressed competition in industries and increase in concentration of industries has led to weak business investment. In line with the arguments produced by Dottling, Gutierrez and Philippon (2017) for weak business investment in EU economies, Bussière, Ferrara and Milovich (2015) also argue that weak expected demand is one of the important factors of stagnating business investment in EU countries, supplemented by uncertainties and financial constraints to a lesser degree.

Based on the arguments reviewed so far, it is clear that stagnating business investment is a pressing problem. We can also see that despite the presence of factors like low cost of borrowing rates or high

market valuations of firms, which are conducive to promote business investment, business investment in the E.U. has not increased. Thus, there must be other drivers which are countering the positive effects of low interest rates or high Tobin's Q on the business investment.

With this background, in the next paragraph we will examine the research objective pertaining to this specific proposal.

## 1.2.    Research Objective and Research Questions

Stagnating business investment is cause for concern in the E.U. There is no consensus in the literature on the potential factors that might have caused stagnating private business investment. While there exists an extensive literature on the factors driving weak business investment specifically in the U.S., a similar literature for European countries such as the Netherlands and Germany is found to be wanting. Also, the recovery in business investment (after the financial crisis of 2008-09) was quicker in the United States than in the Eurozone countries (Fay et al, 2017). The Netherlands and Germany are advanced / core countries of the European Union. The weakness in private fixed investment has been more prominent in advanced (OECD) countries as compared to the emerging and developing countries like India or Brazil (see Bussière, Ferrara and Milovich 2015, IMF 2015). In the emerging and developing countries, there was a gradual slowdown in business investment, whereas for advanced economies, there was rapid contraction in business investment since the crisis of 2008 and the recovery has been very slow (IMF, 2015). The determinants of weak business investment are probably different for advanced economies and developing economies (Bussière, Ferrara and Milovich, 2015). Advanced economies have wider data availability as compared to developing ones (Bussière, Ferrara and Milovich, 2015).

In this thesis, we will use an accelerator-type multivariate regression model (which is explained in Chapter 3), to explain weak fixed business investment. The thesis focuses on the Netherlands and Germany, because the Dutch and German economies were not affected very strongly by the Eurozone sovereign debt crisis. We can therefore empirically analyse the longer-run causes of declining fixed business investment in these two economies, because the Eurozone crisis did not fundamentally affect the long-run declining trend in fixed business investment in the Netherlands and Germany. Other (Southern-European) Eurozone economies[3] experienced a deep and prolonged recession due to the Eurozone debt crisis of 2010-12, and in these economies business investment declined very strongly. According to the IMF (2015), for these economies the actual investment is 7% less than what the accelerator-type model would predict. The Eurozone crisis did, in other words, depress fixed investment in these countries even more strongly. The north- European countries were relatively protected by the debt crisis. Hence, the north-European advanced economies can better fit the empirical model. Thus, because our focus is on the longer-run drivers of declining fixed business investment, we decided to scope this thesis to two of the advanced north-European economies - the Netherlands and Germany.

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[3] Countries like Greece, Italy, Portugal, Spain and Ireland that experienced sovereign debt crisis.

Hence, this thesis is an attempt to explore the issue of stagnating business investment in the Netherlands and Germany in order to contribute new insights into the causes of the secular stagnation of real GDP growth in these economies. Thus, the objective of this thesis can be stated as follows:

> "*Factors conducive to business investment like low cost of borrowing or high Tobin's Q are present globally. Yet the positive effects of these factors are not showing up in increasing business investment in EU countries, including the Netherlands and Germany. Thus, the question arises as to which obstacles are countering the positive effects of low interest rates and high Tobin's Q on business investment and causing it to stagnate*?"

Achieving this objective is relevant to the "Management of Technology (MOT)" programme at Delft University of Technology that deals with exploring and understanding technology from the perspective of corporations to enhance customer satisfaction, maximize firm profitability and productivity etc. A key insight of the MOT programme is that technological progress, productivity and innovation are important to the profitability and competitiveness of firms. For this reason, the observed (secular) decline in productivity growth and the associated stagnation of fixed business investment and embodied technological progress are a major cause of concern, not just for economic policymakers, but also for corporate executives, shareholders and workers. Firms invest in various tangible and intangible technologies and products to achieve their corporate targets. For unknown reasons, such investments are stalling. Thus, it is important to understand the factors that promote corporate investments, including (macro-economic) factors that are 'external' to the firms. Through this thesis, we aim to investigate such factors. Our analysis will – hopefully – contribute to a better understanding of the causes underlying the stagnation of fixed business investment.

We can translate the above research objective into a main research question and a set of research sub-questions as follows:

**Main Research Question**

Economic growth (GDP and productivity growth) is stagnating in the U.S. and Europe. Stagnating economic growth is a problem because it negatively affects people's livelihoods, jobs, and standards of living. Since one of the reasons of stagnating economic growth is the decline in business investment (net fixed capital formation – defined subsequently in Section 3.3.), it is important to understand which factors affect business investment and cause it to decline. This brings us to our main research question (RQ):

> RQ: *"Which factors have been responsible for the secular decline in business investment in the Netherlands and Germany?"*

To answer this research question, we will use the following sub-research questions (SRQs):


**Sub-Research Questions**

Business investment (net fixed capital formation) is driven by many factors i.e., a firm's decision to proceed with certain investment projects is complicated and is influenced by many aspects (Fay et al,

2017). For example, firms may decide to proceed with certain investments to meet demand from their customers or they may decide to postpone it if they are uncertain about the payoffs of investment projects. These factors may change based on geographic locations or due to any country-specific aspects. Thus, it is important to know which factors can impact business investment in general and if those factors change for our economies of interest – The Netherlands and Germany. We can thus formulate our first SRQ as:

> *SRQ 1: What are the determinants of net fixed capital formation by businesses in general and in the Netherlands and Germany in particular?*

Once we understand the determinants of business investment, it is important to understand how these determinants would empirically affect net fixed capital formation. Some drivers may promote business investment while the presence of other drivers may cause it to decline. We need to understand which determinants will positively affect business investment and which determinants will negatively affect it. We also need to know the strength of these positive and negative effects to understand that if all the determinants are present, then the effect of which determinants will be more significant in explaining changes to net fixed capital formation. We can thus formulate our second SRQ as:

> *SRQ 2: What have been the empirical impacts of changes in these determinants on business investment in the Netherlands and Germany?*

Once we understand which determinants will affect the business investment in the Netherlands and Germany is which manner (positive / negative / neutral), our aim should be to increase the determinants that would promote business investment and decrease those that would lead to a decline in business investment. This would of course involve understanding the policy aspects that would help us in achieving this goal. We can thus formulate our second SRQ as:

> *SRQ 3: Based on the empirical findings of this study, which (policy) lessons can be learned concerning how to reverse the decline in business investment in NL and Germany?*

In the next section we will take a brief look at how these research sub questions will be answered in the thesis.

## 1.3. Method of Analysis

The end goal of the thesis will be to answer the main research question. To do this, we will perform a literature survey to understand the determinants that drive business investment. We will look at drivers of net fixed capital formation in the United States and European Union. We will also take a close look at the drivers that potentially impact business investment in the Netherlands and Germany. We will perform this literature survey in Chapter 3. Thus, the first sub-research question (SRQ 1) will be answered on the basis of a literature review.

After the literature review, we will perform an econometric analysis to deepen our understanding of how these determinants empirically affect net fixed capital formation in the Netherlands and Germany. We will also look into which determinants are more significant in explaining changes to net fixed capital

formation than the others. Thus, in Chapters 4 and 5 we will answer sub-research question 2 (SRQ 2). The third sub-research question (SRQ 3) will be addressed based on the empirical findings and policy analysis.

In the next section we will briefly look at how the thesis will be structured going forward.

## 1.4.    Overview of Thesis

In Chapter 1 we looked at the problem definition, thesis objective and the main research question and sub-questions that will help us in achieving the goal of our thesis.

In Chapter 2, we will review the relationship between economic growth and business investment for the Netherlands and Germany. This will help us understand why fostering investment is key to ensure economic growth in these countries.

Going forward, in Chapter 3, the relevant literature and data around the business investment slump in the Netherlands and Germany will be reviewed. To do this we will first look at the determinants of business investment in the United States and Europe. After that we will try to identify the determinants of business investment for the Netherlands and Germany.

In Chapter 4, we review the empirical model and methodology. Here we will specify the model that will be used to do the econometric analysis to investigate the factors causing weak business investment. We will also review some important terminologies and variable definitions that are used in our empirical model.

In Chapter 5, we look at the results of our econometric analysis. This chapter will present the determinants of business investment, first for the Netherlands and then for Germany. We will also look at the relationships between these determinants and fixed investment.

In Chapter 6, we will look at some literature and theories for those determinants that are not considered inside the econometric analysis. These variables are treated outside the empirical model due to lack of publicly available data for the duration of analysis. In this chapter, we will see how these variables are impacting business investment in the Netherlands and Germany. This chapter will also offer a comparison of our findings for the Dutch and German economies.

In Chapter 7, we will draw conclusions based on the literature and econometric analysis from previous chapter. We will also see what this would mean from a policy making perspective. We will look into which policy lessons can be derived from our findings and study for the Netherlands and Germany.

Finally in Chapter 8, we will conclude the thesis with a brief summary of our findings and literature and scope for further research. We will also offer some reflections on what has been learned from the analysis, the limitations of the analysis and the generalizability of our findings for the Netherlands and Germany.

# Chapter 2
# Economic Growth and Business Investment

In this chapter, we will look into the relationship between economic growth and business investment in the Netherlands and Germany.

We saw in Chapter 1 that economic growth as indicated by real GDP growth is important for productivity growth, to improve employment and incomes, to improve standards of living of people etc. Fixed business investment is also important to diffuse innovation (and embodied technological progress), which is one of the key drivers of economic growth. In the absence of fixed capital investment, an economy's innovation power reduces, its productivity growth stagnates, and it also loses its competitive edge (Stewart and Atkinson, 2013). Thus, business investment or fixed capital formation is important to speed-up economic growth and foster employment (Meyer and Sanusi, 2019).

We already see from Figures 2 and 3 that economic growth in the Netherlands and Germany, as measured during 1994-2021, is stagnating. In the case of the Dutch economy, the rate of economic growth is actually declining. To understand the contribution of weak business investment towards stagnating economic growth in these two EU countries, we turn towards the available literature and the relevant empirical analyses. But before proceeding, we will first empirically investigate the association between fixed business investment and economic growth in the Netherlands (1960-2021) and Germany (1991-2021).

## 2.1.    Economic Growth and Business Investment: The Netherlands (1960-2021)

To estimate the contribution of business investment in explaining stagnating economic growth in the Netherlands and Germany, we first performed a bi-variate Ordinary Least Square (OLS) regression analysis for the two countries. Our dependent variable in both cases is real GDP growth as denoted by $\dot{Y}$. We chose the independent variable as the ratio of business investment to GDP as denoted by $\dot{X}$. Based on data availability, for the Netherlands we used data from 1960 – 2021. Data for dependent and independent variables have been obtained from the AMECO database.

In the case of the Netherlands, we find the coefficient of $\dot{X}$ to be positive and statistically significant at 1% with a value of 0.41. The empirical model can explain about 42% of the changes to economic growth based on the share of business investment in GDP. This is a very significant value. We also find a strong positive correlation with the coefficient value of 0.65 between $\dot{Y}$ and $\dot{X}$. The regression output and correlation scatter plot for the Netherlands are included in Appendix A1. Groote et al. (1999) also tested the relationship between economic development and infrastructural investment. Here, infrastructural investment can be considered to be a part of fixed capital formation. To study this relationship, the authors used a vector autoregressive system in which they included GDP, investment in infrastructure as well as investment in machinery. They found a sound, positive and significant relationship between investment in infrastructure and GDP. This is in-line with our empirical analysis where we found a positive and significant relationship between fixed investment and economic growth. Thus, it follows that the decline in fixed business investment in the Netherlands has contributed to the slowdown of Dutch economic growth which we observed in Figure 1. Conversely, we can understand that in order to accelerate economic growth in the Netherlands, we need to stimulate business investment.

## 2.2.  Economic Growth and Business Investment: Germany (1960 – 2021 & 1991 - 2021)

We performed a similar empirical estimation for Germany as we did for the Netherlands in Section 2.1. Data points for Germany, as we know it today after unification of former East and former West Germany, are available only after 1991. Prior to 1991, data points are available on West Germany. To get a holistic picture, we performed two empirical analyses to check for the relationship between economic (GDP) growth and fixed business investment. In the first empirical analysis, we consolidated the West Germany and Unified Germany data for $\dot{X}$ and $\dot{Y}$ variables into a single series for the period 1960 – 2021. Here, the period 1960 – 1991 contains data points of West Germany and the period 1992 – 2021 contains data points on unified Germany. In this first empirical analysis, we find the coefficient of $\dot{X}$ to be positive and statistically significant at 1% with a value of 0.31. The empirical model explains about 28% of the changes to economic (GDP) as a result of changes in the share of fixed business investment in GDP. The regression output and correlation scatter plot for first empirical analysis is presented in Appendix A1.

Next, we checked if the relationship between economic growth and business investment remained the same after unification of East and West Germany. For this, we performed a second empirical analysis using data from 1991 – 2021 from the AMECO database for unified Germany. The method of empirical estimation and terminologies for dependent and independent variables are the same as those used in Section 2.1. for the Netherlands.

In the second case, the empirical estimation did not lead to statistically significant coefficient of $\dot{X}$ in explaining $\dot{Y}$. This does not mean that business investment is not important for economic growth. It could mean that there could be some other mediating factor(s) due to which the direct relationship between GDP growth and business investment seems to be broken somewhere in the mid-1990s. It can also be due to the (shorter) period of analysis: 1991-2021. If we look at Figures 3 and 5, we see that while business investment as a share of GDP is declining rapidly during 1991-2021, the decline in economic growth in the same period is not proportionally pronounced. This is in contrast to the case of the Netherlands where economic growth and business investment as share of GDP are both declining relatively at same pace. We can observe this phenomenon from Figures 2 and 4. Before we look into the importance of business investment for economic growth in Germany, it is important to also understand the possible reasons behind the break in the relationship between GDP growth and fixed business investment after the mid-1990s in Germany. The increase in Outward Foreign Direct Investment Flows (OFDIs) from Germany can possibly explain the decline in domestic fixed business investment and the relationship break between GDP growth and domestic fixed business investment. Based on the World Bank data, we can see that net outward foreign direct investments by Germany have increased more than 2 times since 1970s till 2020. Foreign direct investments (FDI) denote the investments made by firms in foreign countries by acquisition of assets of current foreign companies, by commencing new businesses via investments in machinery and buildings or by making more investments in their already existing foreign business (Feldstein, 1995). Based on the country, its firms, financial markets, firm motives etc. the effect of OFDI on domestic fixed business investment can differ (Al-Sadig, 2013). There are different mechanisms via which OFDI can impact domestic investment. For example, if businesses move a part of their capital abroad to seek investments, their domestic savings decline. If such scenario is complemented by imperfect financial markets and tight

financing conditions, OFDI can reduce the domestic investment. However, if businesses seek OFDIs by moving their production to foreign countries, its effect on domestic fixed investment can either be positive, negative or neutral, based on the firm strategies (Al-Sadig, 2013). Some studies have empirically assessed the impact of OFDI on fixed business investment in Germany. Feldstein (1995) analyzed data for OECD economies (including Germany) from 1970 to 1990. The author found a negative relationship between OFDI and domestic investment where an increase in OFDI by one dollar reduced the domestic business investment by a dollar as well. Next, Anderson and Hainaut (1998) analyzed time-series data for the U.S., U.K., Japan and Germany from 1960s to 1990s. The authors discovered similar results to those by Feldstein (1995) where increase in OFDI resulted in a decrease in domestic investment. Similar analysis by Herzer and Schrooten (2007) and Al-Sadig (2013) reveals that increase in OFDI has negative effects on fixed business investment in Germany. Thus, based on theory, we can say that increase in outward foreign direct investment by Germany since mid-1990s has probably resulted in the decline of fixed investment to an extent. This can perhaps explain the broken relationship between GDP growth and business investment in Germany as the contribution of business investment towards GDP growth declined over time. However, in the subsequent paragraphs we will try to understand why business investment is still important for economic growth despite the apparent broken empirical relationship between the both of them.

Let us first look at literature concerning the economic growth of Germany. After the financial crisis of 2008, the German economy recovered quickly as compared to other European nations. Germany's strong position in exports and its global competitiveness is "believed" to have contributed to its success (Erber and Hagemann, 2013). This belief is also supported by Germany's evolving growth model where the growth which was initially due to a combination of net exports and domestic consumption has now completely shifted to exports (Baccaro and Benassi, 2017). Today, most of the mainstream literature attributes Germany's rapid recovery and strong global competitiveness to what Storm and Naastepad (2015) have called "Modell Deutschland 2.0". Some key characteristics of this model include the belief that Germany competes on labour-cost competitiveness, deregulation of labour markets to achieve cost-competitiveness, reduction in unemployment benefits, decline in pattern bargaining etc. (see Storm and Naastepad 2015, Baccaro and Benassi 2017). However, Storm and Naastepad (2015) have refuted the mainstream literature and shown that labour costs do not matter for Germany's export growth and global competitiveness as Germany's strong recovery from the financial crisis is owed to its technological and "non-price" competitiveness. Erber and Hagemann (2013) have also argued that Germany's recovery is mainly due to its technological superiority in capital goods and automobile sector. Germany differentiates itself by investing in high-tech and knowledge-intensive products and goods. Thus, we can argue that as opposed to the mainstream belief, Germany has benefitted more from its technological superiority, investment in knowledge-intensive products, co-ordination between workers and employers and a non-deregulated market.

Now that we have looked into various aspects of Germany's recovery and the possible reasons why its economic growth did not decline as rapidly as its business investment, let us look into the decline of business investment in the context to Germany's "Modell Deutschland 2.0". Germany's economy which had a balance of exports and domestic demand until the late 1990s, became overly reliant on exports after the late 1990s (Lindner, 2014). This might have proved detrimental to the net fixed capital formation of Germany as the German wage depression in 2000s led to decline in household consumption, inflation as well as stagnation of domestic demand (Storm and Naastepad, 2015). Low inflation and borrowing

costs led to housing booms in southern European countries. Since Germany's domestic investment demand was stagnating, Germany became a creditor to these countries which in turn led to risky investments. Again, during the financial crisis, foreign demand collapsed, there was a lot of uncertainty and the states had to raise domestic investment demand (Lindner, 2014). This period of crisis and uncertainty has (most likely) resulted in further stagnation of business investment in Germany.

Next let us turn towards employment. Effective employment that gives workers a sense of security and enables them to do high-quality professional work is important for economic growth and in turn to reduce poverty and improve standards of living (see Tkemaladze 2017, Ioan 2014) As stated earlier, under the new growth model, labour markets in Germany have become considerably de-regulated. From an employment perspective this means that workers' wage bargaining power has reduced, they are forced to take low paying, part-time jobs to avoid being unemployed, their jobs are less protected etc. (Storm and Naastepad, 2015). The deregulation of the labour market has been justified under the pre-text of generating more employment. Thus, such de-regulation can prove detrimental to Germany's economic growth in long-term. Storm and Naastepad (2015) have shown that during 1980 to 2007, more people worked in part-time jobs and there was a decline in working hours worth 3.7 million full-time jobs. Such reduction in full-time jobs can be harmful for long-term economic growth of Germany since its global competitiveness is based on specialized, knowledge-intensive products and services for which workers may need more time to invest in tacit knowledge by working in a secure full-time job. Thus, an increase in jobs could be a way to ensure economic growth in Germany. To do this, investment in fixed capital is important as capital accumulation is of key importance to generate more employment (Deutsche Bundesbank, 1998). To create additional jobs, more business investment would be necessary. Meyer and Sanusi (2019) have also pointed that there exists a positive relationship between employment, economic growth and business investment and more business investment can stimulate employment. Of course, a policy shift from deregulated markets to non-deregulated markets is also necessary.

Thus, we can argue that although Germany recovered quickly from the crisis, it was not due to the so-called "Model Deutschland 2.0". The business investment stagnated due to factors like over-reliance on exports and foreign demand and uncertainty. To ensure sustained long-term economic growth, more effective employment should be generated. A way to do this is to increase business investment. Thus, based on literature and arguments we can say that business investment is important for economic growth in Germany.

## 2.3. Conclusion

In Chapter 2, we reviewed some facts like economic growth is important to maintain high productivity, good standards of living, and to reduce income inequality. Then, we looked into the relationship between economic growth and business investment for the Netherlands and Germany. In case of the Netherlands, we empirically found that stagnating business investment can explain about 42% of the decline in economic growth from 1960 – 2021. In case of Germany, we saw that the country recovered quickly from the crisis owing to its technological superiority and non-price competitiveness. However, to sustain long-term economic growth, along with changes on policy level, Germany needs to step up business investment to boost more effective full-time employment. In the next chapter we will review literature regarding factors that affect business investment since investment is an integral aspect to ensure economic growth.

# Chapter 3

# A Review of the Literature

In Chapter 3, we review the literature on stagnating business investment in the US and the EU. We will first take a look at various drivers of stagnating business investment for the U.S. and the E.U. member economies. This will be done based on existing research articles[4] . We will also briefly touch upon the level of analysis that we will do in this research. Finally, we will arrive at the research sub-questions that will help us in answering our main research question.

## 3.1.    Potential Drivers of Weak Private Business Investment in U.S

Weak private investment is a major issue globally. We will first reflect on this issue in the United States (U.S.).

Dottling, Gutierrez and Philippon (2017) have shown that even though profits of firms have been high in the U.S., especially since 2010, the business investment in the U.S. has been very weak since the 2000s after slightly peaking in the early 2000s due to the dotcom bubble. We will first reflect on this issue in the United States (U.S.). Philippon and Gutierrez (2017) have analyzed the issue of stagnating business investment in the US in context of the Q-theory which is used as a measure of business valuation and profits. A high Tobin's Q implies that the firm is valued more in the stock market as compared to the replacement cost of its assets and this should ideally translate to higher investment. In their paper Philippon and Gutierrez (2017) discuss eight theories/explanations that potentially lead to low private business investment in spite of a high Tobin's Q. These eight potential drivers are grouped into four categories of "Financial Constraints", "Modifications to nature of investment in terms of more globalization and increasing intangible assets", "Reduction in Competition" and "Stricter Corporate Governance". They have explained these drivers as follows:

**Financial Constraints**

- *External Finance*: Philippon and Gutierrez (2017) draw on a large literature, which includes Fazzari, Hubbard, and Petersen (1988) and Rajan and Zingales (1998), which points out that sectors that are in a high need of external funding / financing, grow faster where financial conditions are conducive for them (e.g.: presence and access to financial markets). So, firms that depend on external finance show under-investment if they are not able to secure the required funds (Dottling, Gutierrez and Philippon, 2017).

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[4] For this section various articles have been reviewed using Google search, Research Gate, Google Scholar. In addition to this, databases like Eurostat and AMECO have been referred to for specific current data. The keywords used to search these articles and data are "stagnating business investment", "stagnating business investment in US", "Stagnating Business Investment in EU", "Drivers of Weak Business Investment", "Net Investment in Netherlands", "Income Inequality in the Netherlands", "Business Investment".

- *Bank Dependence of Firms*: Dependency on banks is a constraint that affects those firms which do not have (easy) access to financial markets. The authors have found support for this hypothesis that shows that small firms show underinvestment when business lending (e.g.: bank loans) is reduced.
- *Scarcity of Safe Assets*: The authors have maintained that scarcity of safe assets like government bonds etc. or modifications to asset composition of firms, in itself, will not correlate to and affect investment. However, if businesses are not willing to make use of opportunities like low costs of funding, then it may affect the investment.

**Modifications to nature of investment in terms of more globalization and increasing intangible assets**

- *Intangible Assets*: Philippon and Gutierrez (2017) have shown how intangible assets can affect business investment in many ways. They show that there is an observed underinvestment in firms that have high intangible assets. Also, businesses that invest relatively heavily in intangible assets can have low needs for overall investment or tangible asset investment. We will touch more upon the increase in intangible investment and its effect on business investment later in this thesis.
- *Globalization*: In the U.S., the firm-level and national-level data are consolidated differently (Philippon and Gutierrez, 2017). If we consider national-level data then we can observe underinvestment if U.S. firms have more investment in foreign countries and less in U.S. or if foreign firms make less investment in the U.S. However, on a firm-level, the investment remains the same. Thus, globalization may not be a very good determinant of business investment.

**Reduction in Competition**

- *Uncertainty and Regulation* – The authors say that increase in regulation can reduce competition in an industry by increasing the barriers to entry for new firms. Drawing upon investment theory, they have further mentioned that firms may not invest if there is regulatory uncertainty and if they are unsure about the return on their investment. Firm-related uncertainty can also lead to low investment (Philippon and Gutierrez, 2017). Small businesses have pointed that uncertainty is one of the biggest factors that constrains economic activity (Lewis and Menkyna, 2014)
- *Market Concentration* - Philippon and Gutierrez (2017) have pointed out that competition fosters innovation and business investment. This is because if the competition is low then firms may not have incentives to innovate and make new business investments. Markets with high concentration or with incumbent firms have low competition and thus, exhibit a weak tendency to make business investments. They have also shown that market concentration has increased in the United States while it has remained fairly constant or even decreased in Europe.

**Stricter Corporate Governance**

- *Shareholder Influence and Ownership* – We can define institutional ownership as the available stock of a company that is owned by large agencies like mutual funds, pension funds etc. who manage funds on behalf of other people (Kenton, 2021). Stock-based compensation and its ownership is on the rise since the 1980s. This suggest that firms consider stock-based

compensation to be of significant importance (Fenn and Liang, 2001). Furthermore, Fenn and Liang (2001), show that companies that mostly rely on stock-based compensation, tend to repurchase their shares as compared to other companies. This is done because stock repurchase increases the value of the share, thus leading to higher compensation. Since there is a shift towards stock-based compensation and an increase in institutional ownership, companies may cut back long-term investment in favor of short-term profits and payouts (Philippon and Gutierrez, 2017). Thus, institutional ownership and shareholder influence also affects business investment.

Based on data gathered from various sources like Compustat and the U.S Bureau of Economic Analysis (BEA) and performing industry and firm-level regression analysis, Philippon and Gutierrez (2017) have found support for the three possible explanations of weak business investment in the U.S. out of the many drivers that are explained above. They have found that companies in business industries that have less competition invest less. Also, those companies that have high amounts of their stock owned by institutions including mutual funds and pension funds also invest less. Finally, according to the third explanation, increase in the intangible assets explains some of the investment gap. But it also leaves quite some gap unexplained which can be attributed to the first two explanations – decrease in competition and increase in institutional ownership in businesses.

Furman (2018) in his note on market concentration has also made arguments in which are in-line with the conclusions by Philippon and Gutierrez (2017). Furman (2018) concludes that reduced competition and increase in market power is linked with less private business investment in the U.S. Furthermore, it is also mentioned that reduced competition and increase in market concentration has invariably led to reduction in labor wage share and thus to increase in income inequality. Furman (2018) argues that these conclusions can "possibly" be generalized for other OECD economies.

These findings and possible explanations for a weak private business investment in the U.S. have been corroborated in the literature by Dottling, Gutierrez and Philippon (2017). Grullon, Larkin, and Michaely (2016) have found that more than three-fourths of the businesses / sectors in the U.S. have become concentrated in the past 20 years and they concluded that the U.S. economy has undergone structural changes that have weakened competition in the product markets. Additional studies by Autor, Dorn, Katz, Patterson, and van Reenen (2017), and Gutierrez and Philippon (2017) indicate that the decrease in private business investment in the U.S. has been due to an increase in concentration of firms and a decrease in competition. Thus, overall, based on our review of the literature, we can say that explanations of decreased competition and increase in market concentration, as well as an increase in intangible assets can be considered to be causes of declining private business investment in the United States.

However, Dottling, Gutierrez and Philippon (2017) and Philippon and Gutierrez (2017) have emphasized that the drivers of weak business investment in the United States are different from those in Europe. Thus, we have dedicated the next section to understand the literature that talks about the drivers affecting business investment in Europe.

## 3.2. Potential Drivers of Weak Private Business Investment in EU Economies

Let us next consider the literature concerning the decline in private business investment for the EU member states. For the EU economies, the market concentration of industries did not rise (due to factors like globalization), unlike in the U.S. IMF (2014) highlights that drivers such as weakness in demand, financial constraints and issues and political uncertainties have resulted in low private business investment in EU economies. These drivers are shown to be affecting the business investment in EU advanced countries in Bussière, Ferrara and Milovich (2015). Let us look at some of these drivers as follows:

**Weak Aggregate Demand**

Bussière, Ferrara and Milovich (2015) provide empirical evidence using an investment-accelerator model[5] to show how private business investment in the EU has been significantly affected by weak overall expected demand. As aggregate demand has been weak since 2008, businesses may have less incentives to make further investments. Bussière, Ferrara and Milovich (2015) have shown a strong and significant correlation between business investment and demand during 2007-2014, suggesting that aggregate demand is one of the main determinants that can explain the decline in business investment. The authors have also shown how considering the expected aggregate demand better explains the decline in investment as compared to considering the past aggregate demand. In line with Bussière, Ferrara and Milovich (2015), Banerjee, Kearns and Lombardi (2015) argue that if businesses are unsure about the future expected demand or if it is low, then such businesses will refrain from making any investments. Results by European Commission (2017) report also point to the fact that business investment has been weak since 2008 mainly due to weakness in demand. Lewis and Menkyna (2014) have attributed the decline in business investment to weak aggregate demand in their findings for OECD economies. They have pointed to the fact that weak demand has limited the business investment and production in most of the Euro area economies.

**Uncertainty**

According to European Commission (2017), business investment is significantly affected by uncertainty in economic outlook and anticipated profits. Bussière, Ferrara and Milovich (2015) have shown that after 'weak aggregate demand', 'uncertainty' is the next important driver that can explain the weakness in business investment. They argue that uncertainty regarding the future of the economy can prompt business owners and investors to postpone their investments. After the crisis of 2008, household and businesses are uncertain about many economic aspects like future spending, taxation, monetary policies, healthcare and regulatory policies etc. Aspects like uncertain tax rates leads businesses to postpone their investment plans if the uncertainty is not resolved quickly in the near future (Stokey, 2013). According to Banerjee, Kearns and Lombardi (2015), evidence shows that uncertainty regarding future economic

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[5] Bussière, Ferrara and Milovich (2015) start with a standard accelerator equation where business investment is modeled as a function of capital stock, where the level of capital stock is assumed to be proportional to output. The authors have then augmented this model by including two more explanatory variables – user cost of capital and uncertainty. In the augmented investment-accelerator model investment is modeled as function of GDP (current and forecast values to represent current and future demand), user cost of capital and uncertainty.

outlook, plays an important role in determining business investment. In some economies, business investment has improved where uncertainty about future economic conditions has reduced. On the contrary, uncertainty has greatly increased in the European economies, thus, causing a decline in the business investment. The authors also suggest that investment can be greatly boosted if greater clarity and certainty is created about the economic outlook. Since the crisis of 2008, there has been a lot of uncertainty about the future of economy and policy developments (Lewis and Menkyna, 2014). In times of such uncertainty, may businesses postpone their investment decisions that are hard to reverse, once made. Thus, such uncertainty might have affected the business investment (Lewis and Menkyna, 2014).

**Financial Constraints**

Financial constraints can also be one of the determinants that affects business investment. Businesses are unable to fund an investment when they do not have enough internal funds and are unable to access external funding due to constraints (Banerjee, Kearns and Lombardi, 2015). Businesses that have access to capital markets can get cheap and rapid access to external funding, however, for firms that are dependent on bank-financing, securing funds is a bit more difficult. The access to bank credit has become tighter in some of the European economies after the crisis of 2008 and hence smaller businesses that are heavily reliant on bank-financing may face some financial constraints to fund their investments (Banerjee, Kearns and Lombardi, 2015). Despite the above-mentioned facts regarding financial constraints, according to Banerjee, Kearns and Lombardi (2015), the lack of financing is not sufficient to explain the decline in business investment. This could be because the contribution of small businesses that face such financial constraints is small relative to the overall investment. Another possible explanation is that if small businesses had profitable business investment opportunities, then large firms with access to capital financing could finance the small businesses via business mergers or trade credit. But this form of interaction between small and large businesses is not visible (Banerjee, Kearns and Lombardi, 2015). Bussière, Ferrara and Milovich (2015), have also found similar results in their research for advanced economies. According to economic theory, businesses make investments until a level where they can cover up their costs of financing (user cost of capital). Thus, a low user cost of capital should promote a higher investment. But in many euro area economies, a continuous decline in user cost of capital has failed to result in a high investment. Bussière, Ferrara and Milovich (2015) do not find any statistical significance between business investment and the user cost of capital. Similarly, European Commission (2017) does not find significant relationship between cost of capital and business investment.

In EU, stringent credit constraints are seen to be an issue mainly for businesses in the "periphery" economies. Generally, the "periphery" economies consist of Greece, Italy, Spain, Portugal and Ireland. Other countries like Germany, Netherlands, Austria, Belgium, Finland, Luxembourg are deemed to be core countries which are thought of as being more advanced as compared to the periphery economies (Gräbner et al 2017). As expected, financial credit constraints play a little role in explaining sluggish private business investment for advanced economies, because these economies do not face stringent financial constraints as those faced by the less advanced countries. These findings for advanced economies are corroborated by Lewis and Menkyna (2014).

**Regulations**

Lewis and Menkyna (2014) have highlighted market regulations as one of the possible drivers that can affect business investment. They have pointed that the exact effect of market regulation on business investment can be uncertain as these regulations can either prove to be incentives for businesses to make new investments or prove to be deterrents to the incumbent firms by introducing unfavorable conditions for financing new investments. However, empirical evidence shows that regulations that lead to barriers to market entry or dissuade competition have negative effect on business investment. Although in some of the vulnerable countries in euro area, the market regulations are reducing and thus, helping in promoting business investment. European Commission (2017) has also highlighted a similar relationship between product market regulations and business investment. An analysis of 32 OECD countries shows that strict product market regulations are related to weak business investment. Again, less restrictive sector-specific regulation helps in facilitating more business investment in long-term. This is specifically for regulation related to entry barriers.

**Demographics**

Demographics, in particular low birth rates are associated with weak economic growth (Bloom et al. 2011). Aging of population can lead to weak economic growth in future. As per Bloom et al. (2011), the OECD economies can expect moderate decline in their economic growth rates. Afonso and Jalles (2015) have also found evidence linking the aging of population to decline in business investment. These authors analyzed a panel dataset of 95 countries to check the relationship between investment and fiscal policy. They have shown that growing population is positively related to both private and public investments. They have used dependency ratio which is the percentage of working age population to account for the demographic effect on investment. Their results show that dependency ratio is negatively associated with private business investment. The effects of changing demographics – change in population growth / dependency ratio – can usually be reflected in the employment rates of a country. Thus, employment rate can also be a variable of interest that can impact the business investment.

**Unemployment Rate**

Many authors have analyzed the relationship between unemployment rate and business investment. (Herbertsson and Zoega, 2002) have found strong negative relationship between unemployment rate and business investment. They have analyzed the data for 19 OECD countries from 1960 to 1997. The authors have attributed many decades to low investment in OECD economies to low hiring and employment rates in those countries. Sigurdsson (2013) has analyzed panel data for 15 OECD economies from 1970 to 2011 where he has defined investment to be gross fixed capital formation as percentage of GDP. He has defined the unemployment rate as share on unemployed work force to the total work force. His results show a statistically significant negative relationship between investment and unemployment. Karanassou et al. (2003) and Karanassou et al. (2004) have concluded the importance of understanding the capital formation trends in the European Union to understand more about the unemployment rate trends.

**Commodity / Energy Prices**

Many authors have also highlighted the relationship between investment and energy / commodity prices. Uri (1980) has econometrically shown that energy prices is one of the significant determinants for business investment which is often overlooked. Energy prices affect the marginal rate of return on investment because when energy prices rise, firms need to use more capital to achieve the same amount of output and hence their rate of return decreases. Thus, increase is energy could depress business investment. Herbertsson and Zoega (2002) have found significant correlation between investment, unemployment and price of oil. Fay et al. (2017) has highlighted the commodity prices – energy prices – as one of the determinants of business investment highlighting its positive relationship with investment as increase in energy prices can signify increase in demand, thereby leading to increase in business investment. The authors have analyzed a dataset of 30 advanced economies by regressing the business investment on various determinants like demand, uncertainty, energy prices etc. They have found significant positive relationship between business investment and global energy prices. Similarly, European Commission (2017) has identified the energy sector to be one of the investment challenges for many European economies. Dlugosch and Koźluk (2017) have also studied the relationship between firm-level business investment and energy prices for 30 OECD economies from 1995 to 2011. They have however found that increase in energy price inflation is related to significant decrease in business-level investment. It seems like although there is no consensus among authors on the relationship between energy prices and business investment, there is definitely a consensus among the authors on the fact that energy prices is a significant determinant of business investment.

Thus, to summarize, the literature review shows that weak demand, uncertainty issues, regulations, demographics, unemployment rate, energy prices are the main drivers for low private business investment in the advanced countries in the EU. There is not much literature linking the significance of financial constraints like user cost of capital to weakness in business investment.

In this thesis, as mentioned previously, the countries of focus will specifically be the Netherlands and Germany. In the next sub-section, we will review the data related to business investment in the Netherlands and Germany.

## 3.3.    Potential Drivers of Weak Business Investment in The Netherlands and Germany

Gross fixed Capital Formation (GFCF) investments as defined by Eurostat are acquisitions minus disposals of investments in machinery, equipment, buildings, structures, mineral exploration, computer software, literary / artistic originals and major land improvements like clearance of forests. The World Bank has defined GFCF as investments in land improvements like fencing, making ditches, drains etc.; plant, machinery, equipment, and construction of roads, railways, schools, offices, hospitals, private residential buildings, commercial and industrial dwellings. Additionally, net acquisition of valuables is also included in GFCF. According to International Monetary Fund (IMF), GFCF can used to proxy private business investment. Thus, GFCF includes physical tangible assets and a component of intangible assets like software, mineral exploration innovation etc. GFCF includes the depreciation of existing assets. Depreciation expenditures are used to replace already existing tangible assets which have reached the

end of their economic life-time. Subtracting depreciation / consumption of fixed capital (CFC) from GFCF, we get Net Fixed Capital Formation (NFCF). NFCF consists of new capital goods which are added to the existing capital stock. Hence, NFCF entails an increase in the production capacity of the economy and as such it is a driving force of economic growth.

In this thesis, first we have used the GFCF values from AMECO database annotated as OIGT. OIGT per AMECO is defined as:

OIGT = GFCF at constant prices in construction (OIGCO) + GFCF at constant prices in equipment (OIGEQ) + GFCF at constant prices in agriculture, forestry, fishery and aquaculture + GFCF at constant prices in "other products".

Where, OIGCO, OIGEQ and agriculture, forestry, fishery and aquaculture represent the physical tangible assets and "other products" represent the intangible asset component that includes mineral exploration, software, entertainment, literary / artistic originals and other intangible fixed assets.

We have used the NFCF values from AMECO database as well annotated at OINT. OINT per AMECO is defined as:

OINT = OIGT – OKCT

Where OKCT represents the CFC / depreciation values for total economy at constant prices.

Based on AMECO data, we have calculated the ratio between NFCF (at constant prices) to GDP (at constant prices) for the Netherlands and Germany. See the Figures 4 and 5 below. For the Netherlands, the ratio NFCF/GDP was around 14% in 1970 and it declined to about 4% in 2021. The Figure 4 shows that net fixed capital formation has stagnated in the Netherlands. Similarly, Figure 5 for Germany (1991-2021), also shows the relative decline in NFCF over time where it declined from 8,32% in 1991 to 2,57% in 2021. Thus, we can see that NFCF has been stagnating in both these countries relative to GDP.
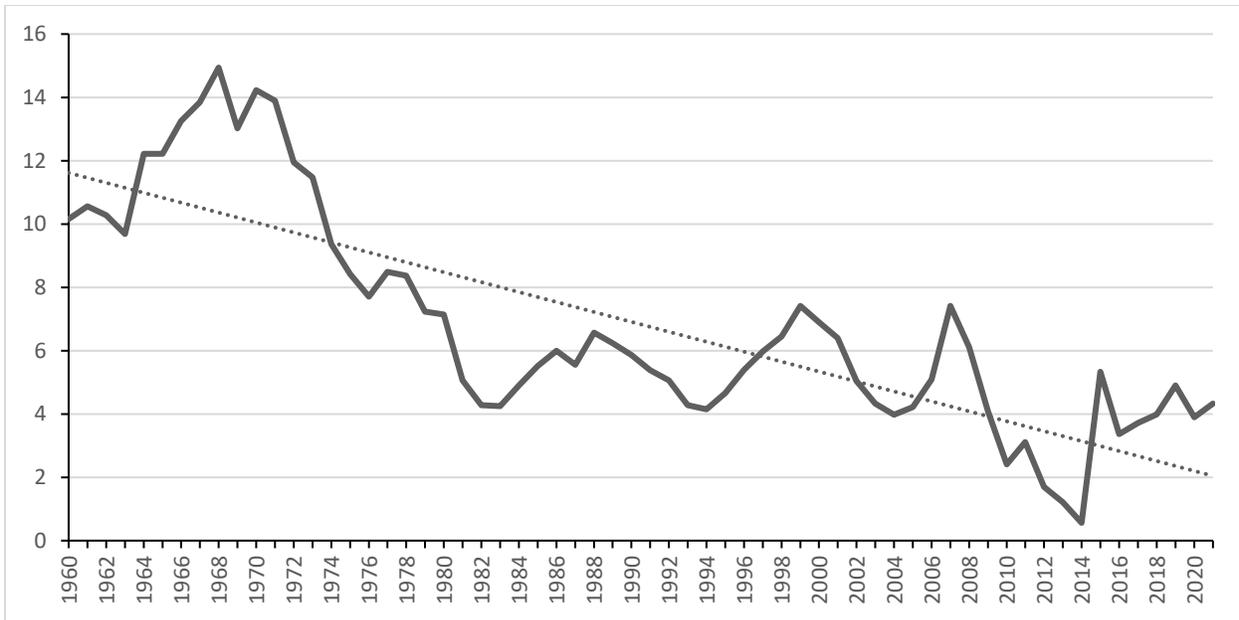
Figure 4 NFCF as % of GDP for Netherlands (1960-2021).
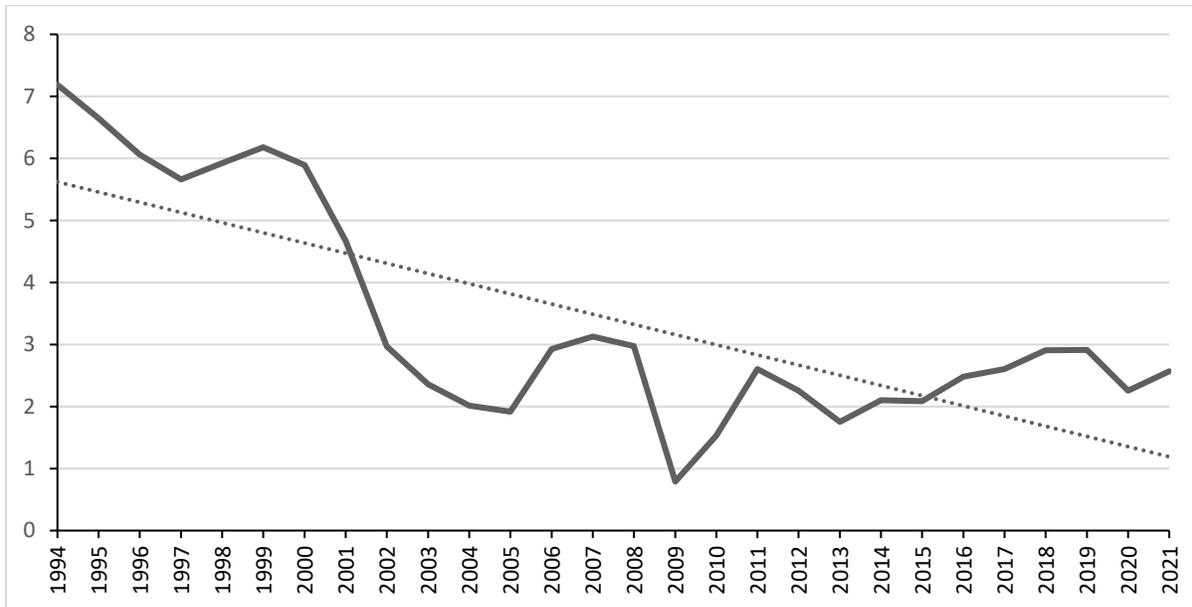
*Source*: AMECO database



Figure 5 NFCF as % of GDP for Germany (1991-2021).

*Source*: AMECO database

Based on data published by ECB, the cost of borrowing for corporations in Germany decreased from about 4,9% in 2003 to about 1,6% in 2021. Yet, this decrease in borrowing cost did not translate into increased investment. Thus, some drivers may be keeping the investment down in these countries. Now the counterfactual question is what are these drivers and would the investment have been higher if these factors had been absent?

Another aspect that we must consider here are the intangible investments. Eurostat defines these investments as "non-monetary assets without any physical or financial aspects to it". According to ESA 2010, investment in intellectual property products and ICT related equipment can be considered as intangible investment. Assets like human capital, relationships, distribution systems are not considered under the umbrella of intangible investments by ESA 2010. Investment in intangible assets is important for improving economic growth, raising standards of living and increasing productivity (Thum-Thysen et al, 2017). As we saw at the beginning of Section 3.3, NFCF includes a component of intangible assets that includes software, mineral exploration, artistic / literary originals and other intangibles. Here, from Figures 4 and 5 we can see that total NFCF (tangible + component of intangible investment) shows a declining trend for the Netherlands and Germany. Thus, it could be the case that businesses are increasing investments in intangibles and we see a decline in NFCF. In this situation, decline in NFCF may be less of a problem for economic growth because intangible investment is rising. Thus, it is important to check if intangible investment is rising in the Netherlands and Germany. We will check the trend of intangibles as part of NFCF in Chapter 5. In fact, Philippon and Gutierrez (2017) have found it to be the case for the U.S. The authors have shown how an increase in intangible investment can explain a decline in NFCF.

Another important aspect is a process called financialization through which financial corporations and institutions can influence macro and micro economic systems (Palley, 2007). Increase in financialization has consequences like increase in the importance and transfer of income from financial sphere to real / non-financial corporations, increase in stagnation of wages and income inequality (Palley, 2007). Thus, if the process of financialization increases, it can lead to stagnating or declining NFCF. Palley (2007) also argues that more financialization corresponds to lower economic growth. According to him, this can happen in various ways. Financialization leads to a change in corporate behaviour where profits are invested in shareholders' interests or by making share buybacks to increase the stock price.

Financialization takes place due to particular economic policies that promote labour market deregulation, eroding of labour protection, abandoning the goal of full employment, globalization etc. One of the global aggregate indicators of financialization is the measure of total financial assets as % of GDP affecting total economy (Stolbova et al, 2017). In Figure 6, we can see this value increasing for the Netherlands and Germany, thus, signaling an upward trend in financialization.
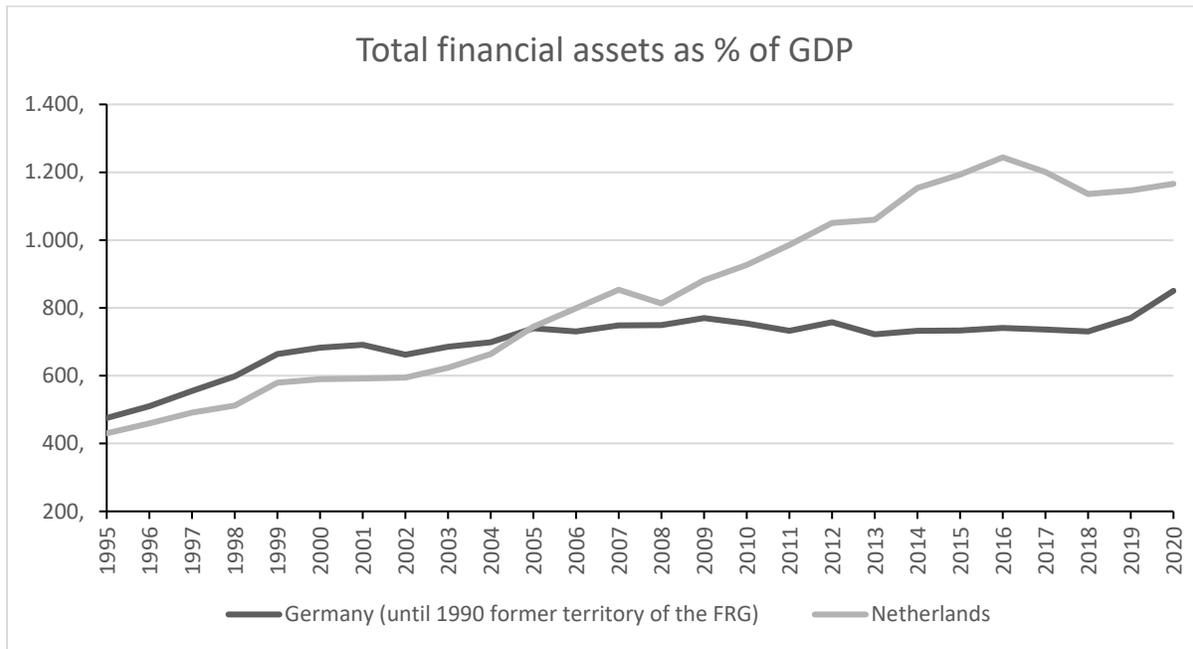
Figure 6 Total financial assets as % of GDP for Netherlands - Germany (1995-2020).

*Source :* Eurostat database

In the subsequent paragraphs we will investigate these and other possible drivers of stagnating business investment based on literature reviewed until now for US and EU both.

## 3.4. Identifying the determinants of business investment in the Netherlands and Germany

In this thesis, we will first consider all relevant determinants of stagnating business investment for the Netherlands and Germany that can be empirically analyzed based on aggregate and industry data. We will exclude determinants that require firm-level data analysis because of the fact that these data sets are not publicly available free of cost.

To compile a list of all possible determinants of weak business investment, we will especially focus on the literature from European Commission (2015), European Commission (2017), Gutierrez and Philippon (2017), Dottling, Gutierrez and Philippon (2017), Bussière, Ferrara and Milovich, (2015), Fay et al. (2017), Banerjee, Kearns and Lombardi, (2015). Thus, we can group determinants of stagnating business investment as follows in Table 1:

| Category | Determinants | Expected sign (+/-) of effect | Level of Aggregation |
|---|---|---|---|
| Demand (D1) | | | |
| | Demand growth (DEM) | + | Aggregate |
| Business Environment (D2) | | | |
| | Business dynamism (BD) | + | Industry + Aggregate |
| | Global energy index (GEI) | +/- | Aggregate |
| | Uncertainty (UNCT) | - | Aggregate |
| Financial constraints (D3) | | | |
| | User cost of capital (UCoC) | - | Aggregate |
| | Real net profits (RNP) | + | Aggregate |
| | Term spread (TS) | - | Aggregate |
| | | | |
| Type of Investments (D4) | | | |
| | Increase in Intangible assets (ITA) | +/- | Firm and Industry |
| | Financialization (FNC) | - | Aggregate and Firm |
| Demographics (D5) | | | |
| | Working age population percentage (WP) | + | Aggregate |
| | Unemployment rate (UNEMPR) | - | Aggregate |
| | Total factor productivity growth (TFP) | + | Aggregate |
| Regulations (D6) | | | |
| | Network sector regulation (NSR) | - | Industry + Aggregate |
| | Employment Protection Legislation (EPL) framework | +/- | Aggregate |

Table 1 List of possible determinants of stagnating business investment in the Netherlands and Germany

## 3.5. Conclusion

In Chapter 3, we reviewed literature to understand the relevant determinants of business investment in general and specifically for the Netherlands and Germany. The factors that significantly affect business investment are different in the U.S. and in Europe. Market concentration, increase in institutional share ownership and increase in intangible assets are the determinants that can explain changes in net fixed capital formation in the U.S. Whereas for Europe there is a slight change in the factors at play. For Europe and specifically for the Netherlands and Germany, determinants like demand, business environment,

financial constraints, demographics and sectoral regulations are considered as the relevant factors in explaining changes to business investment. Table 1 provides a list of these determinants with their expected effect on fixed business investment. Thus, in Chapter 3, we have answered our first sub research question (SRQ1).

# Chapter 4

# Model, Data and Methodology

In Chapter 4 we present the empirical model that will be used to identify and analyze the determinants of business investment for the Netherlands and Germany econometrically. In Sections 4.2 and 4.3 we discuss the data used in statistical analysis. Section 4.4 will discuss the preliminary expected relationships between dependent and independent variables.

## 4.1. Empirical Model and Methodology

In this thesis, we have used an augmented accelerator-type model as that is used by Bussière, Ferrara and Milovich, (2015), Fay et al. (2017), Banerjee, Kearns and Lombardi (2015). In the standard accelerator model, business investment is modelled as a function of capital stock which is proportional to output (GDP) (Bussière, Ferrara and Milovich, 2015). In this thesis, we will augment this accelerator model with other determinants.

Business investment is the dependent variable which is regressed on all relevant determinants that are mentioned in Table 1. These determinants are our independent variables. The business investment variable (dependent variable) is modelled as the ratio of net fixed capital investment (NFCF) to gross domestic product (GDP) of the Netherlands and Germany. This ratio is abbreviated as (i) in this thesis. Thus, (i) is a function of 14 different determinants. Not all the determinants will contribute strongly in explaining changes to NFCF/GDP. Thus, we will commence by including most relevant determinants in the model based on data and literature review.

Determinants, like Increase in intangibles (ITA), Financialization (FNC) and Business Dynamism (BD) will be analyzed outside the model based on direct data and literature review as these determinants are outside the scope of empirical analysis of net fixed capital formation (NFCF).

Let us say that we are remaining with n determinants that will be considered inside the empirical model. Here, n=11. We will refer to the following four steps to continue with our empirical analysis of n determinants.

**Step 1** : Multivariate model of n determinants

To check how our independent variables affect the dependent variable, in step 1, we will first make an empirical time-series model for the period 1994-2021, where business investment (NFCF/GDP) (i) is shown as a factor of these determinants.

$$i \; = \; \sum_{j=1}^{n} \alpha_n * d_n \; \ldots \ldots (1)$$

where $\alpha$ = weight of determinant $d_n$ in business investment (i).

Therefore,

$$NFCF/GDP\ (i) = \alpha_1 * DEM_{t-1} + \alpha_2 * DEM_{t-2} + \alpha_3 * UCoC + \alpha_4 * RNP + \alpha_5 * TS + \alpha_6 * UNCT + \alpha_7 * GEI + \alpha_8 * WP + \alpha_9 * UNEMPR + \alpha_{10} * TFP + \alpha_{11} * EPL + \alpha_{12} * NSR + \text{Constant} \ldots\ldots\ldots\ldots (2)$$

DEM represents the year-on-year growth in overall demand. We have introduced lags of demand growth variable to avoid endogeneity issue. UNCT represents uncertainty in absolute values. UCoC is the user cost of capital in percentage. RNP represents the real profit values of firms in millions of euros. TFP and EPL represent the productivity and strictness of labor regulations in year-on-year growth and absolute values respectively. WP and UNEMPR show the percentage of working population and unemployed population for the current year. NSR and GEI are indices to represent the network sector regulations strictness and global energy prices respectively. Finally, TS shows the term spread values in percentages for a particular year.

**Step 2**: Multivariate regression analysis

Using the model in step 2, we will then perform a Ordinary least square (OLS) multivariate linear regression analysis on these determinants starting with DEM variable. We will add the remaining independent variables one-by-one and repeat the regression analysis for every new addition. This is done to see the explanatory power contribution of every new variable towards explaining the change in NFCF/GDP. We will check if these results are statistically significant at confidence levels of 90%, 95% and 99%. We have assumed that the data fits the characteristics of linear regression. We will also validate these assumptions by performing diagnostic checks subsequently.

In Sections 4.2 and 4.3 we will look at how the dependent and independent variables are defined and modelled in our empirical equation.

## 4.2.    The Dependent Variable

The dependent variable is our variable of interest, which in this case is the ratio of net fixed capital formation (NFCF) to Gross domestic product (GDP). The data for NFCF and GDP have been obtained from the AMECO database at constant prices.

## 4.3.    Independent Variables

The independent variables / determinants are expected to explain changes to our dependent variable. The main determinants that will be treated inside the empirical model are explained as follows:

- **Demand Growth (DEM)**

Our first determinant is growth in demand, abbreviated by DEM. Businesses make investments to fulfil the current and expected demand. Since precise data on the firm's perception of future demand are usually unavailable, the empirical literature generally uses GDP excluding investment to represent demand (Fay et al, 2017). In this thesis, we have represented demand as

$$Demand = GDP - NFCF \ldots (3)$$

Demand growth (DEM) is the percentage change in demand from the previous period to current for every observation. We expect DEM to be positively related to NFCF/GDP as the literature reviewed until now points to the fact that firms show increased investment when there is a growing demand for their product or service.

- **Uncertainty (UNCT)**

Our second determinant is uncertainty, abbreviated by UNCT. The decisions of businesses to make investments can be affected by uncertainty as usually it takes time to plan and implement any project and a significant time may be required before the businesses can actually see returns on their investment projects (Fay et al, 2017). Firms are often seen to postpone their investment decisions in face of uncertainties until they have some certainty about the future (Bernanke, 1983). Based on the literature reviewed until now, we can expect UNCT to be negatively related to NFCF/GDP.

Various measures of uncertainty have been used by different authors (see Bussière, Ferrara and Milovich 2015, Fay et al, 2017). One of the widely-used measures of uncertainty is the Economic Policy Uncertainty (EPU) index. However, due to lack of sufficient data points of this index for the Netherlands, we decided to use the World Uncertainty Index (WUI) that was developed by Nicholas Bloom (Stanford University), Davide Furceri (International Monetary Fund) and Hites Ahir (International Monetary Fund) as a measure of uncertainty (UNCT). The WUI data for the Netherlands and Germany are taken from the Federal Reserve Economic Data (FRED) database. Figure 7 shows the world uncertainty index for the Netherlands and Germany from 1994-2021. We can see an increase in the uncertainty for both the countries over the course of 28 years.
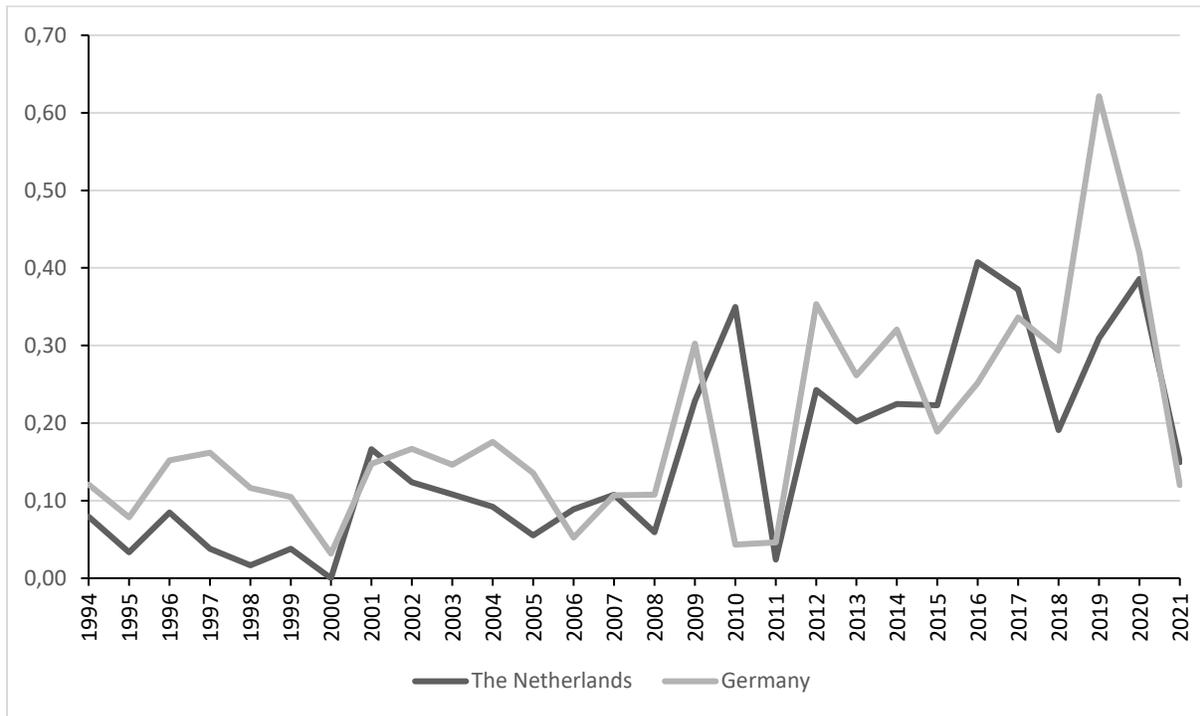
Figure 7 Uncertainty Index for the Netherlands and Germany (1994 - 2021).

*Source*: FRED database

- **User Cost of Capital (UCoC)**

Our third determinant is the user cost of capital, abbreviated by UCoC. It is essentially a function of the interest rates and measures the minimum cost / return that a business requires in order to cover for the depreciation, opportunity costs etc. that are involved in funding an investment (Fay et al, 2017). It is used as one of the proxies for financial constraints. A decrease in the user cost of capital is usually associated with increase in investment as it becomes cheaper to borrow and fund projects (Bussière, Ferrara and Milovich, 2015). This variable has been replicated by taking inspiration from Bussière, Ferrara and Milovich (2015) and is defined as follows

$$UCoC = (\gamma - \pi + \delta) * \frac{def\ (inv)}{def\ (GDP)} \text{ .... (4)}$$

Where $\gamma$ is the long-term rate on 10-year government bond obtained from FRED database, $\pi$ is the growth rate of GDP deflator (the inflation rate) obtained from World Bank national accounts database and OECD national accounts database. Then, $\delta$ is defined as the depreciation rate obtained as the ratio of consumption of fixed capital (CFC) to the lagged net capital stock. The data on net capital stock and CFC are obtained from AMECO database. Finally, $\frac{def\ (inv)}{def\ (GDP)}$ is the relative price of capital defined as the ratio of investment deflator to GDP deflator. The values of these deflators are obtained from AMECO database. Figure 8 shows the decline in user cost of capital for the Netherlands and Germany from 1994 – 2021.

Based on the literature reviewed so far, we can expect negative association between user cost of capital and NFCF/GDP if the user cost of capital is statistically significant. However, despite the decline in user cost of capital, not many studies have found a significant impact of this variable on business investment (Bussière, Ferrara and Milovich, 2015).
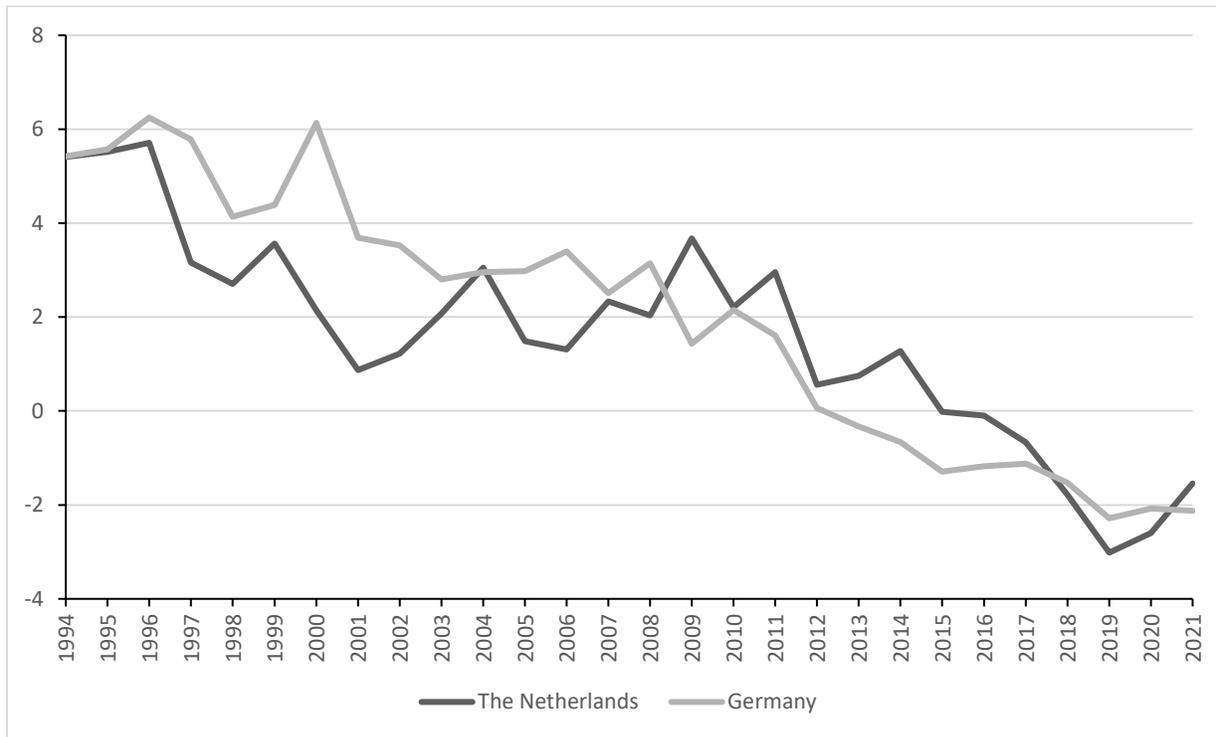


Figure 8 User cost of capital for The Netherlands - Germany (1994 - 2021).

*Source :* Author's calculations

- **Real Net Profits (RNP)**

Our fourth determinant is Real net profits of businesses, abbreviated by RNP. Based on European Commission (2017), corporate profits are used as a proxy for financial constraints. Corporate profits can be used internally to fund any new investment project. Therefore, considering all other things equal, higher profits can translate into lower financial constraints for funding investments and hence, leading to higher business investments. The real net profits are calculated as gross operating surplus for non-financial corporations minus CFC and are deflated by the GDP deflator. The data on gross operating surplus, CFC and GDP deflators for the Netherlands and Germany are obtained from the AMECO and FRED databases.

Figure 9 shows the trend in real net profits for the Netherlands and Germany from 1994 – 2021. We can see that the profits are following an upward trend. Based on the literature reviewed, we can expect a positive relationship between RNP and NFCF/GDP.
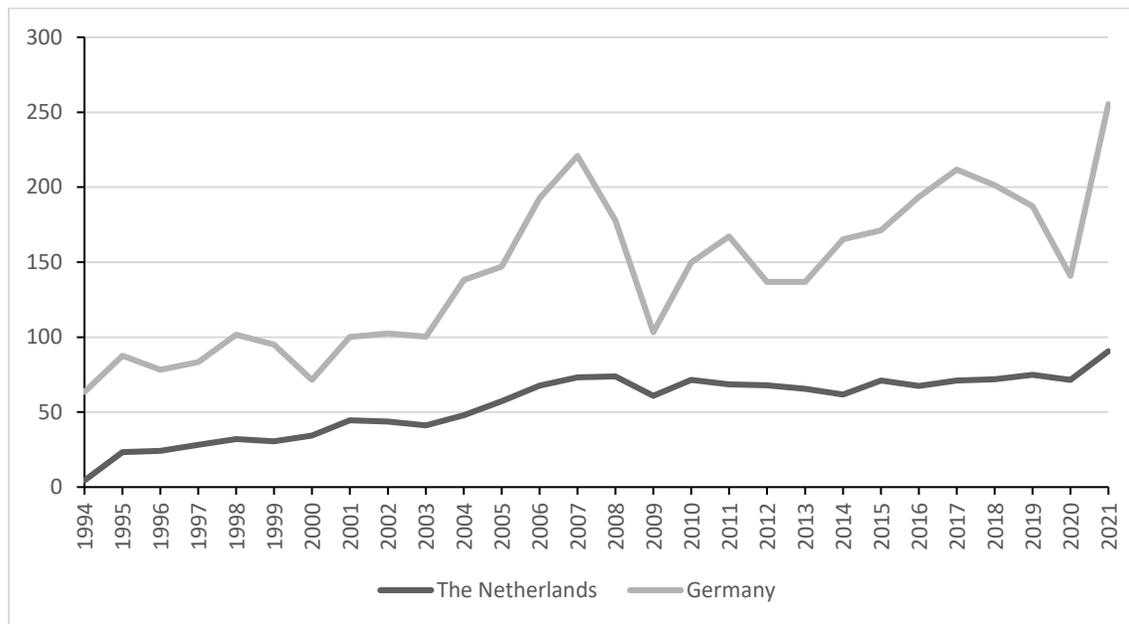
Figure 9 Real net profits for the Netherlands - Germany (1994 - 2021).

*Source* : Author's calculations

- **Total Factor Productivity growth (TFP)**

Our fifth determinant is total factor productivity growth, abbreviated as TFP. Total factor productivity is positively associated with business investment as evidenced from the literature (Fay et al, 2017, Kose et al., 2017). Since business investment is usually related to the development of new technologies, productivity-improving technologies, the decrease in total factor productivity can account to an extent for the weak business investment in advanced economies (Kose et al, 2017). Similarly, Fay et al. (2017) have argued that a country's total factor productivity growth is one of the structural aspects that drives the long-term business investment.

Based on the literature reviewed, we can expect a positive relationship between TFP and NFCF/GDP. Figure 10 shows the trend in TFP for the Netherlands and Germany over the period of 28 years. The total factor productivity growth has remained fairly constant over the years with a significant drop after the financial crisis of 2008 and then bouncing back again in 2010. The data on total factor productivity growth for the Netherlands and Germany are obtained from the OECD database.

Figure 10 Total factor productivity growth for the Netherlands - Germany (1994-2021).

*Source*: OECD database

- **Employment Protection Legislation Framework (EPL)**

Our sixth determinant is Employment protection legislation index, abbreviated as EPL. Many authors have pointed to the fact that strong employment protection for workers is negatively associated with firm-level investment. Calcagnini and Giombini (2009) have analyzed the effect of EPL on business investment in the presence of imperfect financial markets for Europe. They found that investment by firms decreases in the presence of strong employee protection frameworks. However, if businesses have fewer financial constraints and better access to financial markets, then strong EPL is not found to hinder firm-level investment. Bai et al. (2018) have also found negative relationship between EPL and firm-level investment for the U.S. labour market. It is also important to note that the effect of EPL on business investment can be ambiguous as strong EPL can serve as an incentive to the employees to invest more in firm-specific human capital, learn more and thereby increase investment and productivity (European Commission, 2017). There is literature pointing to the fact that reduction in EPL can be counter-productive and result is loss of motivation among the employees (Storm, 2021). In line with Calcagnini and Giombini (2009), European Commission (2017) has also mentioned that the negative effect of EPL on business investment can get amplified if access to financial markets is constrained. In this thesis, based on the literature

reviewed, we will assume a negative or positive relationship between EPL and NFCF/GDP as the exact relationship is unclear from the literature.

Figure 11 shows the EPL indices for the Netherlands and Germany from 1994-2021. These data are obtained from the OECD database. We can see that the EPL value for Germany has been constant throughout the period of 28 years. Thus, we have not included it in the final empirical model for Germany. For the Netherlands, the EPL value has increased slightly since 2015, although it too has been fairly constant over the years.
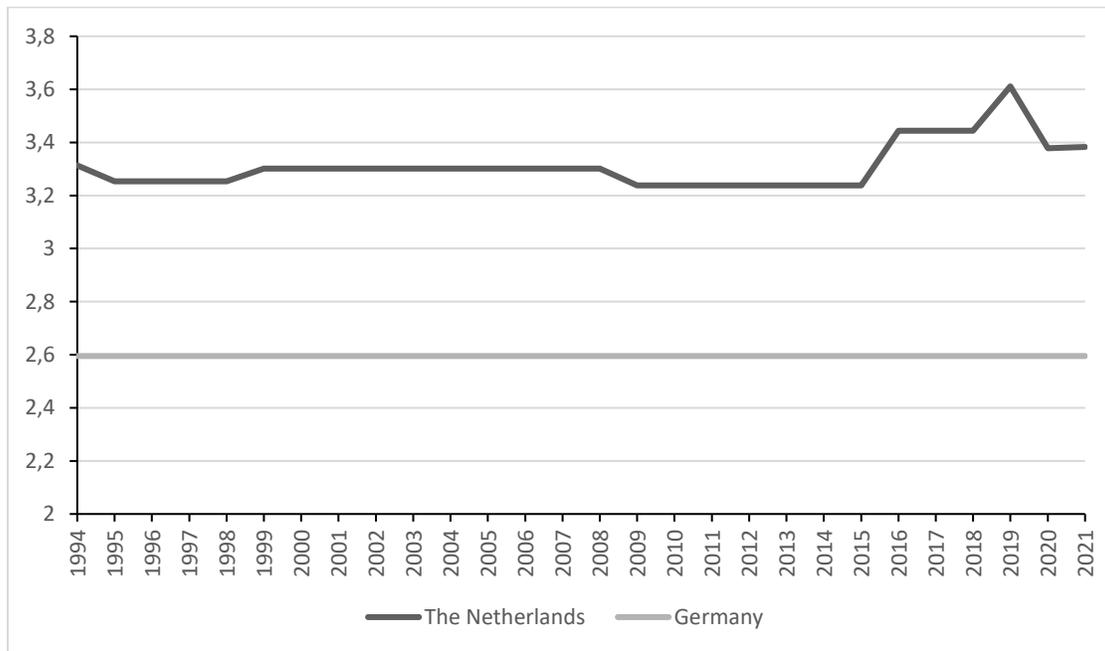


Figure 11 EPL for the Netherlands - Germany (1994-2021).

*Source* : OECD database

- **Working age population percentage (WP)**

Our seventh determinant is the percentage of the working age population in the total population, abbreviated as WP. Various authors have studied the relationship between population ageing, economic growth and business investments. Campbell and Mehlman (2018) argue that a decrease in economic growth will be the effect of population ageing. Maestas et al. (2016) have analyzed the population data for the U.S. from 1980-2010. They find that a 10% increase in the percent of population aged 60 and above translates into a decline in GDP growth by 5,5%. Similarly, Hsu and Lo (2019) analyzed the impact of population aging on economic growth, capital formation and savings in Japan. These authors found that aging population leads to lower economic growth and decrease in capital formation

Based on European Commission (2014), the E.U. is experiencing a decline in the working age population due to various reasons like low birth rates, long life expectancies etc. In this thesis, working age population percentage is used as the proxy to capture the essence of population aging as decrease in the working age population can be translated to increase in population aging. Here, working age population percentage includes all the individuals between ages 15-64 as a percentage of total population. These data for the Netherlands and Germany are obtained from the OECD database for 1994 – 2021. Figure 12 shows the declining working age population as a percentage of total population for the Netherlands and Germany. Based on the literature reviewed till now, we can expect a positive relationship between WP and NFCF/GDP.
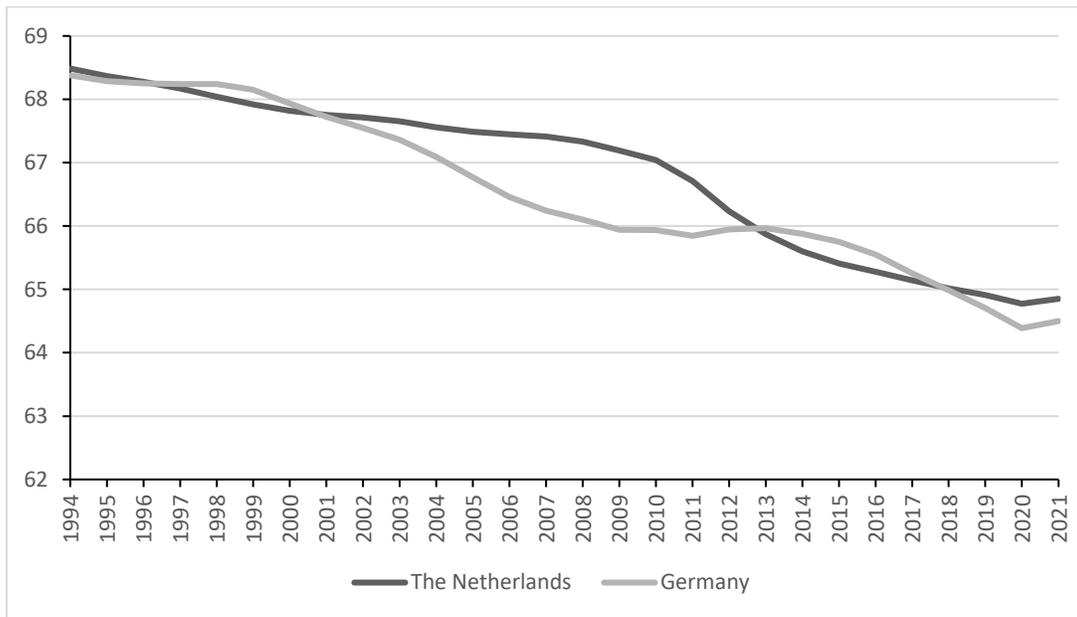


Figure 12 Working age population % for the Netherlands - Germany (1994-2021).

- **Unemployment Rate (UNEMPR)**

Our next determinant is the unemployment rate, abbreviated as UNEMPR. Here, the unemployment rate is defined as the workforce that is currently out of work but is available for employment (as a percentage of the total work force). The data for the Netherlands and Germany are obtained from the OECD database. Many authors have found a significant negative relationship between unemployment and business investment (see Sigurdsson 2013, Herbertsson and Zoega 2001). Thus, we can expect that a decrease in unemployment will be associated with increase in business investment and vice versa. Figure 13 shows the unemployment rate for the Netherlands and Germany from 1994 – 2021. For Germany we can see a decline in the unemployment rate after a peak in 2005, however, such a trend for the Netherlands is not visible.
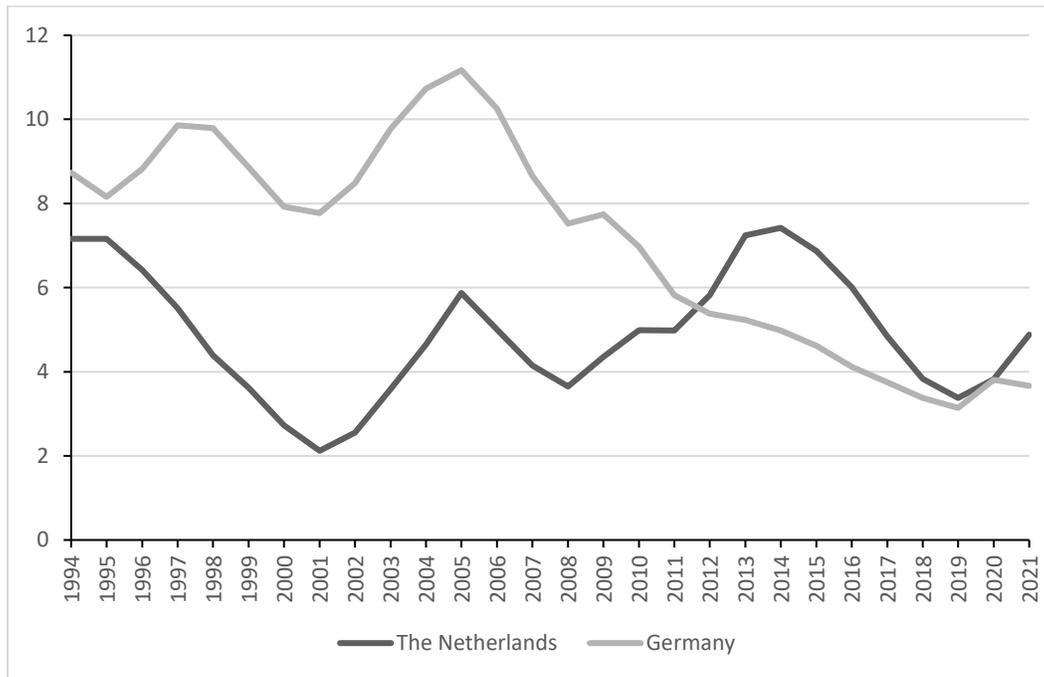
Figure 13 Unemployment rate for the Netherlands - Germany (1994 - 2021).

*Source:* OECD database

- **Network Sector Regulations (NSR)**

Our ninth determinant is Network sector regulations, abbreviated as NSR. Some literature has highlighted sectoral/market regulations to businesses as one of the determinants of business investment (see European Commission 2017, Lewis and Menkyna 2014). Schiantarelli (2016) has analyzed the market regulations in the OECD economies in the past decades and their effect on business investment and innovation. The author has shown that reducing market / sectoral regulations to reduce the barriers to entry for businesses leads to increase in physical business investment and innovation. We hypothesize a negative relationship between network sector regulations and business investment.

In this thesis, OECD network sector regulation indices are used to proxy for the barriers to business entry and investment. Based on OECD calculations, low indices indicate more competition friendly regulations that promote business entry by reducing any barriers. The regulations in energy, transport and communication sectors are coupled to obtain the total network sector values for regulations. Figure 14 shows the decline in network sector regulations for the Netherlands and Germany.
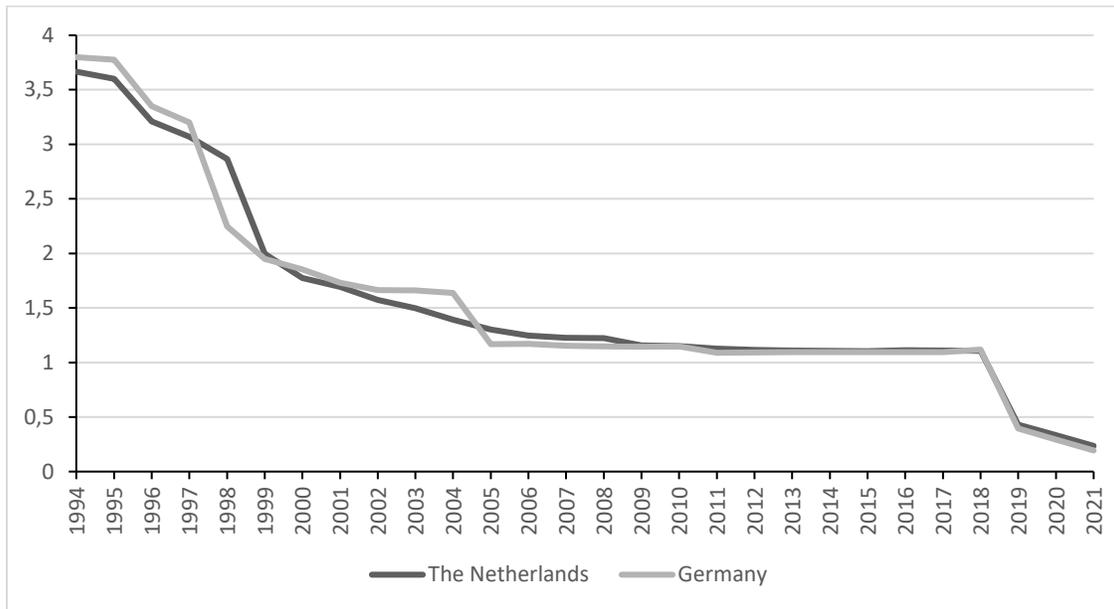
Figure 14 Network sector regulations for the Netherlands - Germany (1994 - 2021).

*Source*: OECD database

- **Term Spread**

Our tenth determinant is Term Spread, abbreviated as TS. Term spread can also be used as a measure / proxy to assess the financial constraints and availability of funding for firms (Banerjee, Kearns and Lombardi, 2015). The variable determinant term spread is defined as the difference between the yield of long term 10-year government bond and the yield of 3-months treasury bill. Banerjee, Kearns and Lombardi (2015) have found a statistically negative and significant relationship between business investment and term spread, indicating that lower long-term interest rates have a more significant impact on firm-level investment as compared to the short-term interest rates. Based on the literature, we expect a negative relationship between TS and NFCF/GDP. The data on yields of 10-year government bonds and 3-months treasury bills for the Netherlands and Germany are obtained from the FRED database.

Figure 15 shows the term spread for the Netherlands and Germany over a period of 28 years. We can see that TS was negative during the 2008 financial crisis, after which it increased in 2009 and again started declining from there on. The TS for both the countries shows a similar trend.

Figure 15 Term spread for the Netherlands - Germany (1994-2021).

*Source*: FRED database

- **Global Energy Index (GEI)**

Our final determinant is the Global Energy Index, abbreviated as GEI. Fay et al. (2017) have highlighted the importance of commodity prices – especially the prices of energy – in determining the overall business investment. Furthermore, the authors have pointed the fact that changes in energy prices affect the sectoral and overall business investment in countries that produce energy related commodities as well as those that consume such commodities. They have found significant positive relationship between the energy prices and business investment. Such positive relationship can seem to be counterintuitive as core (advanced) countries are usually importers of energy. However, the literature seems to suggest that the changes in energy prices reflects the current and anticipated demand (see Fay et al, 2017, Kilian and Murphy 2014). Thus, strong energy indices can reflect strong demand, thus, giving incentives for further business investment.

In this thesis, we have used the global energy index obtained from the IMF database. This index is representative of the global benchmark prices of energy commodities. The global energy index is made up of the indices of crude oil, natural gas, coal and propane.

Figure 16 shows the trend in the world energy index, which is also applicable to the Netherlands and Germany. We can see that the energy price index shows an upward trend.
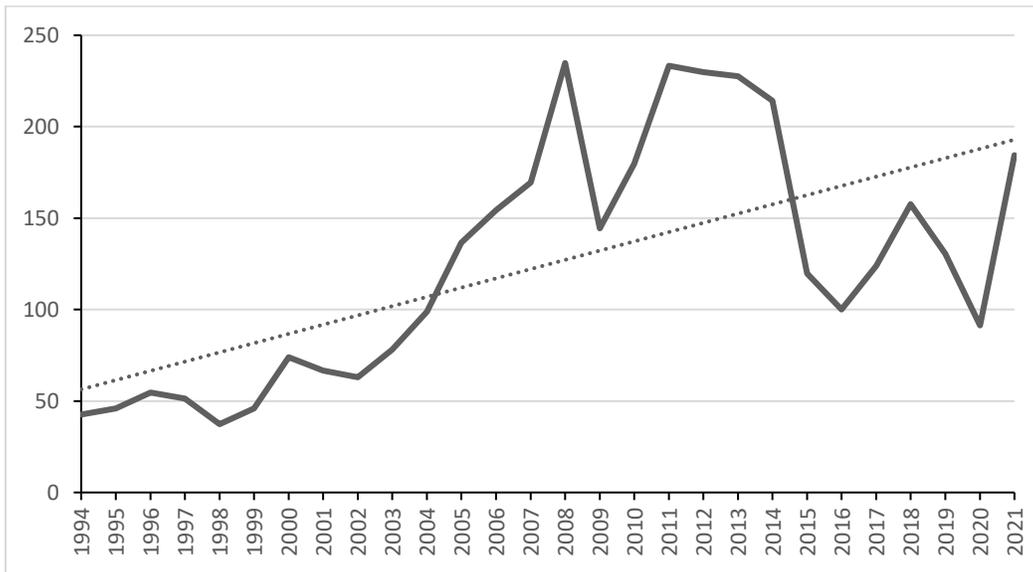
Figure 16 Global Energy Index (1994-2021).

*Source*: IMF database

Table 2 lists the determinants and data sources that will be used to obtain the data to estimate our empirical model.

| Category | Determinants | Data Source |
|---|---|---|
| Demand (D1) | | |
| | Demand growth (DEM) | AMECO database |
| Business Environment (D2) | | |
| | Business dynamism (BD) | Outside model |
| | Global energy index (GEI) | IMF database, Energy Index (Primary Commodity Price System PCPS) |
| | Uncertainty (UNCT) | FRED database, World Uncertainty Index |
| Financial constraints (D3) | | |
| | User cost of capital (UCoC) | Databases – FRED, AMECO, OECD, World Bank National Accounts |
| | Real net profits (RNP) | AMECO, IMF databases |
| | Term spread (TS) | FRED database |
| | | |
| Type of Investments (D4) | | |
| | Increase in Intangible assets (ITA) | Outside empirical model |
| | Financialization (FNC) | Outside empirical model |
| Demographics (D5) | | |
| | Working age population percentage (WP) | OECD database |
| | Unemployment rate (UNEMPR) | OECD database |
| | Total factor productivity growth (TFP) | OECD database |
| Regulations (D6) | | |
| | Network sector regulation (NSR) | OECD database, Network Sector Indicators |
| | Employment Protection Legislation (EPL) framework | OECD database, Strictness of Employment protection for regular contracts |

Table 2 Determinants, Data Sources and Description

In the next chapter, we will discuss the baseline model and methodology that will be used to perform the empirical analysis.

## 4.4.  Some Expected Results

Given that the independent variables explain changes in NFCF, we expect to see either positive or negative relationships between the independent and dependent variables. Figure 17 presents a summary of the (+/-) relationships between our dependent variable (NFCF/GDP) and the selected independent variables (or causes).
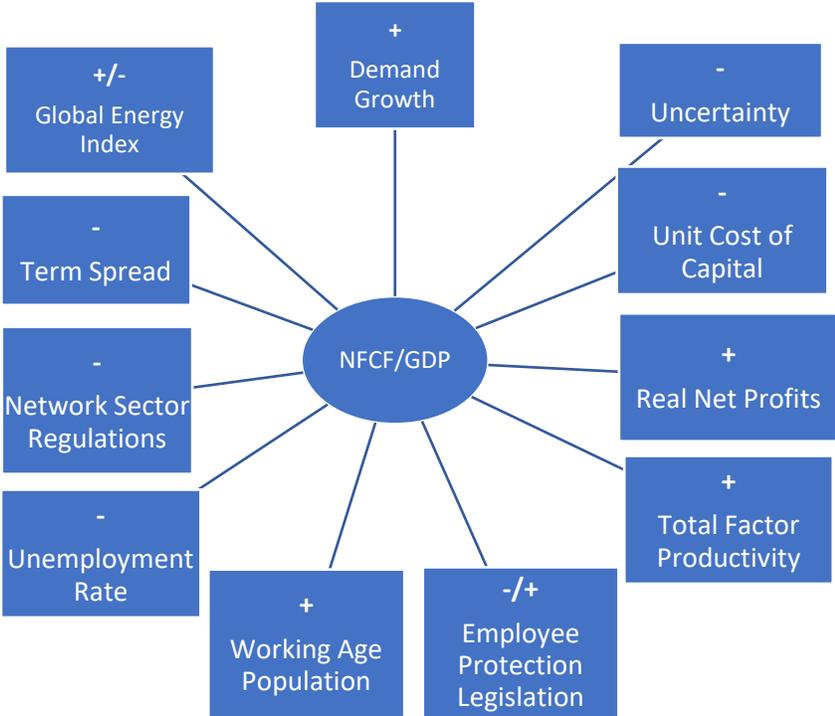


Figure 17 The expected sign (+/-) of the relationship between the independent variables and Net Fixed Capital Formation / GDP.

## 4.5.  Conclusion

In Chapter 4 we looked at the methodology that will be used to do the empirical analysis. We will use OLS multivariate regression with NFCF/GDP as the dependent variable as outlined in Section 4.2. The dependent variable will be regressed on the independent variables identified in Section 4.3. Thus, we can understand the explanatory power of each independent variable and the total explanatory power of the empirical model with all the 11 determinants together. We also identified the expected signs that these variables would have with the dependent variable. We expect a positive relationship between NFCF/GDP and DEM, RNP, TFP and WP. Instead, we expect a negative relationship between NFCF/GDP and UNCT, UCoC, UNEMPR, NSR and TS. Regarding EPL and GEI, we expect these independent variables to have either

a positive or negative relationship with our dependent variable as the literature on the empirical impacts of these variables on investment is conflicting.

In Chapter 5, we will discuss the empirical results that we obtained from the empirical analysis. In Chapter 6, we will discuss the effects on business investment of those determinants that are treated outside the empirical model.

# Chapter 5

## Stagnating Net Fixed Investment in the Netherlands and Germany (1994-2021): An Empirical Analysis

This chapter presents and discusses the OLS regression results for the Netherlands and Germany using data for the period 1994 – 2021. To reiterate the baseline model and methodology of the empirical analysis as explained in Section 4.1, we will begin our econometric analysis with a standard accelerator type model where our dependent variable i.e., fixed business investment (NFCF/GDP), is modelled as a function of the demand growth (lagged by one year and lagged by two years). We will then augment this model with other determinants of business investment like financial constraints, business environment, labor market / demographics and regulations. Thus, we will observe the role and impact of every independent variable that is included in our augmented empirical model. We will determine which variables are statistically significant in explaining the decline in business investment in the Netherland and Germany and which variables are insignificant. Based on these findings, we will finally present, for each economy, a preferred version of the empirical model consisting of relevant explanatory independent variables. Finally, we will compare our findings for the Netherlands and Germany to identify similarities and/or differences.

We use data for the period 1994-2021. In order to ensure that our findings for the two countries are comparable, we aimed at keeping the same time duration for the data for both the Netherlands and Germany. For example, while we could use the data on demand variable for the Netherlands from 1963 onwards, for Germany the data points before 1994 were unavailable[6]. Similarly, for other variables the period of availability of data was different. Since the demand variable had data availability for the shortest duration, it was the bottleneck. Hence, we decided to use data for 1994 – 2021. For some variables, the (secondary) data for the year 2021 were not yet available; for those missing observations, we have approximated the values for 2021 by extrapolating the linear trend exhibited by the variable under consideration during 1994-2020. Going forward, we first discuss the results of the econometric analysis for the Netherlands. In so doing, we will also perform the relevant diagnostic checks for our preferred model. The results of diagnostic checks are included in appendices. Then we will turn to the discussion of our findings for Germany; we will review the German case using a similar framework as we did use for the Netherlands.

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[6] Although data for West Germany dates back to 1963, the data for Unified Germany (unified East and West Germany) is available from 1991 onwards after unification in 1990. In this thesis we have used relevant data for unified Germany starting 1994 onwards.

## 5.1. The Netherlands

Table 3 presents the results of the regression analysis for the Netherlands (1994-2021) in which the dependent variable, net fixed capital formation as a ratio of GDP or (NFCF/GDP), has been modelled as a function of demand growth and the other independent variables identified in Chapter 3. The models are estimated using Ordinary Least Squares (OLS)[7] and we check for autocorrelation in the residuals (using the Durbin-Watson (DW) test). The variable values in Table 3 are rounded to 4 decimal places.

Column (1) of Table 3 presents the basic regression model for NFCF/GDP as a function of (only) demand growth lagged by 1 year (DEM(t-1)) and demand growth lagged by 2 years (DEM(t-2). The coefficients for demand growth are positive and statistically significant at less than 1% and 5% respectively. A permanent increase in Dutch demand growth by 1 percentage point is associated with an increase in the ratio NFCF/GDP of about 0.82 in the Dutch economy as a whole. This is quite a considerable impact. It would mean that the decline in Dutch demand growth say from 2000 to 2004 by 3.04 percentage points has led to a decline in the NFCF/GDP ratio during that period by 2.5. The actual value of decline in NFCF/GDP ratio is 2.93 which is very close to the estimated value of 2.5. The demand variable alone can explain about 35% change in NFCF/GDP as we can see from the value for the adjusted $R^2$. When we regress NFCF/GDP on DEM (t-1) and DEM (t-2) during 1994-2021, we get positive coefficients of 0.4591 and 0. 3586. However, if we go further behind in time and do the regression using data from 1963-2021, we find a considerably higher, statistically significant impact of demand variables on NFCF/GDP: the coefficients on DEM (t-1) and DEM (t-2) are 0.8460 and 0.6945, respectively. These coefficients are consistently higher than the estimated coefficients obtained by using data from 1994 – 2021. This difference tells us that the importance of demand variable in influencing net fixed capital formation in the Netherlands has reduced after the mid-1990s. This could be due to increased influence of other variables on business investment. Thus, from column (2) onward, we will augment our model with other explanatory variables to check for their influences on NFCF/GDP. Figure 18 shows the rolling regression of the two lags of DEM on NFCF/GDP from 1963 - 2021. The coefficient of rolling regression between DEM and NFCF/GDP is fairly stable throughout 1963-2021. The $R^2$ value ranges from 45% to 55%.

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[7] The assumptions of OLS regression have been tested during the data diagnostic checks. All assumptions are satisfied and hence we can use OLS for our econometric analysis. The results are included in appendix A2
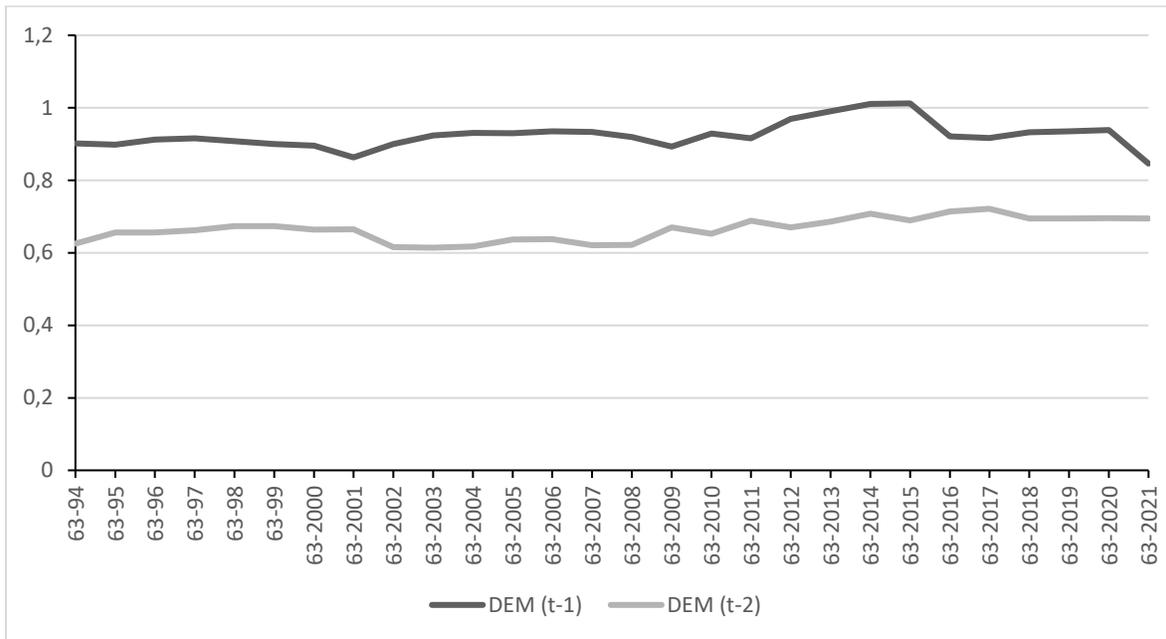
Figure 18 Coefficient of rolling regression between lagged DEM and NFCF/GDP for the Netherlands. (1963-2021)

In column (2)-(5) we add other explanatory variables for which most data are available from 1994 onwards. As explained previously, we add other variables to control for other influences than the demand variable (DEM (t-1), DEM(t-2)). Thus, we also restrict the time period for the data on demand growth variable to 1994-2021.

Columns (2)—(5) extend the basic regression model of column (1) by introducing additional explanatory variables. We want to test whether the impact of demand growth on NFCF/GDP changes, when additional control variables are included in the analysis. In column (2), we have included financial constraints using our variables (listed in Chapter 3): the user cost of capital (UCoC), real net profit (RNP) and term spreads (TS). The empirical model in column (2) that includes demand variables and the variables that measure financial constraints can explain about 52% of changes in NFCF/GDP. We can see that UCoC and TS are statistically significant at 10% and 1% respectively. We do not find RNP to be statistically significant in column 2. The lagged demand growth variables remain statistically significant at 1% and 5% respectively. Thus, there is no change in the statistical significance of DEM(t-1) and DEM(t-2) in column (2). The sign of the coefficients of demand growth variables and TS are in-line with our prior (theoretical) expectations and they are positive and negative respectively. Thus, an increase in the term spread by 1 unit will cause the NFCF/GDP ratio to decline by 0.0107. This means that low long-term interest rates are more impactful in boosting business investment as compared to short term interest rates.

We find that UCoC has the opposite sign from what we expected. Thus, the coefficient on UCoC is positive and statistically significant. We have seen that UCoC has been declining since the crisis of 2008, mostly because the European Central Bank (ECB) lowered the interest rate in order to stimulate business investment. Despite such favorable conditions, if firms are uncertain about the future demand or if they are unsure about the profitability of their investment projects, they avoid making investments. Especially investments in physical assets that are often irreversible (Banerjee, Kearns and Lombardi, 2015). The (likely) positive impact of a lower UCoC on NFCF/GDP has been overwhelmed by other factors such as low demand growth and high uncertainty. Thus, the positive relationship between UCoC and NFCF/GDP in the Dutch economy does reflect the historical fact that both net fixed capital formation (as a percent of GDP) and UCoC declined during the period 2008-2021.

Real net profits (RNP) can proxy the presence of funds within firms to finance new investment projects (Banerjee, Kearns and Lombardi, 2015). Hence, theoretically, if RNP is high, businesses have more retained profits (in-house) which they can use to fund investment without incurring additional bank debt and obligations to pay interest. A higher RNP is, therefore, expected to contribute to higher investment, and vice versa. We did not find such a positive association between NFCF/GDP and RNP for the Netherlands (1994-2021). However, one reason why we did not obtain this relationship can be because of the presence of financialization; we will investigate this issue in greater detail in Section 6.3.

In column (3), we have included variables describing the business environment in the regression model. These variables are our indicators for the global energy index (GEI) and the uncertainty indicator (UNCT). We will consider business dynamism (BD) separately outside the empirical model in Chapter 5. The coefficients for UNCT and GEI are negative and statistically significant at 1%. The signs are consistent with our theorized / expected outcomes. In the case of the uncertainty indicator, we find that an increase in uncertainty by 1 unit reduces the NFCF/GDP ratio by 0.0574. Similarly, an increase in global energy index GEI by 1 unit reduces the NFCF/GDP ratio by 0.0003. These coefficients appear to suggest that changes in UNCT and GEI have only a small impact on NFCF/GDP, but we must understand that these are unstandardized coefficients. In order to gauge the strength of their impact on NFCF/GDP we can standardize all variables that would measure the impact of one standard deviation change of independent variables on the dependent variable. We will present the standardized coefficients results in a separate table (below).

In column 3, the variables DEM, UCoC, RNP, TS, UNCT and GEI are all statistically significant at 1%. Except UCoC, all other variables in column (3) are in-line with the expected coefficient signs. The coefficient on RNP is now statistically significant and positive; we find in column (3) that an increase in RNP by say 1 million euros leads to an increase in NFCF/GDP by 0.0009. The empirical model in column (3) that includes demand variables and the variables that measure financial constraint and business environment can explain about 88% of changes in NFCF/GDP.

The regression model in column (4) includes labour market and demographic variables including working age population percentage (WP), the unemployment rate (UNEMPR) and total factor productivity growth (TFP). None of the variables WP, UNEMPR, TFP are statistically significant. The variables DEM (t-1), UCoC, RNP, TS, UNCT and GEI are statistically significant at 1% and DEM (t-2) is statistically significant at 5%. Similar to the results of column (3), in column (4) the signs of variables (namely DEM, RNP, TS, UNCT and

GEI), except UCoC, are in-line with the expected signs of their coefficients. We see a slight decline in the adjusted $R^2$ value from 88% in column (3) to 86% in column (4). This reflects the fact that the additional variables that measure labour market and demographics with which the empirical model was augmented, are not statistically significant.

Finally, the model of column (5) is the same as that of column (4) but also includes regulatory indicators: network sector regulation (NSR) and employment protection legislation (EPL). We can see that both indicators of regulation EPL and NSR are not statistically significant. The statistical significance and signs of coefficients of all other variables are same as in the model of column (4).

Thus, to summarize, the demand growth variables (DEM (t-1), DEM (t-2)) have remained statistically significant with positive coefficient signs through columns (1) – (5). Theory also supports the fact that demand growth is an important determinant of business investment (see Bussière, Ferrara and Milovich 2015, Fay et al, 2017, Lewis and Menkyna 2014) . Thus, we will include DEM (t-1) and DEM (t-2) in our final empirical model. Next, we saw that the variables that measured financial constraints – UCoC, RNP and TS – remained statistically significant through columns (2) – (5) with the exception of RNP that was statistically insignificant in column (2). Moreover, the addition of these financial variables to the demand variables in column (2) increased the explanatory power of the empirical model from an adjusted R of 35% in column (1) to 52% in column (2). Although most literature like Bussière, Ferrara and Milovich (2015), Banerjee, Kearns and Lombardi (2015), European Commission (2017) that we reviewed did not find financial constraints to be key in determining NFCF, we have found the opposite to be the case for the Netherlands. Thus, we include UCoC, RNP and TS in the final empirical model. Next, we saw that the variables that measured the business environment – UNCT and GEI – remained statistically significant through columns (3) – (5). Addition of these business environment variables to the demand and financial variables in column (3) increased the explanatory power of the empirical model from an adjusted $R^2$ of 52% in column (2) to 88% in column (3). This constitutes a considerable increase in explanatory power of the regression model.

Finally, the coefficients of the variables EPL, NSR, WP, TFP and UNEMPLR are found to be not statistically significantly different from zero; these variables have a low variance (because these variables are structural and do not change significantly between years) and hence cannot explain the decline in NFCF/GDP. For example, the employment protection laws in the Netherlands did not change significantly during 1994-2021. The EPL index remained constant through 1999-2008, then decreased slightly between 2009 – 2015, before increasing again. Similarly, the measure for NSR has been fairly constant from 2002 to 2018, after which it declined slightly. However, the overall variance of EPL and NSR is low.

Moreover, the addition of these variables in columns (4) and (5) did not increase the explanatory power of empirical model. Thus, these variables can be dropped from the analysis without loss of statistical explanatory power.

The preferred model in Table 3 is therefore given by column (3). This specification of the empirical model explains about 88% of the variance of Dutch fixed capital formation (NFCF/GDP) and thus is able to explain most of the decline in NFCF/GDP in the Netherlands over the years. Equations (5 and 6) give the preferred regression model.

$$NFCF/GDP\ (i) = \alpha_1 * DEM_{t-1} + \alpha_2 * DEM_{t-2} + \alpha_3 * UCoC + \alpha_4 * RNP - \alpha_5 * TS - \alpha_6 * UNCT - \alpha_7 * GEI + \text{Constant} \ldots\ldots\ldots (5)$$

$$NFCF/GDP\ (i) = 0,2908 * DEM_{t-1} + 0,3013 * DEM_{t-2} + 0,0070 * UCoC + 0,0010 * RNP - 0,0100 * TS - 0,0546 * UNCT - 0,0003 * GEI + 0,0259 \ldots\ldots\ldots (6)$$

|  |  | Dependent Variable : NFCF/GDP | | | | |
|---|---|---|---|---|---|---|
| Determinant Name | Abbreviation | (1) | (2) | (3) | (4) | (5) |
| Demand growth (t-1) | DEM (t-1) | 0.4591*** | 0.4009*** | 0.2928*** | 0.3044*** | 0.2908** |
| Demand growth (t-2) | DEM (t-2) | 0.3586** | 0.3491** | 0.2997*** | 0.3173** | 0.3013** |
| User cost of capital | UCoC |  | 0.0034* | 0.0061*** | 0.0073*** | 0.0070*** |
| Real net profits | RNP |  | -0.0001 | 0.0009*** | 0.0010*** | 0.0010*** |
| Term spread | TS |  | -0.0133*** | -0.0110*** | -0.0107*** | -0.0100*** |
| Uncertainty | UNCT |  |  | -0.0574*** | -0.0548*** | -0.0546*** |
| Global energy index | GEI |  |  | -0.0003*** | -0.0003*** | -0.0003*** |
| Working age population percentage | WP |  |  |  | -0.0021 | -0.0013 |
| Unemployment rate | UNEMPR |  |  |  | -0.0007 | -0.0011 |
| Total factor productivity growth | TFP |  |  |  | 0.0014 | 0.0013 |
| Employment protection legislation | EPL |  |  |  |  | 0.0195 |
| Network sector regulations | NSR |  |  |  |  | 0.0034 |
|  | N | 28 | 28 | 28 | 28 | 28 |
|  | $R^2$ | 0.4016 | 0.6128 | 0.9074 | 0.9133 | 0.9215 |
|  | Adjusted $R^2$ | 0.3537 | 0.5249 | 0.8750 | 0.8623 | 0.8587 |
|  | DW Statistic | 1.2 | 1.7 | 2.4 | 2.5 | 2.5 |
|  |  | *** $p<0.01$, ** $p<0.05$, * $p<0.1$ | | | | |

Table 3 Determinants of net fixed capital formation in the Netherlands (1994-2021)

As mentioned earlier, it is important to check the relative importance of the relationships which have been found to be statistically significant. This can be done by performing OLS regression on standardized coefficients of dependent and independent variables. To standardize the coefficients, we subtract the mean from each data point and divide it by the variance. The resulting regression coefficients will help us in understanding the most important contributors (independent variables) that can help in explaining the changes to our dependent variable. We can see the standardized regression output in Table 4. The standardized coefficient gives us the impact (measured in standard deviations of NFCF/GDP) of a change in the explanatory variable (by one standard deviation) on the dependent variable NFCF/GDP. For example, a one-standard- deviation increase in demand growth DEM(t-1) will raise the ratio NFCF/GDP by 0.3270 standard deviations. And a one-standard-deviation increase in net real profits NRP will raise the ratio NFCF/GDP by 1.2281 standard deviations.

Because the impacts have been made comparable (in terms of standard-deviation changes), we can create a rank column as in Table 4. Rank 1 means that a one-standard-deviation change in RNP would have the greatest impact in absolute terms on the standard deviation of NFCF/GDP. Rank 2 implies second-highest change and this goes all the way up to rank 6. Thus, an increase in GEI by one standard deviation will cause NFCF/GDP to decrease by 1.05 standard deviations. The same logic applies to all the other variables given in Table 4.

| Dependent Variable: NFCF/GDP | | | |
|---|---|---|---|
| Determinant Name | Abbreviation | Standardized Coefficient | Rank |
| | | | |
| Demand growth (t-1) | DEM (t-1) | 0.3270 | 6 |
| Demand growth (t-2) | DEM (t-2) | 0.2943 | 7 |
| User cost of capital | UCoC | 0.7918 | 3 |
| Real net profits | RNP | 1.2281 | 1 |
| Term spread | TS | -0.5381 | 4 |
| Uncertainty | UNCT | -0.4024 | 5 |
| Global energy index | GEI | -1.0500 | 2 |

Table 4 Standardized coefficients of determinants of net fixed capital formation in the Netherlands (1994-2021)

After performing our main econometric analysis and obtaining the preferred model, we also did diagnostic checks to see if the data associated with our preferred model as given by equation 6 suffers from any irregularities like the presence of first-order autocorrelation, multicollinearity, heteroscedasticity, non-normality etc.

From Table 3, we can see that the Durbin-Watson (DW) statistic of our preferred model as shown by column (3) is 2.4. This value is slightly higher than the upper critical value of 2.07. Thus, we can say that

there is some degree of first-order autocorrelation in our model. To account for this autocorrelation and to check the robustness of our results, we added the first lag of dependent variable to the right-hand side of equation (2). We performed OLS regression test on the new empirical model given by equation (7)

$$NFCF/GDP\ (i)\ =\ \alpha_1 * DEM_{t-1}\ +\ \alpha_2 * DEM_{t-2}\ +\ \alpha_3 * UCoC\ +\ \alpha_4 * RNP\ +\ \alpha_5 * TS\ +\ \alpha_6 * UNCT\ +\ \alpha_7 * GEI\ +\ \alpha_8 * WP\ +\ \alpha_9 * UNEMPR\ +\ \alpha_{10} * TFP\ +\ \alpha_{11} * EPL\ +\ \alpha_{12} * NSR + \alpha_{13} * NFCF/GDP\ (t-1)\ \text{Constant} + \text{error term} ……………… (7)$$

However, NFCF/GDP (t-1) was not found to be statistically significant. This implies that there is no first-order serial autocorrelation. The results that we obtained in Table 3 were found to be robust as the statistical significance and explanatory power of the empirical model did not vary. Thus, we can ignore the small amount of first-order autocorrelation. The regression results of empirical model given by equation (7) are included in Appendix A2.

Upon checking, we did not find multicollinearity in the data. The values for the variance inflation factor (VIF) are found to be below the threshold value of 10, thus indicating no presence of multicollinearity. The correlation matrix does not show any correlation values greater than the absolute value of 0.80 between any of the independent variables. Thus, there is no problematically high correlation between any pair of two independent variables. Our data points are mostly normally distributed, homoscedastic and the error term is random with a mean of zero. Thus, we did not find any irregularities in the diagnostic checks. The detailed results of the diagnostic checks are presented in Appendix A2.

Finally, based on the preferred model given by equation (6), we checked the contribution of the change of each significant independent variable to explain the decline in NFCF/GDP for the timeframes 1994-2000 and 2010 – 2020. Let us call period 1 as 1994-2000 and period 2 as 2010 – 2020. To see how much decline in NFCF/GDP the independent variables can explain, we calculated the increase / decrease in the average values of independent variables from period 1 to period 2. Then we multiplied this change with the respective regression coefficients to see its contribution to decline in NFCF/GDP. Finally, we also checked the relative contributions of each independent variable to explain the decline in dependent variable. These results are given in Table 5.

| Variables | NFCF/GDP | GEI | UNCT | TS | RNP | UCoC | DEM (t-2) | DEM (t-1) |
|---|---|---|---|---|---|---|---|---|
| period 1 | 5.85% | 50.23 | 0.04 | 1.92 | 26.73 | 4.03 | 2.91% | 3.18% |
| period 2 | 3.11% | 164.34 | 0.27 | 1.04 | 74.78 | -0.04 | 1.35% | 1.11% |
| (period 1 - period 2) | -2.74% | 114.11 | 0.23 | -0.88 | 48.05 | -4.07 | -1.56% | -2.07% |
| Regression coefficient | | 0.00 | -0.06 | -0.01 | 0.00 | 0.01 | 0.30 | 0.29 |
| Contribution to NFCF/GDP decline | | -0.03 | -0.01 | 0.01 | 0.04 | -0.02 | 0.00 | -0.01 |
| Relative contribution to NFCF/GDP decline | | 124.84 | 47.12 | -35.34 | -157.73 | 90.53 | 17.04 | 22.09 |

Table 5 Contribution of independent variables in decline of NFCF/GDP

We can see that taken together, the relative contribution of GEI, UNCT, TS, RNP, UCoC, DEM (t-2) and DEM (t-1) in explaining the decline in NFCF/GDP is 108.56%. Thus, there is some over explanation in the model. The decline in demand variables (DEM (t-1) and DEM (t-2)) by total of 3.63% from period 1 to period 2 can explain about 39.13% of the decline in NFCF/GDP from period 1 to period 2. An increase in the global energy index by 114 units can explain about 128% of the decline in NFCF/GDP.

Similarly, the increase in RNP and the decrease in TS from period 1 to period 2 have positively contributed to the decline in NFCF/GDP. This means that these variables could off-set the negative effects of say decline in DEM (t-1) or GEI on NFCF/GDP. Thus, for the Netherlands, we can conclude that while demand, uncertainty and energy prices have caused the NFCF to decline, low term spreads and high profits were partially able to off-set that decline.

## 5.2. Germany

Table 6 presents the results of the regression analysis for Germany (1994-2021) in which the dependent variable (NFCF/GDP) has been modelled as a function of demand growth and the other independent variables identified in Chapter 3. The models are estimated using Ordinary Least Squares (OLS) and we check for autocorrelation in the residuals (using the Durbin-Watson (DW) test).

Column (1) of Table 6 presents the basic regression model for NFCF/GDP as a function of (only) demand growth lagged by 1 year (DEM(t-1)) and demand growth lagged by 2 years (DEM(t-2). The coefficients for demand growth are positive. However, they are not statistically significant at 1%, 5% or 10%. Based on the $R^2$ and adjusted $R^2$ values, it appears that in Germany demand growth may not play a significant role in explaining changes to NFCF as it did for the Netherlands. One possible explanation of the insignificant relationship between NFCF/GDP and DEM variables could be the already noted increase in Foreign Direct Investment. We saw in Section 2.2 that the relationship between economic (GDP growth) and net fixed business investment weakened over time, especially after mid-1990s. Increase in OFDI by more than 2 times during the same period, seems to be a plausible explanation for the weakness in this relationship. The DEM variables are defined as GDP minus NFCF. Thus, although the increase in OFDI has negatively affected NFCF, its impact on other components on GDP, whether positive or neutral, can probably explain why DEM variables are not statistically significant in explaining the decline in NFCCF/GDP. For example, FDI outflows can complement a country's exports. If this is the scenario, then increase in OFDI can help in boosting domestic investment, to an extent, by complementing the export demand in GDP (Al-Sadig, 2013). We have seen that the German economy is export-oriented. If the German export demand is complemented by FDI outflows, then perhaps we can comprehend why the demand variables play little role in explaining the decline in NFCF/GDP as the demand variables may not show the same rapid declining trend as that observed in NFCF/GDP. Another possible explanation could be that the increase in OFDIs is due to firms' investments in countries other than Germany. If businesses relocate their production facilities and equipment from home country to another host/foreign country, then the increase in OFDI can reduce domestic investment (Al-Sadig, 2013). Such a scenario could also possibly explain the broken relationship between NFCF/GDP and DEM (t-1), DEM (t-2). One of the studies presented in Deutsche

Bundesbank (2018) report highlights that due to offshoring of production, the demand for traditional domestic capital goods has moved towards IT and communication technologies.

Columns (2)—(5) extend the basic regression model of column (1) by introducing additional explanatory variables. In column (2), we have included financial constraints using our variables (listed in Chapter 3): the user cost of capital (UCoC), real net profit (RNP) and term spreads (TS). The empirical model in column (2) that includes demand variables and the variables that measure financial constraints can explain about 47% of changes in NFCF/GDP. We do not find demand variables to be statistically significant in column (2).

Only one of the variables that represents financial constraints – UcoC – is found to be positive and statistically significant at 5%. The sign of UCoC is not in-line with our hypothesized (theoretical) relationship. This result is similar to what we obtained in case of the Netherlands. The deviation from the hypothesized relationship could be due to the fact firms prefer to postpone investments in physical assets in face of high uncertainty even if the ECB was lowering interest rate to increase business investment. Thus, the probable positive impact of low UCoC on business investment might be influenced by other determinants. Hence, we must understand that the positive association between UCoC and NFCF/GDP indicates the fact that both NFCF/GDP and UCoC decline during 2008-2021.

In column (3), we have included variables describing the business environment in the regression model. These variables are our indicators for the global energy index (GEI) and the uncertainty indicator (UNCT). We will consider business dynamism (BD) separately outside the empirical model in Chapter 5. Here we find UCoC and GEI to be statistically significant at 5% with UCoC having a positive sign as in column (2) and GEI having a negative sign which is in-line with our theory. Thus, an increase in GEI by 1 unit will lead to a decline in NFCF/GDP ratio by 0.0001. The explanatory power (adjusted $R^2$) of the empirical model has increased from 46.95% in column (2) to 56.64% in column (3).

The regression model in column (4) includes labour market and demographic variables including working age population percentage (WP), the unemployment rate (UNEMPR) and total factor productivity growth (TFP). Here, we see that the demand growth variables (DEM (t-1) and DEM (t-2)) are negative and statistically significant at 5% and 10% respectively. The negative sign is opposite to our hypothesized relationship. However, it does not mean that decrease in demand will increase business investment. Germany is very export oriented (Stockhammer and Grafl, 2008). The share of foreign exports was very high since late 1990s. During this period, domestic demand was very low. The construction sector which was found to contribute the most to the most decline in business investment in Germany (Lindner, 2014), was in a bad shape since 2000s and the construction demand declined during this period. These facts can help us understand the obtained negative relationship between demand and business investment where although the business investment was declining (owing mainly due to the construction sector), the demand did not decline proportionally due to increase in exports and foreign demand.

Next, under the financial constraints variable category, we find UCoC to be positive and statistically significant like it was in columns (2) and (3). RNP and TS are statistically significant at 5% with positive and negative signs respectively which are in-line with our hypothesized relationships. A negative TS signals that low long-term interest rates as compared to short-term rates are more impactful in boosting business investment. Thus, a decline in TS by 1 unit can lead to increase in NFCF/GDP ratio by 0.006.

Under the business environment variable category, we find UNCT and GEI to be statistically significant at 5% with positive and negative signs respectively. The positive relationship between UNCT and NFCF/GDP

may seem counterintuitive and is not in-line with our theoretical assumptions. However, the study by Stockhammer and Grafl (2008) on the relationship between financial uncertainty and business investment may help us in partially reconciling the positive sign of UNCT. Stockhammer and Grafl (2008) have focused on the financial aspect of uncertainty and econometrically analyzed its impact on business investment in the Netherlands, UK, Germany, USA and France. They have pointed out that while the Netherlands is a market-based, small and open economy, Germany is a bank-based, large and export-oriented economy. The authors did not find any effect of uncertainty on business investment in Germany owing to the fact that it is mainly bank-based. However, they found a statistically significant effect of uncertainty in the Netherlands and UK as these are market-based economies. Thus, we should understand that a positive sign between uncertainty and NFCF/GDP does not mean that increase in uncertainty will lead to an increase in business investment. It may mean that the positive sign of UNCT may be due to overwhelming importance of other variables with which column (4) has been augmented. This brings us to the category of demographics and labour market. We see that WP and UNEMPR are statistically significant at 1% with positive and negative signs respectively. These relationships are in-line with our theoretical assumptions. Thus, an increase in WP by 1 unit will lead to increase in NFCF/FDP ratio by 0,0168 whereas a decrease in UNEMPR by 1 unit will lead to an increase in NFCF/GDP ratio by 0.0065. Lindner (2014) has also emphasized the role of demographics (slow population growth and rise in unemployment during 2000s) in dampening the investment in construction sector which is majorly responsible for overall weak business investment in Germany.

Finally, the model of column (5) is the same as that of column (4) but also includes regulatory indicators: network sector regulation (NSR). EPL has not been included as it has remained same during 1994-2020. We see that NSR is positive and statistically significant at 10%. NSR only focuses on the regulation in network industries – energy, transport, communications. These industries are very infrastructure intensive. Although we reviewed literature indicating the fact that more competition and less regulation will promote business investment (Gutierrez and Philippon, 2017), there is literature with a conflicting view as well. Mathis and Sand-Zantman (2014) have pointed that in sectors like telecommunications that are heavy on physical infrastructure, reduction in regulations can dissuade business investment as whole as new entrants get access to incumbents' infrastructure. Additionally, the authors highlight that in presence of market imperfections, reduction in sectoral regulations can lead to decrease in internal profits as firms compete to satisfy market demand. This results in increased cost of capital which can lead to decline in business investment. These hypotheses need to be tested out for Germany which is out of the scope of this thesis. However, these can very well be the factors why we have obtained positive relationship between NFCF/GDP and NSR. The explanatory power of the empirical model in column (5) is the highest of all the columns. Thus, we can include all the statistically significant variables from column (5) in our preferred model.

The preferred model in Table 6 is therefore given by column (5) which is replicated in preferred model (1) column. This specification of the empirical model explains about 87% of the variance of German fixed capital formation (NFCF/GDP) and thus is able to explain most of the decline in NFCF/GDP in the Netherlands over the years. Equations (8 and 9) are the preferred regression model.

$$NFCF/GDP \ (i) \ = \ - \ \alpha_1 * DEM_{t-1} - \ \alpha_2 * DEM_{t-2} + \ \alpha_3 * UCoC - \ \alpha_4 * TS + \ \alpha_5 * UNCT - \alpha_6 * GEI + \ \alpha_7 * WP - \ \alpha_7 * UNEMPR + \ \alpha_8 * NSR + \text{Constant} \ ……….. (8)$$

$$NFCF/GDP\ (i) = -0.2330 * DEM_{t-1} - 0.2737 * DEM_{t-2} + 0{,}0050 * UCoC - 0.0082 * TS + 0{,}0358 * UNCT - 0{,}0001 * GEI + 0.013 * WP - 0.0052 * UNEMPR + 0.0067 * NSR - 0.5010 \ldots\ldots (9)$$

| Determinant Name | Abbreviation | Dependent Variable : NFCF/GDP | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | (1) | (2) | (3) | (4) | (5) | Preferred Model (1) | Preferred Model (2) |
| Demand growth (t-1) | DEM (t-1) | 0.2599 | -0.0242 | -0.0406 | -0.2336** | -0.2330** | -0.2330** | N/A |
| Demand growth (t-2) | DEM (t-2) | 0.0547 | -0.1014 | -0.1880 | -0.3043 * | -0.2737* | -0.2737* | N/A |
| User cost of capital | UCoC | | 0.0038** | 0.0046** | 0.0065*** | 0.0050** | 0.0050** | 0.0054*** |
| Real net profits | RNP | | -0.0001 | 0.0000 | 0.0001** | 0.0001 | N/A | N/A |
| Term spread | TS | | -0.0058 | -0.0050 | -0.0060** | -0.0082*** | -0.0082*** | -0.0083*** |
| Uncertainty | UNCT | | | 0.0231 | 0.0453** | 0.0358* | 0.0358* | N/A |
| Global energy index | GEI | | | -0.0001** | -0.0001** | -0.0001* | -0.0001* | -0.00** |
| Working age population percentage | WP | | | | 0.0168*** | 0.0130** | 0.0130** | N/A |
| Unemployment rate | UNEMPR | | | | -0.0065*** | -0.0052*** | -0.0052*** | -0.0037*** |
| Total factor productivity growth | TFP | | | | -0.0014 | -0.0013 | N/A | N/A |
| Network sector regulations | NSR | | | | | 0.0067* | 0.0067* | 0.0110*** |
| | | | | | | | | |
| | N | 28 | 28 | 28 | 28 | 28 | 28 | 28 |
| | $R^2$ | 0.0608 | 0.5677 | 0.6788 | 0.9098 | 0.9257 | 0.9257 | 0.8924 |
| | Adjusted $R^2$ | -0.0143 | 0.4695 | 0.5664 | 0.8567 | 0.8747 | 0.8747 | 0.8471 |
| | DW Statistic | 0.2 | 0.5 | 0.8 | 1.5 | 1.4 | 1.4 | 1.3 |
| | | *** $p<0.01$, ** $p<0.05$, * $p<0.1$ | | | | | | |

Table 6 Determinants of net fixed capital formation in Germany (1994-2021)

It is important to check the relative importance of the relationships which have been found to be statistically significant. This can be done by performing OLS regression on standardized coefficients of dependent and independent variables. The standardization process is already explained in section 5.1. We can see the standardized regression output in Table 7.

| Dependent Variable: NFCF/GDP | | | |
|---|---|---|---|
| Determinant Name | Abbreviation | Standardized Coefficient | Rank |
| | | | |
| Demand growth (t-1) | DEM (t-1) | -0.1863 | 6 |
| Demand growth (t-2) | DEM (t-2) | -0.1499 | 9 |
| User cost of capital | UCoC | 0.6035 | 1 |
| Term spread | TS | -0.4302 | 5 |
| Uncertainty | UNCT | 0.1632 | 8 |
| Global energy index | GEI | -0.1825 | 7 |
| Working age population percentage | WP | 0.5980 | 2 |
| Unemployment rate | UNEMPR | -0.5920 | 3 |
| Network sector regulations | NSR | 0.4405 | 4 |

## Table 7 Standardized coefficients of determinants of net fixed capital formation in Germany (1994-2021)

The standardized coefficient gives us the impact (measured in standard deviations of NFCF/GDP) of a change in the explanatory variable (by one standard deviation) on the dependent variable NFCF/GDP. For example, a one-standard- deviation increase in working age population percentage (WP) will raise the ratio NFCF/GDP by 0.598 standard deviations.

Because the impacts have been made comparable (in terms of standard-deviation changes), we can create a rank column as in Table 7.

After performing our main econometric analysis and obtaining the preferred model, we also did diagnostic checks to see if the data associated with our preferred model as given by equation 8 suffers from any irregularities like the presence of autocorrelation, multicollinearity, heteroscedasticity, non-normality etc.

Based on the D-W statistic and standardized residuals plot, we do not find autocorrelation and heteroscedasticity in our model. The model also upholds the zero mean error assumption. However, the model violates the normality assumption. This could be due to our small sample size.

Finally, we performed VIF test to check for multicollinearity. The variables UCoC and WP show presence of multicollinearity with VIF values of around 14 and 17 respectively. Since these are very high VIF values, we decided to first drop WP from our preferred model and then check the OLS regression results. The results of regression coefficients after dropping WP are given by preferred model (2) column of Table 6. The D-W statistic of preferred model (2) does not indicate autocorrelation. Next, upon performing a

second VIF test after dropping WP, we see that the remaining significant variables do not indicate multicollinearity. The results of this second VIF test are included in Appendix A3. Thus, we can say that after correcting for multicollinearity, our preferred model (2) column is our final empirical model. This is indicated below by equation (10).

$$NFCF/GDP\ (i)\ =\ 0.0054 * UCoC - 0.0083 * TS - 0.0000 * GEI - 0.0037 * UNEMPR + 0.0110 * NSR + 0.0527 ……….. (10)$$

We see that demand variables and uncertainty are no longer significant in explaining changes to NFCF/GDP. This is contrary to most of the literature reviewed in Chapter 3 for Europe. Based on our findings, we can say that financial aspects, business environment (GEI), unemployment rate and network sector regulations are significant contributors that can explain the decline in net fixed capital formation as a part of GDP.

We have included the results of all diagnostic checks in Appendix A3

Finally, based on the preferred model given by equation (10), we checked the contribution of the change of each significant independent variable to explain the decline in NFCF/GDP for the timeframes 1994-2000 and $2010 - 2020$ as we did for the Netherlands in Section 5.1. The results of this analysis are given in Table 8

| Variables | NFCF/GDP | UCoC | TS | GEI | UNEMPR | NSR |
|---|---|---|---|---|---|---|
| period 1 | 6.22% | 5.38 | 1.78 | 50.23 | 8.88 | 2.88 |
| period 2 | 2.32% | -0.60 | 0.78 | 164.34 | 4.65 | 0.96 |
| (period 1 - period 2) | -3.90% | -5.99 | -1.00 | 114.11 | -4.22 | -1.92 |
| Regression coefficient | | 0.01 | -0.01 | -0.00 | -0.00 | 0.01 |
| Contribution to NFCF/GDP decline | | -0.03 | 0.01 | -0.01 | 0.02 | -0.02 |
| Relative contribution to NFCF/GDP decline | | 82.83 | -21.28 | 22.78 | -40.03 | 54.04 |

Table 8 Contribution of independent variables in decline of NFCF/GDP

We can see that taken together, the relative contribution of UCoC, TS, GEI, UNEMPR and NSR in explaining the decline in NFCF/GDP is about 98%. Thus, there is some under explanation in the model, of about 2%.

We see that the decrease in NSR by 1.92 index points can explain about 54% of decline in NFCF/GDP. This relationship between decrease in NSR leading to decline in NFCF/GDP is in-line with Mathis and Sand-Zantman (2014) for network-based industries. Similarly, the increase in GEI by 114 points can explain about 23% of decline in NFCF/GDP. Decreases in TS and UNEMPR from period 1 to period 2 have positively contributed to decline in NFCF/GDP. This means these variables have most likely off-set the negative effects of say decline in NSR or increase in GEI on NFCF/GDP. Thus, for Germany, we can conclude that while variables like energy prices, or NSR have caused the NFCF to decline, factors like low term spreads or low unemployment rates were partially able to off-set that decline.

## 5.3.    Discussion

Here, first we will discuss the results obtained for the Netherlands and then for Germany. For the Netherlands, we saw that real net profits (RNP), energy prices (GEI), user cost of capital (UCoC), term spread (TS), uncertainty (UNCT) and demand (DEM) are the statistically significant factors that can help in explaining the changes to net fixed capital formation. Demand, real net profits, and user cost of capital are positively associated with NFCF and energy prices, uncertainty, term spread are negatively associated with NFCF. Since the overall NFCF/GDP has shown a declining trend, we can say that factors like UNCT, GEI and TS that depress the investment are stronger than factors such as DEM or RNP that promote business investment. Thus, for the Netherlands, we can conclude that while demand, uncertainty and energy prices have caused the NFCF to decline, low term spreads and high profits were partially able to off-set that decline. The empirical model comprising of explanatory variables DEM (t-1), DEM (t-2), UCoC, RNP, TS, UNCT and GEI can explain about 87.5% of the changes to net fixed capital formation.

For Germany, we found statistical significance for factors including UCoC, UNEMPR, TS, NSR, GEI. We did not find statistical significance for DEM(t-1), DEM(t-2), UNCT, WP RNP and TFP. Business environment, financial constraints and sectoral regulations are important factors that can explain changes to NFCF. For Germany, we can conclude that while variables like energy prices, or NSR have caused the NFCF to decline, factors like low term spreads or low unemployment rates were partially able to off-set that decline. The empirical model comprising of explanatory variables UCoC, TS, GEI, UNEMPR and NSR can explain about 85% of the changes to net fixed capital formation.

# Chapter 6

## Stagnating Business Investment in the Netherlands and Germany: Other Determinants

In Chapter 6, we will look at three determinants of net fixed capital formation that we did not consider in the empirical model. These variables are (a) intangible investment (ITA), (b) business dynamism (BD) and (c) financialization. These determinants are considered outside the empirical model, because there is a lack of available data at the aggregate level for these variables. In this chapter, we will briefly try to understand the effects of these determinants on business investment (NFCF).

### 6.1. Intangible Investment (ITA)

Intangible investment / assets (ITA) are key resources for boosting economic growth and productivity (Thum-Thysen et al, 2017). These are resources that essentially indicate the "productive knowledge" possessed by businesses (Thum-Thysen et al, 2017). These resources do not have a physical structure like that of tangible assets (equipment, machinery, buildings etc.) and they are not easily transferrable. Different types of intangible assets include the outputs of innovative processes, organizational practices like employee development, training etc. and resources related to human capital. Although intangible assets mainly indicate tacit productive knowledge, these assets also include fixed investment that is required to produce this tacit knowledge. Thus, intangible assets include tacit productive knowledge like branding, training, organizational development and it also includes fixed investment that will result in production of tacit intangible knowledge. Net fixed capital formation includes fixed physical investment like investment in construction and equipment. It also includes any fixed investment that may give rise to intangible assets. This can be considered as the intangible component of net fixed capital formation. From hereon, we will refer to this component as IC.

The intangible assets that are currently captured in the national accounts as per ESA 2010 are software, databases, R&D, mineral exploration, copyrights and artistic / literary originals. These are essentially the intangible component of NFCF as captured by AMECO. This intangible component (IC) can essentially be seen as the fixed investment required to produce software, databases etc. The intangible assets that are not captured by the national accounts include new product developments, new designs, branding, market research, personnel training, management consulting and investments for organizational development. Capturing intangible assets is difficult. There are many challenges in capturing and defining these assets. These include valuing these assets, tackling the lack of financial accounting rules to measure these assets, lack of appropriate price deflators for intangibles etc. (Moulton and Mayerheuser, 2015). Thus, in this thesis we have decided to treat these assets outside the empirical model and acknowledge their contribution in explaining changes to NFCF/GDP based on available literature.

According to ESA 2010, the category "Intellectual Property Products (IPP)" includes intangible assets like RandD, mineral exploration, computer software and databases, entertainment, literary and artistic originals. Thus, IPP can be equated to the "other products" category as defined in AMECO and forms a part of NFCF. According to (Thum-Thysen et al, 2017), investment in intangible assets is rising constantly and contributing to a major share of total investment. An analysis of 28 European Union national accounts (including the Netherlands and Germany) shows that IPP forms about 4% of the GDP and about 19% of total GFCF (Thum-Thysen et al, 2017). Figures 19 and 20 confirm the rising trend of intangibles (here IPP) in the share of GDP. The figures show an increase in intangible investment (Intellectual property) as a part of GDP for the Netherlands and Germany. This means that although NFCF as a share of GDP is declining for the Netherlands and Germany, investment in intangibles as a share of GDP is increasing. This is good news as rising intangibles may (partly or wholly) offset the negative effects of declining NFCF.
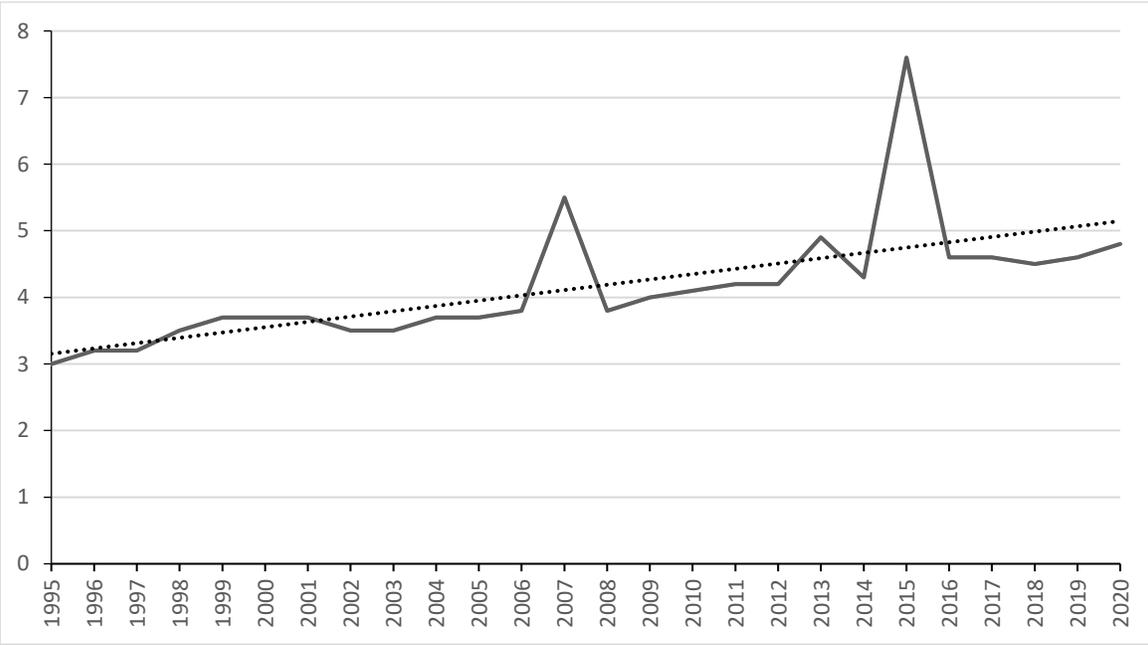


Figure 19 Intangibles (IPP) as % GDP for the Netherlands (1995-2020).

*Source:* Eurostat database
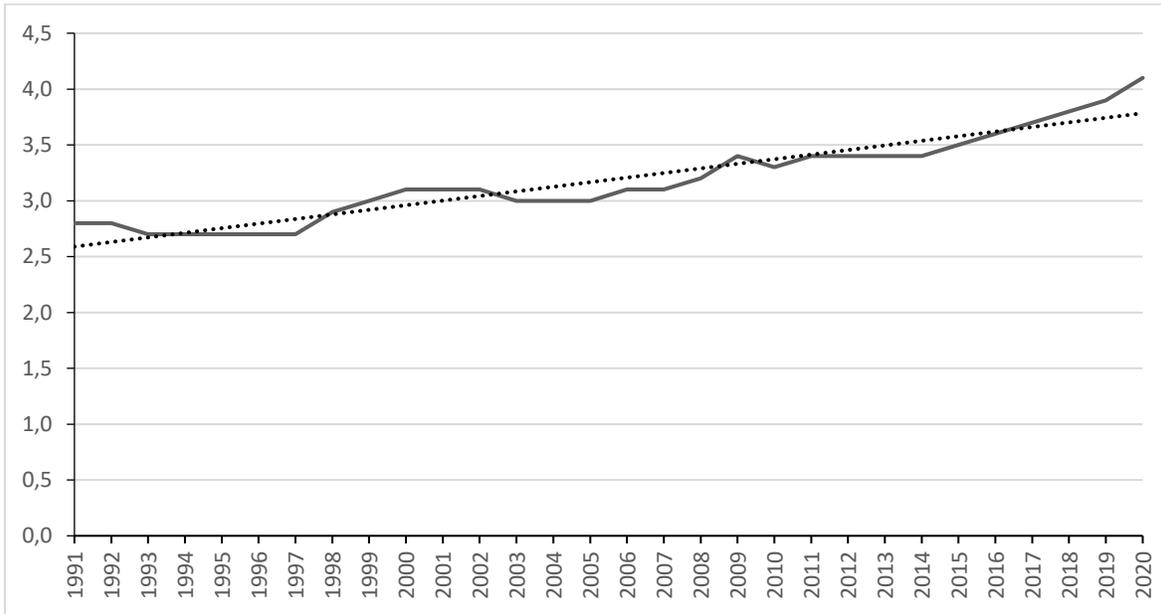
Figure 20 Intangibles (IPP) as % GDP for Germany (1995-2020).

*Source*: Eurostat database

Thum-Thysen et al. (2017) also argue that investment in intangibles is increasing more rapidly than investment in tangible assets in the European Union as a whole. For the Netherlands and Germany, we looked at the trend in intangible component (IC) of NFCF as a share of NFCF. Figures 21 and 22 show that investment in intangibles as share of NFCF is increasing for the Netherlands and Germany. Data on the GFCF's intangible component (IC) is obtained from AMECO database and includes mineral exploration, software, R&D, entertainment / artistic / literary originals and other intangibles. It is important to note that intangible investment is difficult to capture and this intangible component (IC) does not represent all the aspects of intangible investment (Thum-Thysen et al., 2017). Due to the lack of appropriate data on consumption of fixed capital (CFC) for the intangible component, we have assumed the share of intangible component in CFC to be equal to the share of intangible component in GFCF. Therefore, we have calculated the value of NFCF's intangible component as:

$$IC\ (NFCF)\ =\ IC\ (GFCF)\ -\ CFC\ *\ \frac{IC\ (GFCF)}{Total\ GFCF}$$

The values on CFC and GFCF are obtained from AMECO database. We had to separately calculate IC (NFCF) because the breakup of NFCF in tangible and intangible components is not provided in AMECO database.
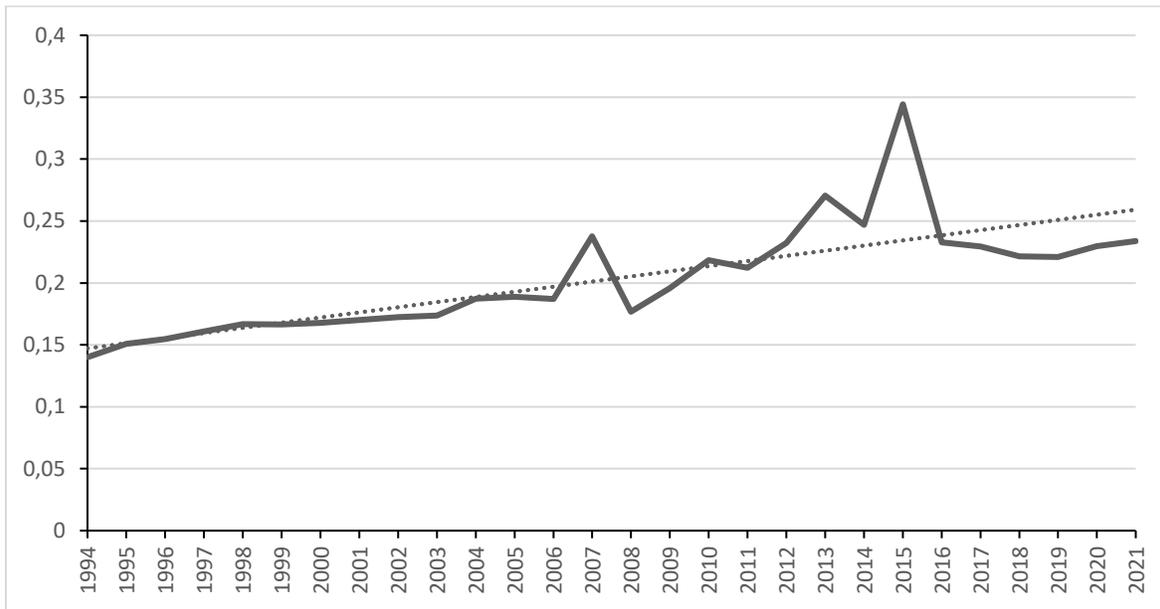
Figure 21 Intangible Component as share of NFCF for the Netherlands. (1994-
2021).

*Source:* Author's calculations, AMECO database
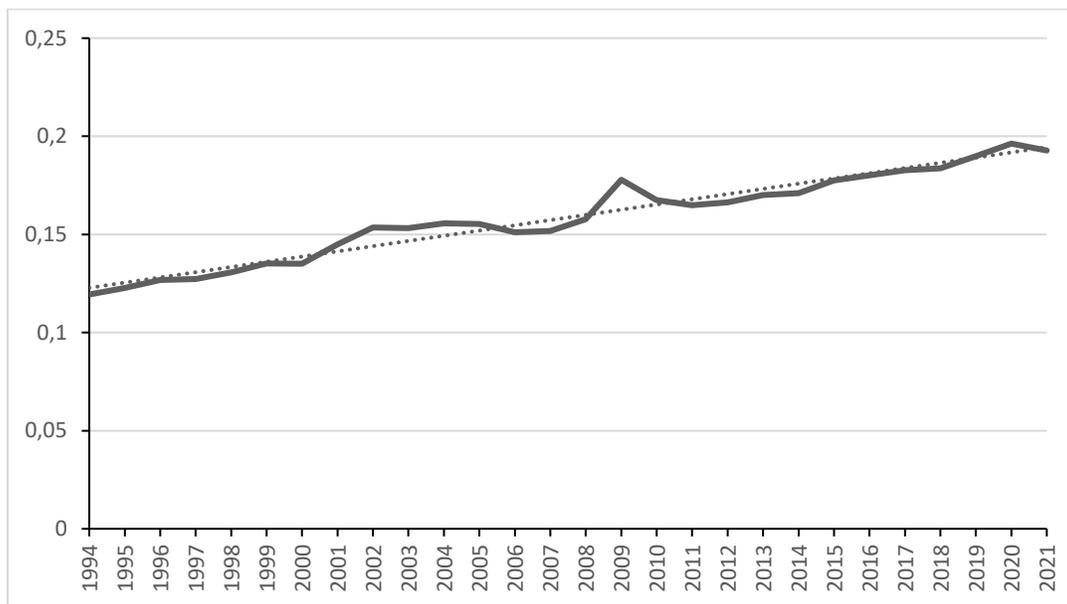


Figure 22 Intangible Component as share of NFCF for Germany. (1994-2021).

*Source*: (Author's calculations, AMECO database)

We can see that IC is increasing for both the Netherlands and Germany although NFCF is declining. This means that the decline in fixed tangible investment has a greater impact on NFCF as compared to the increase in fixed IC. It also means that fixed IC is partly offsetting the decline in NFCF and in the absence of IC, we might have experienced greater decline in NFCF. Thus, intangible investment can partly explain the changes in NFCF and is an important determinant when we want to examine the decline of NFCF.

To conclude, although NFCF is declining in the Netherlands and Germany, investment in intangible assets is increasing. Hence, when we take intangible investment into consideration, the decline in total fixed capital formation is less steep as compared to when we only consider tangible fixed assets (investment in construction and equipment

## 6.2. Business Dynamism (BD)

Business dynamism (BD) reflects the health of businesses and their operating environments. Business dynamism highlights the number of jobs, the number of new firms that are created over time and those that exit the market over time (Cavalleri et al, 2019). In this thesis, we have also considered market concentration under the umbrella of business dynamism where high concentration would imply less dynamic markets (Phillipon and Gutierrez, 2017).

Philippon and Gutierrez (2017), Dottling, Gutierrez and Philippon (2017) and Cavalleri et al. (2019) have argued that business dynamism is an important determinant of business investment as BD reflects the degree of competition in a business economy. They argue that competitive business environments foster more business investment and innovation. Thus, less dynamic markets are less competitive.

Dottling, Gutierrez and Philippon (2017) have analyzed the business investment for about two decades in the European economies of Austria, Belgium, Germany, Spain, Finland, France, Great Britain, Italy, Netherlands and Sweden and compared with the business investment in the United States. The authors argue that business dynamism is declining rapidly in the U.S. since 2000. The market concentration is also rising. They state that the decline in business dynamism is one of the key determinants that can explain low business investment in the U.S. However, the authors have not found evidence of declining business dynamism for Europe. The market concentration in Europe has also been fairly constant. Thus, they conclude that business dynamism is not a key determinant that could explain low business investment in Europe.

Cavalleri et al. (2019) have analyzed the data on market dynamism and concentration for Germany, France, Italy and Spain, the four biggest economies in Europe. In line with Dottling, Gutierrez and Philippon (2017) Cavalleri et al. (2019) find that market concentration is fairly constant in the Euro Area in the past decade. The authors did not find any observable trend in business dynamism in Europe. However, they have pointed out that the business dynamism in the U.S. has decreased considerably.

Thus, based on literature and theory, we can conclude that although business dynamism has proven to be an important determinant of fixed business investment in the U.S., it is not a key determinant of business investment in Europe and thereby in our economies of interest – the Netherlands and Germany.

Therefore, in this thesis, we will exclude BD from the list of determinants that have affected business investment in the Netherlands and Germany.

## 6.3.   Financialization (FNC)

The term financialization as defined by Epstein (2001) refers to the "increasing importance of financial markets, financial motives, financial institutions, and financial elites in the operation of the economy and its governing institutions, both at the national and international level (Epstein 2001, p.1)." Financialization also refers to the rising importance of finance-related activities, profits and income in an economy (Stolbova et al, 2017). We already saw in section 3.4 that the increase in financialization has led to negative consequences like an increase in income inequality, slow economic growth, and stagnating wages. Financialization also provides an incentive to businesses to invest in reversible short-term financial commodities rather than making investments in tangible irreversible projects. From 1980 onwards, the decline in investment and growth went in tandem with an increase in dividend and interest payments and share buy-backs in non-financial corporations (NFCs) that consequently reduced the value created by the NFCs. Thus, businesses saw a decrease in funds available for tangible investments (Tori and Onaran, 2017). Thus, the increase in financialization also leads to crowding out of fixed tangible investment component of NFCF.

In this thesis, we decided to treat FNC outside empirical model because to analyze the impact of financialization on NFCF/GDP empirically, we required firm level data which was not publicly available. Thus, FNC cannot be treated at aggregate national level as we treated other variables which are inside the empirical model.

Stolbova et al. (2017) analyzed the process of financialization in the European economies of Austria, Belgium, Germany, United Kingdom, Italy, the Netherlands and France from 1999-2016. The authors have found an increasing trend in financialization across these economies. From Figure 6 we can see an increasing share of financial assets in total GDP for the Netherlands and Germany. This shows an increasing importance of finance in these economies. This result is in line with Stolbova et al. (2017). The intensity of financialization is rising even in the non-financial sector of European economies (Stolbova et a.l, 2017). There is an increase in direct and indirect exposure of the non-financial (real) sector of the European economy to the financial sector in the form of equity holdings for investment companies, pension funds etc. (Stolbova et al, 2017).

Tori and Onaran (2017) have analyzed the impacts of financialization on physical investment in European economies Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, the Netherlands, Portugal, Spain, Sweden, and the UK during 1995 – 2015. They studied the balance sheets of firms in these economies which included information on the firms' sales, profits, dividend payments, financial incomes etc. The authors find statistically sound and robust results of a negative impact of financial payments and incomes on the physical investment by non-financial corporations (NFCs). They found an increasing trend in the financial assets of NFCs. Germany, along with Sweden and UK, saw the strongest increase in financial assets of NFCs. Furthermore, Germany saw a decline in accumulated physical assets by almost 50%

between 1995 – 2015. During this period, financial payments in Germany increased by almost 80% (Tori and Onaran, 2017). All these factors point to a serious increase in financialization in Germany. Similarly, the Netherlands also experienced a decline in accumulated assets from 25% in 1995 to 16% in 2015. During this period, the Netherlands experienced a significant rise in the ratio of financial payments to fixed investments. Finally, Tori and Onaran (2017) conclude that the rise in financialization as represented by an increased substitution of tangible assets by financial activity, an increase in dividend payouts and shareholder value maximization, has led to decline in fixed tangible investments in the NFCs.

Thus, based on the literature reviewed and empirical findings of various studies, we can conclude that the rise in financialization is an important determinant of decline in NFCF in the Netherlands and Germany and increased financialization is negatively associated with NFCF/GDP.

## 6.4. Conclusion

In Chapter 6, we considered three additional determinants that were not considered inside the empirical model due to a lack of aggregate country-level data. These three determinants are intangible investments (ITA), business dynamism (BD) and financialization (FNC).

Reviewing the literature and the empirical results, we found support for the variables ITA and FNC in the case of the Netherlands and Germany. These variables are important factors that can explain the decline in NFCF in these two economies. Both ITA and FNC are negatively associated with NFCF/GDP. Increase in intangibles can explain why companies are investing less in tangible assets and this increase in intangible investment has shown to partially off-set the decline in NFCF. We saw that rise in intangibles is good for economic growth and productivity. Thus, we can say that the decrease in tangible component of NFCF has been partly offset by an increase in intangibles.

On the other hand, we see that increase in financialization is also able to explain decrease in NFCF. However, literature seems to suggest that increase in FNC has led to negative consequences like increase in income inequality and slow economic growth. Thus, the decline in NFCF due to increase in FNC is bad for the Netherlands and Germany.

Finally, in the literature I did not find support for the hypothesis that a decline in business dynamism has contributed to the decline in NFCF in the Netherlands and Germany.

# Chapter 7

## Policy Lessons

In Chapter 7, we will first compare our empirical findings for the Netherlands and Germany to that of the literature reviewed for the E.U. and the U.S. We will also look at the difference in our findings between the Dutch and German economy. Next, we will look into what lessons can be derived from a policy perspective in context of stimulating net fixed capital formation in the Netherlands and Germany.

### 7.1. Comparison of Empirical Findings

As reviewed in Chapter 3, we saw that the reasons behind weak business investment in the U.S. and E.U. are different. As markets in the United States have become concentrated (or more oligopolistic) and competition has stagnated, it has led to lower incentives to make business investments. On the other hand, weak capital formation the E.U. has been attributed to weak demand, some financial frictions, rise of uncertainty, change in labour markets and increase in energy prices. In case of the Netherlands and Germany, we found support for many of the independent variables / determinants that we discussed in Section 3.2 for the E.U.

Based on the comparison between U.S. and E.U. we analyzed the effects of demand, financial constraints, business environment, labour and market regulations, energy prices, intangible investments, business dynamism and financialization on net fixed capital formation as a share of GDP in the Netherlands and Germany. In case of the Netherlands, we found empirical support for the variables of demand growth, financial constraints, uncertainty and energy prices in explaining the changes to NFCF/GDP. We saw that while the decrease in demand and the increases in uncertainty and the energy price index have contributed to the decline of NFCF/GDP, the decrease in term spread and increase in real net profits of firms have partially off-set the negative effects. Additionally, based on Chapter 6, we can say that the increase in the fixed intangible component of NFCF might have slowed down the decline in NFCF/GDP. Furthermore, the increase in financialization in Europe might have contributed to the stagnating business investment in the Netherlands. These results for the Netherlands are very-much in-line with the literature like Bussière, Ferrara and Milovich (2015), Banerjee, Kearns and Lombardi (2015), Lewis and Menkyna (2014), European Commission (2017) that we reviewed in Section 3.2. for the E.U.

In case of Germany, our empirical study yielded some different results in comparison to the Netherlands case. For instance, we did not find empirical evidence for demand variables (DEM (t-1), DEM (t-2)) as we found in the case for Netherlands. As explained in Section 2.2 and furthermore in Section 5.2, we suspect that the relationship between NFCF/GDP and DEM (t-1), DEM (t-2) has weakened, especially since mid-1990s. This could plausibly be due to the increase in OFDIs via off-shoring of production activities or over-reliance on exports. Thus, demand may not play a significant role in explaining the decline in NFCF/GDP as it did in the case of the Netherlands. Next, we found empirical support for the variables of term spread, energy price index, unemployment rate and network sector regulations in explaining changes to NFCF/GDP. While increase in energy price index and decrease in network sector regulations have contributed to the decline in net fixed capital formation as a share of GDP, decrease in term spread and

unemployment rate have managed to partially off-set the decline. These results are quite different from the literature that we reviewed for the E.U. and the empirical findings for the Netherlands as demand, uncertainty and profits of firms seem to play an insignificant role towards explaining any changes to NFCF/GDP. This could be due to the fact that Germany recovered very quickly from the crisis owing to its strong global competitiveness and position in exports of quality, and high-tech products. Furthermore, we expect the same relationships between intangible investment, financialization, and net fixed capital formation as those we delineated in case of the Netherlands in the previous paragraph.

We have left the variable of user cost of capital (UCoC) out of discussion for both the Netherlands and Germany because the obtained positive relationship between UCoC and NFCF/GDP is most likely because of the overwhelming effect of other variables. A positive and statistically significant coefficient of UCoC can also represent a scenario of structurally low inflation and suppressed demand. This is something that can be empirically explored further. However, for now, it is out of the scope of this thesis. Although UCoC is significant, we cannot conclude that increase in UCoC will increase NFCF/GDP. In this case, we prefer to stick to the theoretical relationship between UCoC and fixed capital formation where lower UCoC makes borrowing for firms easier and provides incentives for further investment.

Next, let us look at policy lessons that can be learnt based on our study and findings so far.

## 7.2. Insights and Policy Lessons

We saw that the net fixed capital formation in the Netherlands is significantly affected by demand growth, real net profits, term spread, uncertainty and energy price index. Decrease in demand growth has contributed to decline in business investment as share of GDP. Thus, macroeconomic policies should be aimed at stimulating demand. More expansionary fiscal policies can be implemented. For example, we can think of policies to increase the spread of social safety net like providing health insurance, increasing unemployment benefits and pension coverage. These policies can probably help in increasing household consumption (Morgan, 2011). Tax policies can also help in stimulating household and corporate demand. Tax cuts for firms can increase the share of real profits and encourage business investment (Morgan, 2011). We already reviewed the fact that the increase in real net profits can positively affect business investment. Government spending on infrastructure can encourage private businesses to make more investments (Morgan, 2011). Moreover, the government can encourage the investment climate by ensuring proper governance, regulation, maintenance of legal rights etc. (Morgan, 2011). Such improvement in the investment climate can also help in partially alleviating economic uncertainty and thereby, give more boost to business investment. Next, decrease in yields of corporate bonds can encourage more business investment as it will reduce financing costs of investments (Lewis and Menkyna, 2014). Within the E.U. efforts can be made to reduce the spreads between bank lending. However, regulations can be put in place to reduce the likelihood of giving out risky credits. Finally, the variable GEI that deals with energy prices is out of scope of macroeconomic policymaking. Thus, in nutshell, we can expect expansionary fiscal policies to raise demand, leave households and businesses with more income after taxes for consumption and investment, and increase the social net and benefits.

We reviewed in previous chapters that after 2000, Germany's economy became mainly export-led and dependent on foreign demand. Thus, it became difficult for the German government to increase domestic demand and prevent the economy from going into a deep recession when the foreign demand collapsed suddenly during the crisis of 2008 (Lindner, 2014). Additionally, excessive dependence on foreign demand

might not be good for an economy as the national Government policies are mostly ineffective in influencing foreign demand. Moreover, it fluctuates more erratically as compared to domestic demand (Lindner, 2014). Thus, in case of Germany, macroeconomic policies can be targeted at reducing strong dependence on exports. One can think of implementing expansionary fiscal policies where an increase in Government spending may translate into higher imports and improve the net exports (Morgan, 2011). Policies targeting promotion of exports can be reduced as it can help in improving fiscal balance. We see that decrease in NSR had contributed to decline of NFCF/GDP. As explained in Section 5.2., this could probably be due to the fact that reduction in regulations can give free access to the entrants to the incumbents' infrastructure and also lead to reduction in internal profits where businesses have to compete to satisfy market demand. Thus, for infrastructure heavy network sectors, policies can be made to restrict easy entry of new entrants. One can also think of providing tax or monetary incentives to the incumbents to continue investments in a scenario where NSR remains the same. Finally, in case of Germany, we can think of macroeconomic policies targeted at providing effective and secure employment by restoring bargaining powers of the workers, by extending unemployment benefits and creating more full-time jobs. One way to go would be to step up the domestic investment which can help in creating more jobs.

It might seem difficult to apply full scale expansionary fiscal policies due to binding treaties and pacts like the Maastricht Treaty and Stability and Growth Pact (SGP). Fiscal consolidation is one of the main goals pursued by this pact (Barrell, 2001). For example, the treaty states that Government budget deficits for member states should be less that 3% of GDP (Barrell, 2001). If the deficits are not within 3% of GDP, then corresponding fines would be imposed on the economies with excess deficits. Barrell (2001) highlights the work of Buti et al. (1997) to show that European economies can follow a balanced-budget approach to leverage the advantage of fiscal deficits (expansionary policies) without breaching the 3% mark. Furthermore, we can recommend reforming the SGP rules such that the 3% GDP deficit limit can be increased and made more flexible. During crisis periods, public investment and spending should be protected from fiscal consolidation. This is because after the crisis of 2008, during 2009 – 2012, tight austerity policies were applied that resulted in massive cuts in public spending. Owing to the large effect of the fiscal multiplier, these cuts proved harmful, especially to the periphery economies in the E.U. where total public investment declined more than 2% of GDP (Truger, 2020). The pay-as-you-use concept as suggested by Truger (2020) can help the economies, here the Netherlands and Germany, to finance investments without severe austerity threat. For example, the next generations can contribute to financing via debt servicing where in exchange they also receive public / social stocks and benefits. This way the current generations can be saved to an extent from disproportionate burden via more taxes or decreased spending (Truger, 2020). Furthermore, efforts could be made to replace the hard quantitative upper limits of deficits and debts as suggested by SGP with the goal of economic and social well-being of people (Alvarez et al, 2019). For example, Truger (2020), suggests that countries can develop an integrated scoreboard that addresses various social, economic and environmental indicators to follow up with developments and monitor deviations that can be addressed by an integrated policy framework.

## 7.3. Conclusion

In this chapter, we first compared our findings for the Netherlands and Germany to that of the literature reviewed for the U.S. and E.U. We saw that the factors affecting business investment are (some-what) different in the U.S. and E.U. In the Netherlands, net fixed capital is more dependent on variables like

demand growth, uncertainty, and firm profits; whereas, in Germany these variables include sectoral regulations, and unemployment rates. The determinants term spread and energy indices affect business investment in both the Netherlands and Germany.

Next, we looked at what policy lessons can be derived to stimulate more fixed investment. Expansionary fiscal policies in the form of increased government spending, social benefits or tax relaxations can help in stimulating demand and encourage more investment via increased net profits for firms in the Netherlands. For Germany, policies can be targeted at reducing over-dependence on foreign demand and improving effective employment rates. Expansionary policies targeted at employment can help the workers as they can invest more time in knowledge – intensive firm activities.

# Chapter 8

## Conclusion and Reflections

In Chapter 8 we will conclude by summarizing the thesis from Chapter 1 to Chapter 7. We will also point out the scope for further research.

 In Chapter 1, we introduced the problem and objective of the thesis. We see that economic growth in terms of real GDP growth is declining in many OECD nations. Decline in economic growth has negative consequences like decline in productivity, low standards of living, increase in income equality etc. We saw that stagnating / declining business investment as a share of GDP is one of the key causes of declining economic growth. Thus, we decided to investigate the determinants that affect business investment. To scope the thesis, we decided to do this investigation for the European economies of the Netherlands and Germany.

Next, in Chapter 2, we looked into the relationship between economic growth and business investment for the Netherlands and Germany. We performed a bivariate OLS regression with economic growth as dependent variable and business investment as share of GDP as independent variable. We found that business investment can explain about 42% of decline in economic growth in the Netherlands. While in case of Germany we reviewed literature about how stepping up business investment can help in generating more effective employment and thereby contribute towards sustained long-term economic growth.

In Chapter 3, we reviewed various determinants of business investment in the U.S. and E.U. While factors like increased concentration and decline in competition can explain stagnating investment in the U.S., variables related to demand, uncertainty, financial constraints, demographics and regulations can explain stagnating investment in the E.U. Based on the literature reviewed, we decided to empirically investigate the effect of demand growth (DEM (t-1), DEM (t-2)), user cost of capital (UCoC), real net profits (RNP), term spread (TS), uncertainty (UNCT), global energy index (GEI), working age population percentage (WP), unemployment rate (UNEMPR), total factor productivity (TFP), employee protection legislation (EPL), and network sector regulations (NSR) on net fixed capital formation as share of GDP. We decided to treat the effect of intangible investment, business dynamism and financialization outside the empirical model.

In Chapter 4 we explained the data, model and methodology of empirical analysis in detail. We decided to perform multi-variate OLS regression analysis. Here we also explained our dependent and independent variables before concluding with the expected relationships between these variables.

In Chapter 5 we presented the main results of the econometric analysis for the Netherlands and Germany. In case of the Netherlands, we saw that DEM (t-1), DEM (t-2), UCoC, RNP, TS, UNCT and GEI most significantly affect capital formation. They can explain about 108% of the change in business investment as share of GDP. While for Germany, we found UCoC, TS, UNEMPR and NSR to be statistically significant in explaining changes to net fixed capital formation. Taken together, these determinants contribute to 98% of the change to business investment in Germany.

In Chapter 6, we reviewed the determinants – intangible investments, business dynamism and financialization – and their effect on business investment. We see that increase in fixed intangible investment has partially off-set the decline in NFCF/GDP in the Netherlands and Germany. We do not find support for the assumption that decrease in business dynamism has caused decline in NFCF in the Netherlands and Germany. Next, we find support for FNC that increase in financialization can explain decline in NFCF for the Netherlands and Germany. Since, more financialization is also associated with consequences like increase in income inequality and slow growth, it might be bad for the long-term economic growth of the Netherlands and Germany.

Finally, in Chapter 7, we compared our findings to those of the U.S. and E.U. after which we looked into the policy lessons that can be derived. We concluded that expansionary fiscal policies can promote firms to invest more, encourage workers to invest in knowledge-intensive activities without worrying about their jobs and these policies can also help in stimulating demand.

## 8.1.    Reflections

In the thesis, we looked into why business investment is important for economic growth and we identified the  determinants that are holding back the investment. However, the notion of economic growth (or the 'growth paradigm') has its limits and many scholars argue that economic growth, conventionally measured as the average annual increase in per capita real GDP, is not a useful indicator of well-being, societal progress and living standards. We can reflect on the alternative pathways at the intersection between economic growth, the environment and sustainable progress (see Van den Bergh and Kallis, 2012).  Two alternatives to the growth paradigm have been put forward: namely, "a-growth" and "degrowth."

The first alternative is called 'a-growth' and it tries to explain that GDP growth cannot effectively capture important aspects of societal welfare (Van den Bergh and Kallis, 2012). Most importantly, the focus on economic growth does not consider the contribution of non-market and informal activities to social welfare, while at the same time ignoring the damage done by economic growth to climate, health and Some studies related to happiness and well-being suggest that during 1950 – 1980, the average welfare value stagnated despite an increase in GDP growth in some of the advanced economies (Van den Bergh and Kallis, 2012). The 'a-growth' paradigm proposes to ignore the growth of real GDP altogether and to focus instead on sound environmental, social, and economic policies independently of their effects on economic growth.

The second alternative is called 'de-growth' and it recommends a downscaling of the economy so as to make it consistent with biophysical boundaries. The key point is that the scale of human (economic) activities has increased so strongly that it is upsetting the bio-sphere by over-exploitation of its resources (which leads to deforestation, loss of biodiversity, and loss of resilience) and over-pollution of its sinks (most prominently in the form of $CO_2$ emissions in the atmosphere). The damage done to the Earth's bio-sphere is feeding back into damages to human activity and people – in the form of global warming and pollution. Because these ecological damages are not counted or under-estimated in the calculations of economic growth, economic growth is giving us a false impression of progress.

Based on the considerations proposed by the 'a-growth' and 'de-growth' paradigms, we can reflect on having policies that are not centered solely around achieving GDP growth but those that also give importance to social and environmental aspects irrespective of the effect of the latter on the former. Policies that give incentives to invest in environmental or climate-related projects can help in achieving sustainable development. Such policies can make environmental projects more attractive for firms to invest in. In this thesis, we have analyzed the data at country level aggregation. However, such high-level aggregation may not always tell the complete story. For example, in case of Germany, we see that the fixed capital formation in equipment remained fairly stable during 1994 – 2013 while that in construction declined during the same period. However, the aggregated data for investment does not tell this detail. The overall NFCF data, does not give insights into how the individual industry sectors are performing. For instance, from Section 6.1, we can see that the fixed intangible investment is increasing, however the overall NFCF is declining. Thus, while looking at the country-level data we can see the declining trend in business investment, we may fail to appreciate the increase in intangible investments which occurred during the same period of time.

In this thesis, although we have econometrically estimated the determinants of business investment, we would like to emphasize the fact that economies are not deterministic and can be subject to self-fulfilling prophecies (Azariadis, 1981). Even in the most stable economies, expectations or human perceptions can cause fluctuations in the level of economic activity (Azariadis, 1981). Such self-fulfilling prophecies introduce indeterminism in economic models (Azariadis, 1981). Thus, it is important to understand that human perceptions can affect the level of business investment, or the determinants of business investment as identified in this thesis. For example, the increase in energy prices in itself might not cause the business investment to decrease. The increase in energy prices may act as a signal of uncertainty or economic downturn which can affect people's perception of a healthy economy. Thus, when more people start believing that the economy is about to go into a recession, they may cut down on any immediate business investment. This in turn causes the business investment to decline; thus, making it a self-fulfilling prophecy.

This thesis can be used as a guide to understand which factors can affect business investment. However, it is important to know that other factors like human perceptions, expectations, changes at firm and sector levels etc. can also influence the level of business investment.

## 8.2. Suggestions for Further Research

It is important to note that there are some limitations to the thesis that can serve as suggestions for further research in this domain.

In this thesis we only used national level aggregate data in the empirical model as it was publicly available. Because of this reason, we treated the variable FNC outside econometric analysis since data regarding FNC needs to be aggregated at firm level. If we would have included FNC in econometric analysis, we might have found the variable to be negative and statistically significant in explaining the decline in NFCF/GDP. This is because based on theory we can expect a negative relationship between FNC and NFCF/GDP. From Figure 6, we can already see that financialization is increasing in the Netherlands and Germany. A possible avenue for research would be to include firm-level data for financialization in the

econometric analysis and check how and (if) the results change. This may perhaps change the explanatory power of the model and can contribute to the analysis.

Some of the literature that we reviewed like Bussière, Ferrara and Milovich (2015), used multiple measures and indices of certain variables, for example UNCT, to check the robustness. In this thesis, we only used the World Uncertainty Index as a proxy for uncertainty. However, an area for further research could be to include measures of financial uncertainty which are accessible through private data-sets.

Next, in this thesis, we considered the total net fixed capital investment as part of our dependent variable. A future scope for analysis can be to examine the components of NFCF – construction, equipment etc. – to find out how different determinants affect each of these components of NFCF. Another suggestion for further research would be to use a model other than OLS regression to check how the independent variables affect the dependent variable. OLS assumes a linear relationship between the dependent and independent variables. It might be an area of inquiry to see if other relationships, for example quadratic / curvilinear fit the model better.

We saw in this thesis that unlike in the case of the Netherlands and in contrast to literature reviewed on the E.U. in Section 3.2, demand does not seem to be significant in explaining the decline in fixed business investment as share of GDP in Germany (during 1994-2021). As stated previously, outward FDI flows can possibly explain the weak relationship between fixed business investment and demand. It would be interesting to empirically estimate the effect of outward FDI on DEM (t-1), DEM (t-2) and NFCF/GDP. We suspect that based on firm motives, strategies, their asset type, their foreign activities etc., the impact of OFDI on domestic fixed investment can vary. Deutsche Bundesbank (2018) has concluded in its report that the quantitative impact of changes in FDIs on domestic investment in Germany is small. Therefore, we will not expect the results to vary significantly. However, inclusion of FDI in the econometric analysis could be an avenue for further research.

Next, we found the cost of capital to be positive and statistically significant for both the Netherlands and Germany. This result is contradictory to the economic and finance theory which suggests that low user cost of capital will encourage the firms to make more investments. We see from Figure 8 that UCoC has been declining since the financial crisis of 2008. Its value has been very close to zero, especially during 2008 – 2021. This scenario could indicate depression in demand where despite low cost of capital, firms are not making investments. Thus, we can explore further if the positive coefficient of UCoC is signaling a structural depression of aggregate demand.

Finally, for future research, one can analyze how business investment as a share of GDP changed after the Covid-19 pandemic based on the changes in various independent variables that we have explained in the thesis.

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# Appendix A1

Appendix A1 includes the partial regression output with GDP growth as dependent variable and NFCF/GDP as independent variable for the Netherlands and Germany. The appendix also includes correlation output and scatter plot between these two variables to show their strength of association.

Table 9 shows the partial regression statistics for the Netherlands. We see that NFCF/GDP is positively statistically significant at 1% and can explain 41.48% of the changes to the independent variable.

| Regression Statistics | |
|---|---|
| Multiple R | 0.6516 |
| R Square | 0.4245 |
| Adjusted R Square | 0.4148 |
| Standard Error | 0.0169 |
| Observations | 61 |

| | Coefficients | P-value |
|---|---|---|
| Intercept | -0.0012 | 0.8054 |
| NFCF/GDP | 0.4136 | 0.0000 |

Table 9 Partial Regression Output - The Netherlands (1960-2021)

Table 10 shows that GDP growth and NFCF/GDP are strongly and positively correlated with a coefficient of 0.6516 for the Netherlands

| | GDP growth | NFCF/GDP |
|---|---|---|
| GDP growth | 1 | |
| NFCF/GDP | 0.6516 | 1 |

Table 10 Correlation Output - The Netherlands (1960 – 2021)

In Figure 23 we can visually see how both the variables (GDP growth and NFCF/GDP) move together. There is a positive linear association between both the variables.
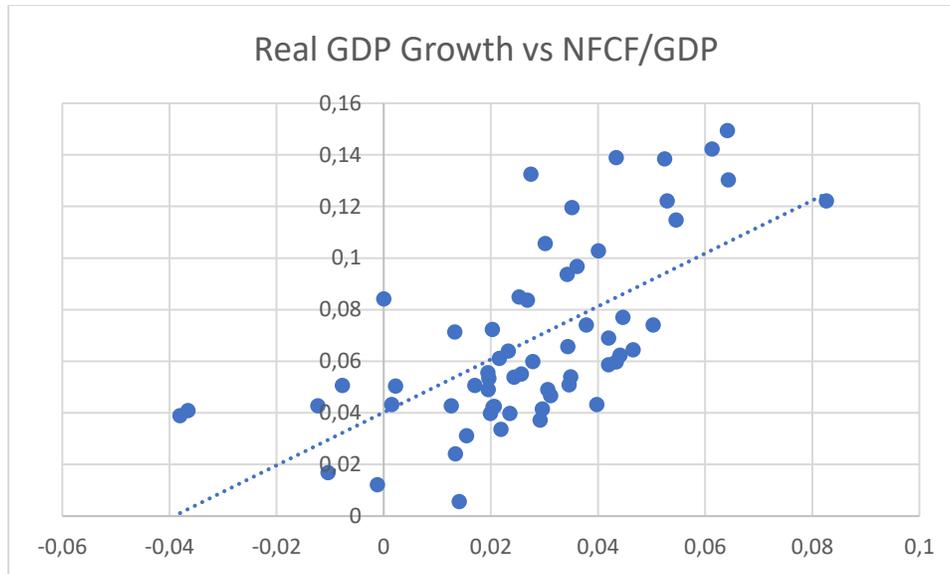
Figure 23 Scatter Plot – Real GDP growth vs NFCF/GDP - The Netherlands (1960-2021)

*Source* : AMECO database

Table 11 shows the partial regression output for Germany. We see that NFCF/GDP is positively statistically significant at 1% and can explain about 28% of the changes to the independent variable.

| Regression Statistics | |
|---|---|
| Multiple R | 0.5318 |
| R Square | 0.2828 |
| Adjusted R Square | 0.2706 |
| Standard Error | 0.0199 |
| Observations | 61 |

| | Coefficients | P-value |
|---|---|---|
| Intercept | 0.0025 | 0.6194 |
| NFCF/GDP | 0.3120 | 0.0000 |

Table 11 Partial Regression Output - Germany (1960 -2021)

Table 12 shows that economic growth and fixed business investment as a share of GDP are positively correlated with a coefficient of 0.5318

|  | *GDP Growth* | *NFCF/GDP* |
|---|---|---|
| Real GDP Growth | 1 | |
| NFCF/GDP | 0.5318 | 1 |

Table 12 Correlation Output - Germany (1960 - 2021)

Finally in Figure 24 we can see the scatter plot between real GDP growth and fixed business investment as share of GDP. We see a positive linear association between both the variables.
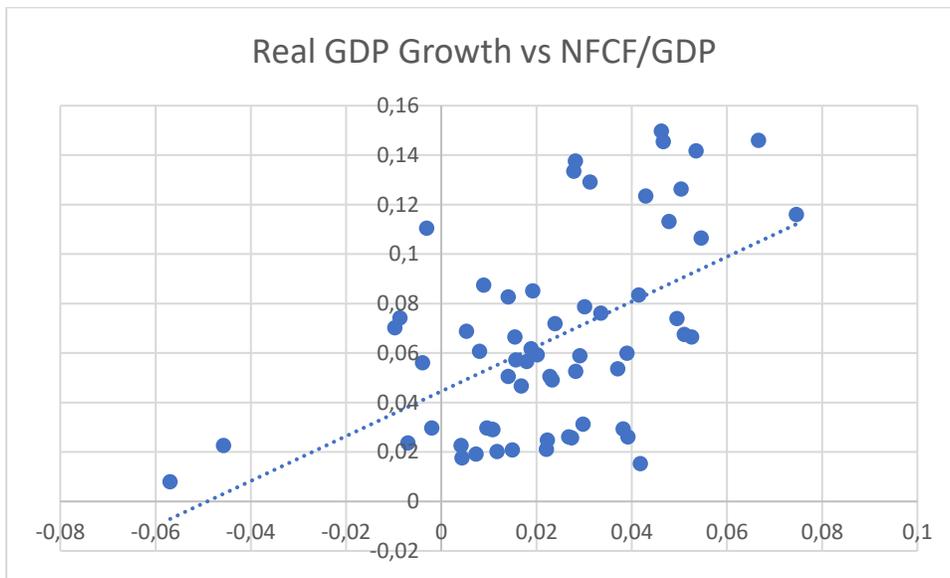


Figure 24 Scatter Plot - Real GDP Growth vs NFCF/GDP - Germany (1960-2021)

*Source* : AMECO database

# Appendix A2

In Appendix A2 we have included the results for the tests to check assumptions of multivariate OLS regression used for the econometric analysis.

Assumptions of Multivariate regression

1. Linear relationship between dependent and independent variables. We can test visually this using scatter plots.
2. The variance of residuals is same for all the values of independent variables. We can test this visually by using scatter plots using the residual values and the predicted dependent variable values. This is also called as the method to test homoscedasticity
3. The residual is a random variable with a mean of zero. We can test this assumption visually by using scatter plots using the residual values and the predicted dependent variable values. We can see if this plot is symmetrically centered around the horizontal zero mean.
4. The residuals are normally distributed random variables. We can test this assumption using the normality plots.
5. The residual values of independent of each other. This phenomenon is called autocorrelation. We can use scatter plots and the Durbin Watson test to check for this assumption.

First we will check for the homoscedasticity of the data i.e. assumption 2. Homoscedasticity helps us in understanding if our empirical equation is good enough for every data point. Thu, we would want our data to be homoscedastic, meaning that the error (residual) terms will roughly have the similar values for every observation. From Figure 25 given below we can see that the standardized residuals of our data have no particular pattern. Also, upon examining the list of residuals, we found that no residual value was more than 3 standard deviations away from the residual mean. Thus, we can say that our data is homoscedastic.
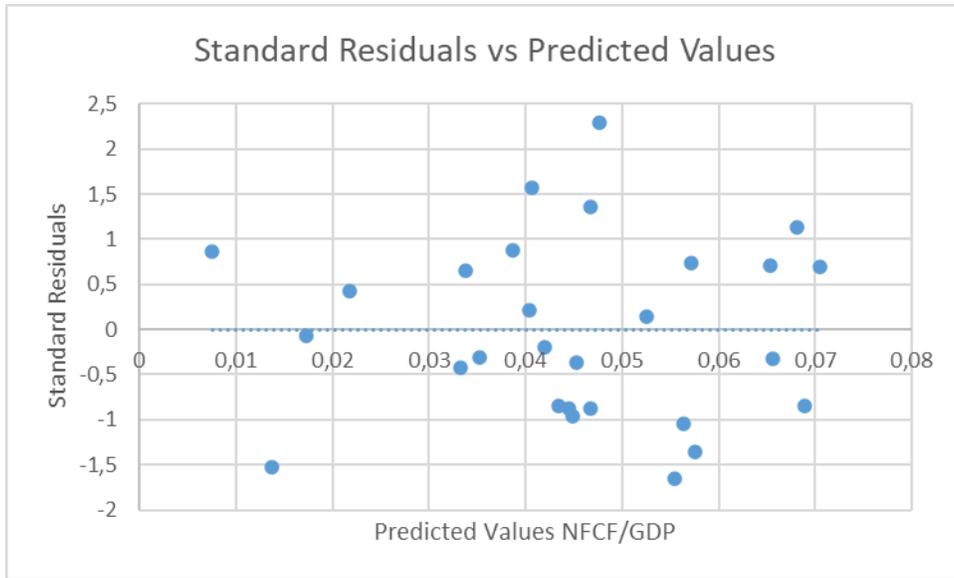
Figure 25 Standardized residuals vs Predicted values - The Netherlands

We can see that the plot in Figure 25 also satisfies assumption 3 as the residual mean is zero. We can observe this from the horizontal trendline at zero.

We also checked the normality of data. From Figure 26 given below, we can see that the data is very much normal. Although it is deviating at some points from the linear trendline, given the small number of observations, we can say that the data upholds the normality assumption to an extent.
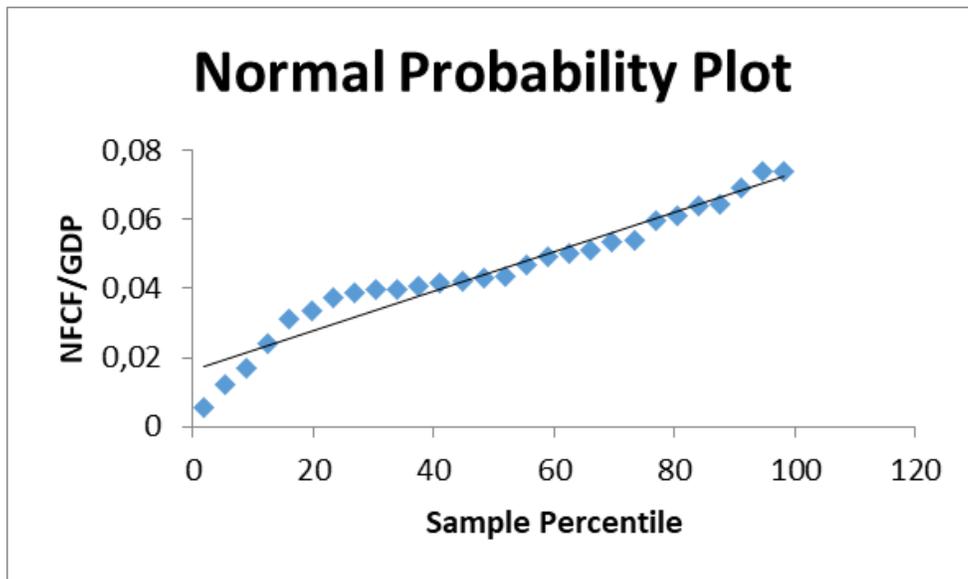


Figure 26 Normality plot - The Netherlands

Next we checked for multicollinearity among the independent variables. From Table 13 we can see that no two independent variables have significantly high correlation (greater than +/- 0.8). Thus, there should be no multicollinearity. However, we will perform the VIF test to quantitively check this fact.

| | NFCF/GDP | DEM (t-1) | DEM (t-2) | UCoC | RNP | TS | UNCT | GEI |
|---|---|---|---|---|---|---|---|---|
| NFCF/GDP | 1 | | | | | | | |
| DEM (t-1) | 0.5270 | 1 | | | | | | |
| DEM (t-2) | 0.3731 | 0.0409 | 1 | | | | | |
| UCoC | 0.2180 | 0.3141 | 0.0960 | 1 | | | | |
| RNP | -0.3634 | -0.4817 | -0.3629 | -0.7695 | 1 | | | |
| TS | -0.1964 | 0.1643 | 0.0842 | 0.6976 | -0.5946 | 1 | | |
| UNCT | -0.5099 | -0.4509 | -0.2054 | -0.6394 | 0.5876 | -0.2694 | 1 | |
| GEI | -0.5600 | -0.4169 | -0.3787 | -0.3412 | 0.7631 | -0.3167 | 0.2475 | 1 |

Table 13 Correlation Matrix - The Netherlands

Table 14 shows the VIF values for each independent variable. In this thesis we have assumed the VIF cut-off to be 10. Thus, if a variable has VIF > 10, it indicates potential multicollinearity. However, we can see that there is no indication of possible multicollinearity.

| Determinants | VIF |
|---|---|
| DEM (t-1 | 1.560 |
| DEM(t-2) | 1.378 |
| UCoC | 5.499 |
| RNP (GDP def) | 9.927 |
| TS | 2.277 |
| UNCT | 2.382 |
| GEI | 3.976 |

Table 14 VIF Test - The Netherlands

Table 15 shows the regression results augmented with lagged dependent variable NFCF/GDP (t-1). We see that since NFCF/GDP (t-1) is not statistically significant, we can ignore the small amount of autocorrelation indicated by DW statistic from Table 3.

| Determinant Name | Abbreviation | (1) | (2) | (3) | (4) | (5) | (6) |
|---|---|---|---|---|---|---|---|
| | | Dependent Variable : NFCF/GDP | | | | | |
| Demand growth (t-1) | DEM (t-1) | 0.4591*** | 0.4009*** | 0.2928*** | 0.3044*** | 0.2908** | 0,3397** |
| Demand growth (t-2) | DEM (t-2) | 0.3586** | 0.3491** | 0.2997*** | 0.3173** | 0.3013** | 0,2998** |
| User cost of capital | UCoC | | 0.0034* | 0.0061*** | 0.0073*** | 0.0070*** | 0,0065** |
| Real net profits | RNP | | -0.0001 | 0.0009*** | 0.0010*** | 0.0010*** | 0,0011*** |
| Term spread | TS | | -0.0133*** | -0.0110*** | -0.0107*** | -0.0100*** | -0,0088*** |
| Uncertainty | UNCT | | | -0.0574*** | -0.0548*** | -0.0546*** | -0,0581*** |
| Global energy index | GEI | | | -0.0003*** | -0.0003*** | -0.0003*** | -0,0003*** |
| Working age population percentage | WP | | | | -0.0021 | -0.0013 | -0,0018 |
| Unemployment rate | UNEMPR | | | | -0.0007 | -0.0011 | 0,0007 |
| Total factor productivity growth | TFP | | | | 0.0014 | 0.0013 | 0,0017 |
| Employment protection legislation | EPL | | | | | 0.0195 | 0,0173 |
| Network sector regulations | NSR | | | | | 0.0034 | 0,0023 |
| Lagged NFCF/GDP | NFCF/GDP (t-1) | | | | | | 0,1744 |
| | | | | | | | |
| | N | 28 | 28 | 28 | 28 | 28 | 28 |
| | $R^2$ | 0.4016 | 0.6128 | 0.9074 | 0.9133 | 0.9215 | 0.9257 |

| | | | | | | |
|---|---|---|---|---|---|---|
| Adjusted $R^2$ | 0.3537 | 0.5249 | 0.8750 | 0.8623 | 0.8587 | 0.8567 |
| DW Statistic | 1.2 | 1.7 | 2.4 | 2.5 | 2.5 | N/A |
| | *** p<0.01, ** p<0.05, * p<0.1 | | | | | |

Table 15 Regression results with lagged dependent variable - The Netherlands

# Appendix A3

The list of diagnostic checks, assumptions and their details are already mentioned in appendix A2.

First we will check for the homoscedasticity of the data. From Figure 27 given below we can see that the standardized residuals of our data have no particular pattern. Also, upon examining the list of residuals, we found that no residual value was more than 3 standard deviations away from the residual mean. Thus, we can say that our data is homoscedastic.
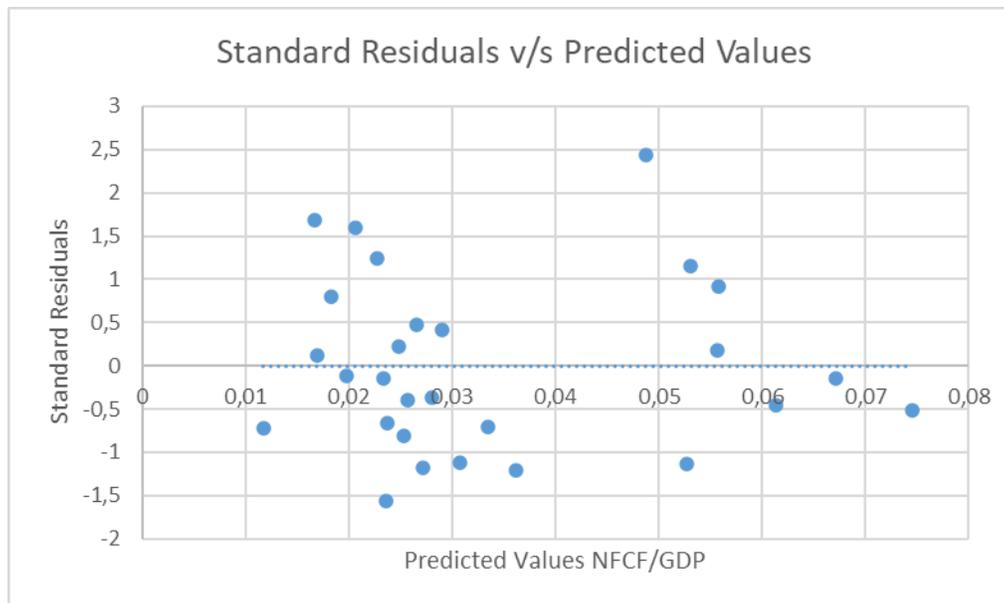


Figure 27 Standardized residuals vs predicted values – Germany

We can see that the plot in Figure 27 also satisfies assumption 3 as the residual mean is zero. The plot is fairly symmetric around the horizontal trendline at zero.

We also checked the normality of data. From Figure 28 given below, we can see that the data is non-normal. It is deviating at many points from the linear trendline. This could be due to the small number of observations. However, we can say that for Germany, the data violates the normality assumption of linear regression. This also means that perhaps there could be another model other than linear regression that would fit the data better.
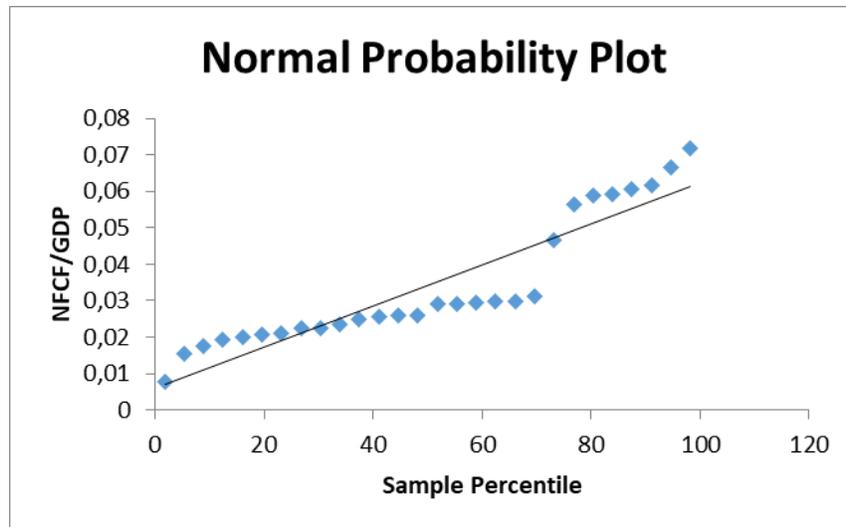
Figure 28 Normality Plot – Germany

Next, we checked for multicollinearity among the independent variables. From Figure 29 we can see that WP and UCoC are showing very high correlation of 0.9. Thus, we can suspect some multicollinearity. However, we will perform the VIF test to quantitively check this fact.

| | NFCF/GDP | DEM (t-1) | DEM (t-2) | UCoC | TS | UNCT | GEI | WP | UNEMPR | NSR |
|---|---|---|---|---|---|---|---|---|---|---|
| NFCF/GDP | 1 | | | | | | | | | |
| DEM (t-1) | 0.2433 | 1 | | | | | | | | |
| DEM (t-2) | 0.0378 | -0.0105 | 1 | | | | | | | |
| UCoC | 0,7140 | 0.2402 | 0.0569 | 1 | | | | | | |
| TS | 0.3088 | -0.1150 | 0.0601 | 0.5540 | 1 | | | | | |
| UNCT | -0.3703 | 0.0496 | 0.3083 | -0.6840 | -0.2927 | 1 | | | | |
| GEI | -0.6870 | -0.1478 | -0.2024 | -0.5412 | -0.3988 | 0.1540 | 1 | | | |
| WP | 0.7660 | 0.3000 | 0.1476 | 0.9338 | 0.6039 | -0.5754 | -0.6704 | 1 | | |
| UNEMPR | 0.3702 | 0.1443 | 0.0638 | 0.8462 | 0.4871 | -0.6220 | -0.4271 | 0.7919 | 1 | |
| NSR | 0.8204 | 0.2374 | 0.0899 | 0.8117 | 0.6685 | -0.4250 | -0.6454 | 0.8688 | 0.5619 | 1 |

Figure 29 Correlation Matrix - Germany

Table 16 shows the VIF values for each independent variable based on preferred model (1) column from Table 6. In this thesis we have assumed the VIF cut-off to be 10. Thus, if a variable has VIF > 10, it indicates potential multicollinearity. As suspected UCoC and WP show signs of multicollinearity as they have VIF > 10.

| Variables | VIF |
|---|---|
| DEM (t-1) | 1.7736 |
| DEM (t-2) | 1.5566 |
| UCoC | 14.4463 |
| TS | 2.4916 |
| UNCT | 3.6084 |
| GEI | 2.4422 |
| WP | 17.9112 |
| UNEMPR | 4.9370 |
| NSR | 4.9370 |

Table 16 VIF Test – Germany

Table 17 shows the VIF test results for each independent variable based on preferred model (2) column from Table 6. We can see that after removing WP, the issue of multicollinearity from the empirical model is removed. All VIF values are less than 10.

| Variables | VIF |
|---|---|
| UCoC | 8,8773 |
| TS | 1,9709 |
| GEI | 1,7576 |
| UNEMPR | 4,6251 |
| NSR | 5,7203 |

Table 17 VIF Test 2 - Germany