Labour shortage in the Netherlands after 2021

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EXECUTIVE SUMMARY

This thesis aims to investigate the causes behind the tension in the labour market that occurred in the Netherlands after 2021. Central to this thesis is the question of what the drivers behind the unprecedented labour market tension are and, if and how COVID-19 may have played a role in the creation of the labour market tensions. The relevance of this research to the Master 'Management of Technology' is touched upon, as developments in the labour market are often intertwined with technological progress.

In the literature overview it is identified that there are various potential causes of the labour market tension in the Netherlands. These include health-related issues, school closures, transformative changes, migration restrictions, increases in house and asset prices, changes in desired type of work, COVID-19 support packages, and lockdowns and export disruptions. These proposed causes of labour market tension in OECD countries in the found literature, might also play a factor in the Dutch labour market.

The labour market is analysed by studying the proximate drivers of the labour market, which are the labour supply, labour productivity and labour demand. The subsequent drivers behind labour supply and labour demand are used to analyse potential causes of the tense labour market. Most of the data that is collected stems from Statistics Netherlands. The main research method is the analysis of quantitative data.

The supply of labour in the Netherlands is determined by the total labour volume and the number of unemployed & underemployed hours (respectively the number of hours not worked due to unemployment and the number of hours not worked by workers that desire to work more hours). Labour volume is the most significant driver of labour supply of the above drivers.

In this thesis it is shown that the total labour supply has increased during the period where the labour market tension increased. The increase in labour volume is due to an increase in the worker population and an increase in the labour force participation rate. An increase in the sick leave ratio had a small decreasing effect on the labour volume but did not cause an overall decrease of the labour volume.

The labour productivity remained roughly the same during the period in which the labour market tension increased.

This indicates that the tension in the labour market is not caused by a lack of workers or a dip in the productivity but is caused by the other driver in the labour market; labour demand.

The demand for labour is defined by the total labour volume plus the total amount of labour that is desired but not fulfilled in the economy. The total labour volume and number of vacancies, which together represents the total labour demand, both increased during the period the labour market tension increased. So, the demand for labour did indeed increase after 2021.

It is hypothesized in this thesis that the demand for labour increased due to the following reasons: government spending during the COVID-19 pandemic and increased household savings, which subsequently where spend after the lockdown ended;

increased investment in green energy, healthcare, and education due to exogenous reasons; and a larger net export.

Labour demand is responsible for the increased tension in the labour market. There is evidence for some potential explanations that answer the question why labour demand increased. The given explanation is not exhaustive so there could be other explanation for the increased labour demand.

There is a strong positive correlation between excess labour demand (number of vacancies) and labour volume, in the past 26 years. Furthermore, most of the time changes in the number of vacancies seem to precede changes in labour volume. These two facts underpin the argument that changes in labour demand are primarily responsible for periods of tense or loose labour market states, while changes in labour supply have not been the primary cause for changing states of the labour market for the past 26 years, but rather follow labour demand.

Based on the findings presented in this report it is concluded that the labour market tension in the Netherlands is primarily caused by an increase in the demand for labour. Changes in labour productivity and labour supply do not provide an answer to the current labour tension. However, there are some factors within the labour supply and labour productivity that could have contributed to a tenser labour market (such as the increased sick leave ratio).

If policy makers aim to change the state of the labour market, they can try to influence labour supply, labour productivity or labour demand. Since labour demand is the primary cause of the current and historical periods of labour market tension, it seems logical to try and change or introduce policies that influence labour demand.

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1 INTRODUCTION

Since the fourth quarter of 2021 there are more vacancies than unemployed individuals in the Netherlands (Statistics Netherlands, n.d. A). The difference between the number of vacancies and number of unemployed persons was the largest in the second quarter of 2022, when there were 142 vacancies for every 100 unemployed individuals. In the first quarter of 2023 this ratio is still larger than 1 with 122 vacancies for every 100 unemployed individuals. This is unprecedented since at least 1997. And because of the high unemployment during the 1980s (Statistics Netherlands, 2009), it is highly likely that a shortage of workers as big as is currently the case did not happen in the 1980s . So, the current labour shortage is unmatched in at least 25 years, and very likely even in 50 years.

A natural question to ask is why this unique situation is current reality in the Netherlands, and in this thesis an answer will be sought. The situation where there is an abundance of vacancies relative to the number of unemployed individuals can be called a 'labour shortage', 'a tense labour market' or 'a tight labour market'. The situation where there are more vacancies than unemployed individuals began in 2021 quarter 4 (Statistics Netherlands, n.d. A). This is a year after the beginning of the COVID-19 pandemic and the economic downturn that followed. The COVID-19 crisis undoubtedly affected the economy and the labour market. In the search for an answer what caused the labour shortage to occur the COVID-19 crisis is an important factor.

1.1 PROBLEM STATEMENT

The labour market is a vital part of the economy and directly influences everyone that is dependent on labour as primary source of income. The state of the labour market can be described by the supply for labour and the demand for labour at a particular point in time (Bridgen & Thomas, 2003), and can categorised into three broad categories: a tight labour market, the 'normal' state, and a loose labour market (Ruth, 2012).

A problem in the labour market could occur when the unemployment is high and there is a dearth of open vacancies (a loose labour market). It means that thousands of individuals who wish to work have no access to an income from labour and are in turn dependent on welfare programs or other means to be able to provide for their basic needs. High unemployment is also a problem for governments that need to support the unemployed by welfare programs. There is also the danger of economic slowdown which in the first place can be the cause of high unemployment, but it can become even worst because unemployed individuals can consume less.

In contrast, in a 'tight' labour market, unemployment is low and there are many vacancies open. A direct consequence of a tight labour market is that businesses find it hard to attract new workers. On the other hand, this situation might be beneficial for workers since it is easier to secure a job, and it might even be easier to secure a higher wage. For some central bankers a very low unemployment rate poses a real threat since this could lead to acceleration of inflation due to a wage-price spiral (Phelps, 1967).

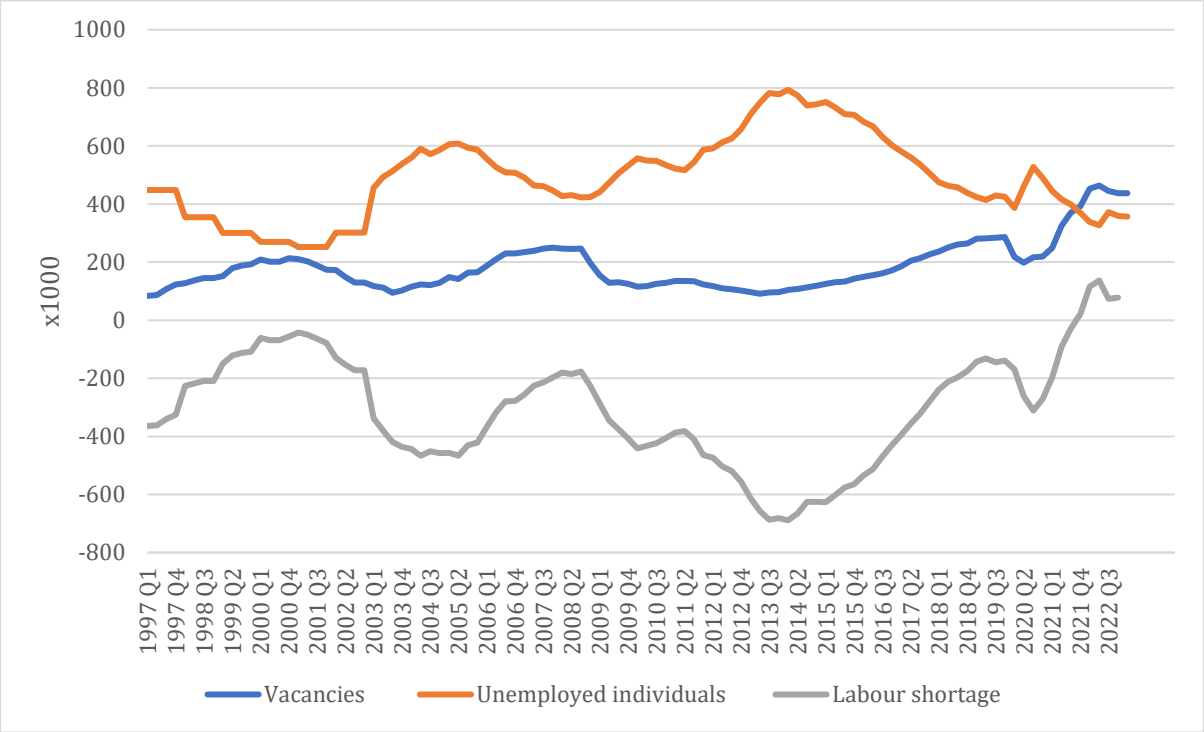
Finally, the labour market could also be in the 'normal' state, which is the average between the two other scenarios. Cases in which both the number of vacancies and unemployment are high or where both the number of vacancies and unemployment are low, are uncommon, as there is a strong negative correlation between the two (see chapter 4 'Labour shortage'). But in case such a situation would occur it can be viewed as an 'average' labour market since supply and demand would match (albeit that this match cannot be materialized, due to some kind of frictions).

Apart from the problems that the current state of the labour market generates (not enough labour for businesses and potentially causing wage-price inflation), it can also create positive effects for workers. The exact unemployment rate and number of vacancies that is desirable is up for discussion and an answer for this will not be proposed in this thesis. It is however still important to know how we did get in this unique situation of 'extreme' labour tightness, since this can help policy makers to steer the labour market into a direction that they desire (independent whether that means that they steer away from a tight labour market or if they do favour a tight labour market). It is for this reason that it is deemed useful to answer the question of why the Dutch labour market is tight in 2021-2023.

1.2 A DESCRIPTION OF THE LABOUR SHORTAGE

In this thesis, the labour shortage is the difference between the number of vacancies and the number of unemployed individuals. In the Netherlands, this labour shortage has been negative since the beginning of the used dataset (1997 Q1) until 2021 Q4. So, for almost two decades there were more unemployed workers than vacancies, hence it can be concluded (with an assumption) that labour supply was generally larger than labour demand (see figure 1.1). The assumptions are that the unemployed would desire to work the same number of hours as the number of hours asked in the vacancies. There are also workers that desire to work more hours than they are currently working, this will make the labour shortage even more negative between 1997 Q1 and 2021 Q4 than depicted in figure 1.1. For the unemployment in the period 1997 to 2003 there were only yearly data available; yearly data are used as approximation for each individual quarter. The quarterly unemployment rate and vacancies are both seasonally adjusted by the CBS.

Figure 1.1
The labour market tension



Data from: Statistics Netherlands and authors calculations
All numbers are seasonally adjusted

1.3 RESEARCH QUESTION

The goal of this thesis is to identify the causes of the labour market tightness in the Netherlands after 2021. To do so, the following research question has been formulated:

RQ: Which factors caused the labour market tightness in the Netherlands after 2021?

This research question is split into a few sub-questions, these sub-questions will each be treated in a separate chapter;

SQ1: *What are found causes in the literature of the labour shortage after 2021 in the Netherlands and other similar countries?* Chapter 2
SQ2: *Which framework can be used to study labour market shortages?* Chapter 3
SQ3: *Did a change in labour supply cause the labour shortage?* Chapter 4
SQ4: *Did a change in labour demand cause the labour shortage?* Chapter 5
SQ5: *How do found causes relate to the historical course of the status of the labour market?* Chapter 6

1.4 RELEVANCE TO MOT

This thesis is written as part of the Management of Technology (MOT) master and the topic should relate to the core of MOT, which is technology in a societal context. The labour market itself is intertwined with society, the current economic system is built upon labour, capital, production and consumption, and the labour market plays a vital role in this system. Technological progress furthermore almost always impacts the labour market, the recent introduction of artificial intelligence software for example soon was followed by a stream of news articles predicting which jobs would disappear and which would still exist in the future. A better understanding of the labour market and especially how a tight labour market is created could in the future give policy makers the ability to compensate for technological progress.

2 LABOUR MARKET TIGHTNESS: A LITERATURE OVERVIEW

In this chapter the literature on how labour markets function and possible causes of the current labour shortage in the Netherlands will be reviewed. Reviewing the current literature will help answer sub-question 1 '*What are found causes in the literature of the labour shortage after 2021 in the Netherlands and other similar countries?*'.

The review will first zoom in on the workings of labour markets in general. Papers describing the labour market in the Netherlands or Europe are favoured. In the second part, the literature review will dig into potential causes for the labour market shortage in the Netherlands. Because the current labour shortage is still very recent and there is not (yet) a vast body of literature on the Dutch economy, papers about the labour market of all the OECD countries will be considered, papers specifically about the Netherlands and Europe are favoured.

2.1 LABOUR MARKETS

The labour market and the way it functions is central for this thesis. In this chapter first a very basic model of the labour markets will be given, then a search will be done to determine which factors impact labour demand and supply.

The labour market is compatible to other markets in the sense that it can be described in terms of a demand side and a supply side. A distinction from other markets is that instead of a good or service, human time is traded. This difference is most pronounced on the supply side and constitutes that humans care about how much their time is worth, and thus make active decisions about how much time they spend working opposed to how much time they spend on leisure. This trade-off between working hours and leisure is central to the neoclassical notion of the labour supply as Cahuc et al. (2014) explain. In addition to leisure and work, household work is also considered by individuals or families. Because of the diminishing marginal returns for all three ways to spend time there exists a balance between work, leisure, and household work in which individual (or household) utility is optimal (Cahuc et al, 2014). Important factors to determine the exact point of maximum utility is the amount of utility that can be subtracted per time unit of activity. For work this can be seen as the wage, for leisure and household work it is the pleasure that is achieved by undertaking the activity or (in the case of household work) by self-consuming the fruits of work. The cost of leisure is furthermore also an important factor.

For the labour demand a distinction is usually made between the short run and long-term labour demand. In the short run, the labour volume is variable, while capital is considered stationary. Firms are considered as profit maximizing organizations and because of this the wage they offer is equal to the marginal rate of productivity when firms operate in a market of perfect competition (Cahuc et al, 2014). In the long run, substitution of capital for labour plays a role and the optimum input of labour and capital is dictated by diminishing marginal returns of both capital and labour. It is assumed that the average firm chooses its labour demand at the point where

substitution of capital for labour or labour for capital no longer increases its returns (Cahuc et al, 2014).

The above description of the labour market is a very brief and simplified version of the neoclassical idea of how the labour market works. The goal of the thesis is to find clues about what caused the labour market tightness, which is essentially a more empirical question than a theoretical exercise. In this sense, it is more important to compare multiple determinants of labour supply and demand than a very detailed description of a labour market model. In the following paragraphs, relevant determinants of labour supply and labour demand are given, and when required, the larger model in which they function is described as well.

The constant elasticity of substitution (CES) production function described by Solow (1956) and Arrow et al. (1961) shows a relation between production, labour, capital, and some constants. Labour demand can be derived from this CES production function, to do so the original CES production function is differentiated with respect to labour to get labour demand. When the CES production function is differentiated with respect to labour and the assumption is made that the marginal rate of productivity is equal to the wage, a function is obtained that describes the labour demand. This function for labour demand can be used to describe labour demand.

Van Ruth (2012) has made a 'tension' gauge for the Dutch labour market, the goal of this tension gauge is to be able to describe the state of the labour market. It does so by analysing multiple variables related to either labour demand or labour supply. The paper by Van Ruth (2012) describes changes in the state of the labour market due to the business cycle and leaves long term trends out of its scope. For labour supply the following indicators are described: Unemployment, ratio jobs/working age population, ratio unemployed/labour force and ratio jobs/labour force. For the demand of labour Van Ruth (2012) uses the following indicators: vacancies, temporary employment, staffing level expectations of different businesses.

2.2 LABOUR SHORTAGE

The Netherlands is not the only country that experiences a labour shortage after 2021. In fact, almost all OECD countries also have a tight labour market (Causa et al, 2022). Since 2021 is very recent there are (yet) few papers published on possible causes for the labour shortage, and unfortunately all of these papers describe other countries than the Netherlands or describe the EU average. However, these papers can provide a basis for some possible explanation for what is happening in the Netherlands especially since all OECD countries had to deal with COVID-19. Causes of the labour shortage related to the pandemic could potentially be generalised to the Netherlands. In this chapter, the literature will be studied in two broad sections, this according to the supply side of the labour market and the demand side of the labour market. Some potential causes could have affected the labour market on both the supply and demand side.

The first suspect of the occurring labour shortage is that a large part of workers might have stopped working because of health-related issues caused by corona. Goda and Soltas (2022) argue that in the U.S. half a million people stopped working directly due to

COVID-19. This is around 0.2 percent of the entire American labour force. Their research further shows that if a worker was ill longer than a week in the past 14 months, the worker is 7 percentage points less likely to still be active in the labour force. That health-related issues play a role in the retreating labour force in the U.S. is further mentioned by (Duval et al, 2022) and (Causa et al, 2022). (Long) COVID-19 might directly play a significant role in the labour market shortage during 2021-2023. Looking at the Netherlands, Ballering et al. (2022) observe that 1 in every 8 COVID-infected persons in the Netherlands has long term health complaints. Around 60% of the population has been exposed to COVID-19 in the Netherlands (RIVM, 2022). Combining these figures means that 7,5% of all persons in the Netherlands have long-term health issues due to COVID-19. However, no reliable information could be found on how many of these individuals stopped working in the Netherlands, but even if it is only a fraction of 7.5% it would concern many Dutch workers. So, even if only a proportion of the 7.5% of Dutch workers who suffer long-term health problems due to COVID-19 can no longer work, , COVID-19 impacted a significant large number of Dutch workers and thus contributed to the current shortage of workers in the Netherlands.

During COVID-19 crisis, many different measures were taken by governments to halt the spread of COVID-19. One of these measures in many countries was the closure of schools for some periods of time. This could be one of the main reasons why caretakers (often women) dropped out of the labour force. Duval et al. (2022) found that this factor explained 15% of the labour supply shortage in the U.S.. Whether this factor also influenced the labour supply in the Netherlands as much as in the US is doubtful. Duval et al. (2022) show that the labour force participation rate of women in the Netherlands remained high after the pandemic.

The labour market is further disrupted by transformative changes. Especially persons who had low paying jobs and who were at the frontlines during the COVID-19 pandemic do not accept the situation any longer and seek for other jobs or have stopped working (Causa et al, 2022). This can induce a labour shortage in two ways, firstly because individual who can afford to stop working can just decide to stop working. Secondly changing from industry requires different schooling and skills, when these skills still must be learned, this can cause temporary unemployment. These structural changes in the labour market where also studied for OECD economies by Duval et al. (2022), who found that COVID-19 could have altered the jobs that workers are seeking for. The workers do not want to work for low-paying, contact-intensive jobs with heightened health risks (because of corona). However, whether these structural changes are really the cause of the labour shortages of the scale at which it is currently present is doubted by Duval et al. (2022) The main reason for this doubt is that the mismatch of workers rose less than during the great financial crisis (in 2008) and is expected to only account for 10% of the labour shortage. They furthermore support this statement by arguing that total unemployment is falling, this means that transformative changes cannot have caused the labour shortage in most OECD countries. The reason for this is that transformative changes would primarily lead to more unemployment (U3) and not necessarily to individuals who drop out of the labour force.

Migration also could have played a part in the labour shortage. Dragoș and Tina (2021) note that migration (to the U.S.) dropped during the pandemic, which consequently may have caused labour shortages in jobs typically done by migrant workers. Duval et al. (2022) also note that migration restrictions could have amplified the labour shortages in OECD countries.

There are also some potential causes of labour shortage that can be attributed to both the supply and demand side of the labour market. A first supply side factor is the increase in house and asset prices during the COVID-19 pandemic (after the initial drop). Duval et al. (2022) note that this could have a reducing impact on labour supply because it allowed workers in the U.K. and U.S. (especially those who can almost retire) to stop working or retire early, this due to an increase in net worth which can be capitalized and used to retire. Duval et al. (2022) note that this effect is probably less important than elders dropping out of the labour force due to COVID-19 induced health issues or health concerns. The increased house and asset prices could also have impacted the demand side of the labour market because homeowners feel richer which can increase their spending.

According to Duval et al. (2022) early articles about the results of COVID19 on the labour market predicted that lower skilled jobs that could easily be digitalized or automated, would disappear. However, this has not happened and vacancies for these jobs increased after the pandemic. It is not clear why more automation has not happened, but the result is that the same amount of work as before the pandemic must be done manually. So, it was expected that more work done in ICT and automation would replace work done manually, but although more work has been done in the ICT sector the replacement of manual labour has stayed out (Causa et al, 2022). This could have led to more workers demand since on top of the unchanged manual labour force the 'ICT' labour force increased.

Looking at the demand side of the labour market a few possible causes have been found in the literature. The first demand side cause is that the extensive COVID-19 support packages could have caused the labour shortages. According to Duval et al. (2022), in countries that had these COVID-19 support packages labour shortages increased sharply. Pizzinelli and Shibata (2023) argue that the support packages probably did not cause the labour tightness, because after they were stopped, the labour tightness remained. Expansionary policy and support packages seem to play an important role, because they prevented an immediate recession, which probably would have resulted in a fall of labour demand. It also provided businesses and consumers with enough money to keep buying products to keep aggregate demand up. Potentially the support packages where even a bit much by providing too much credit and generating a wealth illusion which gave an incentive to spend more.

During COVID-19 many countries had lockdowns that caused a drop in export capacity. Especially China, a huge exporting country, has had several strict lockdowns which were in place far longer than in most Western countries. Bonadio et al. (2021) argues that when countries are in a severe lockdown (relative to other countries) they will export less (due to supply chain disruptions). When China, one of the world's largest exporters,

has severe lockdowns and reduced exports, the rest of the world was forced to buy their needed products elsewhere. This could lead to more labour demand in the rest of the world.

2.3 CONCLUDING REMARKS LITERATURE REVIEW

The following question was central while writing this chapter: *What are found causes in the literature of the labour shortage after 2021 in the Netherlands and other similar countries?* The following causes are found that could have led to the labour shortage: a lower labour force participation rate due to COVID-19 related health issues, fiscal stimulus, migration changes, a (nominal) wealth gain, changes in desired type of work and increased export. Some of these found causes suggest that the supply of labour is responsible for the current labour market tension, while other found potential causes of the labour market tension point to an increased labour demand. In order to find the cause of the labour market tension in the Netherlands empirical data about the drivers behind the Dutch labour market have to be studied, the following chapter will present a model in which these different drivers will be presented. Literature about the labour shortage occurring after the COVID-19 pandemic proposed different explanations. Most of these articles describe the labour shortage in the U.S., U.K., and OECD in general.

Apart from potential causes of the current labour shortage, the functioning of labour market in general is also touched upon. The labour market can be studied by looking at the demand side and supply side of labour. For the labour supply the most important measurements that can be used are the number of hours that are worked in the economy. The labour demand can be studied by looking at a variety of different measurements and by considering economic models such as the CES production function. Most important measurements are the total number of vacancies, GDP growth, wage growth and inflation.

3 METHODOLOGY

In the previous chapter existing literature about labour markets and about the state of labour markets after COVID-19 have been summarized. This chapter will build further on those findings by presenting a framework which can be used to analyse the recent developments in the labour market in the Netherlands (during 2021-2023). This is done by answering sub-question 2 '*Which framework can be used to study labour market shortages?*'. Furthermore, the data collection process and the method of analysis are described.

3.1 LABOUR MARKET FRAMEWORK

The labour market in the Netherlands can be analysed by looking at the three direct drivers of the labour market; labour supply, labour demand and labour productivity.

In an economy, the total labour supply is represented by the total number of labour hours worked by employees plus the total number of unemployed hours. The number of unemployed hours is the summation of all hours that the total labour force (employed + unemployed individuals) desires to work on top of the number of hours they already work. The total labour supply can be written as below, see equation 3.1. All units are in hours and apply in a certain period (e.g., a month, quarter, or year).

$$Labour\ supply\ (LS) = worked\ hours\ (Wh) + unemployed\ hours\ (Uh) \qquad eq\ 3.1$$

Labour demand is represented by the total number of hours that are worked by employees within the Netherlands plus the hours of work that is not fulfilled by the labour market but is desired by companies; the latter is called 'unfulfilled work' in this thesis. The total number of hours worked is the same as in the equation for labour supply. The unfulfilled work is measured by multiplying the number of vacancies and the average workload in hours.

$$Labour\ demand\ (LD) = worked\ hours\ (Wh) + unfulfilled\ work\ (Fw)) \qquad eq\ 3.2$$

In a perfect world, labour demand and labour supply would match, and unemployment and unfulfilled work would both be zero. A gap between labour demand and supply is almost always present, for example because of frictional unemployment (i.e., at any moment in time, there are workers who are unemployed because they are in-between a change of jobs or have finished their education and are looking for their first job). The difference between labour demand and labour supply is the labour shortage and is described by equation 3.3.

$$Labour\ shortage\ (LH) = LD - LS = Wh + Uh\ - Wh\ - Fw\ =\ Uh - Fw \qquad eq\ 3.3$$

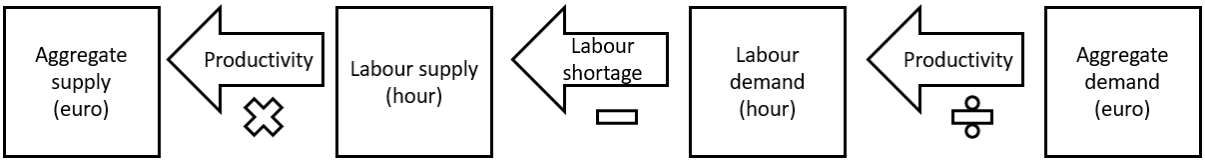
Based on this general framework more refined models for the labour supply and labour demand can be created. These more refined models will later be used to study the labour market.

Labour supply (in hours of labour) can be multiplied by the productivity (in euros of produced products per hour of labour), this gives the supply of goods and services in euros. The labour demand can be seen as the aggregate demand for goods and services

divided by the productivity. in figure 3.1 the relationship between aggregate demand, aggregate supply and the labour market is depicted.

Figure 3.1

Simplified overview of the labour market and its relation to aggragte demand and aggregate supply



Not that figure 3.1 depicts a simplified version to indicate the relationship between aggregate demand and aggregate supply through the labour market, which in turn explains that changes in aggregate demand or productivity can influence the labour market. However, figure 3.1 is not very detailed, unemployment and vacancies are for example ignored (but could be added to create a more accurate but also more complex figure).

3.1.1 Labour supply framework

The equation for labour supply (equation 3.1) can be decomposed into the following determinants of labour supply, this creates the identity formulated in equation 3.4.

*Wh = P [15-75] * ((number of workers) / P[15-75]) * (Wh / (number of workers))*

*= P [15-75] * LFPR.n * WL.n* *eq 3.4*

With;

Wh = the total amount of hours that is worked in the economy

P[15-75] = population aged between 15 and 75

LFPR.n = net labour force participation rate, which is the ratio between the number of workers and the population between 15-75 ((number of workers) / population[15-75]).

WL.n = net workload, describes the average number of hours worked by workers (total hours worked / (number of workers)).

The three determinants of equation 3.4; population, labour force participation rate and workload, can be broken down even further. Giving the following three equations:

$$P[15-75] = P.tot - P[0-15] - P[75->] \quad \textit{eq 3.5}$$

$$LFPR.n = LFPR.g - U3 \quad \textit{eq 3.6}$$

$$WL.n = WL.g * (1 - SL) \quad \textit{eq 3.7}$$

With;
P.tot = total population in the Netherlands
P[0-15] = population aged between 0 and 15
P[75->] = population aged 75 or older

LFPR.g = gross labour force participation rate, the ratio between the labour force and the population between 15 and 75 years old.
U3 = unemployment rate (the definition used is U3, which does not count labourers marginally attached to the labour force)

WL.g = gross workload, the average amount of hours worked excluding sick leave
SL = sick leave ratio, the percentage that a worker in unavailable for work due to sick leave

This decomposition labour supply can be used to see which specific changes in variables has led to the aggregate change in labour supply. Understanding which specific variable caused the overall change can subsequently give insights in the cause of a change in labour supply.

3.1.2 Labour demand framework

Turning to labour demand, equation 3.2 states that labour demand equals the number of hours worked plus the number of work hours demanded by firms that is not fulfilled. The question is what drives the number of hours that is worked and number of hours that is demanded but unfulfilled. Figure 3.1 has already given one potential driver of labour demand, which is aggregate demand. To further investigate possible drivers of labour demand, we can make use of standard (neoclassical) labour demand functions, such as the following one (which is based on a Constant-Elasticity-of-Substitution production function):

$$L^D = \theta\, y\, (\frac{w}{p})^{-\sigma} \qquad \textit{eq 3.8}$$

(Hamermesh, 1993)

where L^D = labour demand;
y = real GDP;
w = the nominal wage;
p = the general price level;
θ = a constant term;
σ = the elasticity of capital-labour substitution.

This equation states that labour demand will rise in response to an increase in real GDP (scale effect) and decline in response to an increase in the real wage (substitution effect).

3.2 THESIS STRUCTURE

In the following chapters the above framework will be used to determine which factors attributed to the labour market tightness. Because the framework for labour supply is an identity al separate factors combined must, by definition, include all aspects of labour supply (note that this does not guarantee that the subdivision is made small enough that every hypothesis can be tested). First the labour supply side will be analysed, the following aspects of labour supply will be studied in order to answer sub-question 3 '*Did a change in labour supply cause the labour shortage?*':

- Did the labour population (P[15-75]) decrease in size?
    - How did the total population change?
    - How did the green and grey populations change?
- Did the net labour force participation rate change?
    - Did the gross labour force participation change?
    - Did the unemployment change?
- Did the net average workload change?
    - Did the gross average workload change?
    - Did the sick leave ratio change?
- Did the labour supply as a whole change?

There is one other factor that is closely related to labour supply and that is labour productivity. If the number of hour labour supplied stays that same but the productivity rises, more labour demand can be met. The productivity will be analysed at the end of chapter 4.

After having examined the labour supply side the labour demand side will be examined. For the labour demand side there is no identity developed in chapter 3.1, instead the labour demand side will be studied by analysing different variables that are thought to have a relation with labour demand, this is done in order to answer sub-question 4 '*Did a change in labour demand cause the labour shortage?*'. These variables are:

- Does the CES production function predict a tight labour market?
    - Did GDP growth increase labour demand?
    - Did a change in price level change demand?
    - Did a change in wage influence labour demand?
- Did public and government spending change?
    - What are possible explanations for these changes?
- Did demand for exports change?
- Was there an autonomous shock in labour demand by companies?
- Did demand for 'public' services change?

3.3 DATA COLLECTION AND ANALYSIS

The data that are used is provided by Statistics Netherlands (SN) which is inside the Netherlands also known as the Central Bureau of Statistics (CBS). The data for labour supply are analysed by comparing the change of labour supply over time with the changes over time of its determinants. After having determined which variables are responsible for changes in the overall labour supply the proportional contribution to the overall change will be calculated for each variable. In the case of the labour demand first the overall change will be established in order to determine whether a change in labour demand might be responsible for the

3.3.1 COVID-19

COVID-19 was a significant event that could have impacted the labour market and be one of the reasons for the current labour shortage. Because of the impact that COVID-19 has had on almost every statistic used in this thesis comparisons over time are always done by using a datapoint that happened (right) before the COVID-19 pandemic, while the other datapoint in time is taken as recent as possible, this to limit the very short term impact of COVID-19 on the calculations. It is furthermore important to know exactly when COVID-19 started to become an important factor in the Netherlands. In the Netherlands the first registered COVID-19 infection was at February the 27th. At March the 23rd the so called 'intelligent lockdown' was called into life, thereby putting restrictions on the personal and professional life of individuals (Ministerie van Algemene Zaken, 2023). The exact time and date that the COVID-19 pandemic started to affect the Dutch economy is hard to determine. It is possible such a hard boundary does not even exist, and a more gradual change from speculation on the stock market to failing businesses might be more plausible. In this research the exact day of COVID-19 started to have a notable effect is not that important since, to a large extend, quarterly data is used. The effects of COVID-19 are expected to show up in the data from 2020 Q2 (from April 2020 onwards) with a slight possibility that it already influences the data from Q1.

3.4 CONCLUDING REMARKS METHODOLOGY

Central to writing this chapter was the question: *Which framework can be used to study labour market shortages?* In conclusion we will analyse the labour market by analysing the supply of labour and the demand for labour, the difference between the two is defined as the labour shortage. In addition, the labour productivity will be used since this is a key figure that needs to be taken into account when analysing the labour market. Labour supply will be split up into different components in order to get a more detailed view of why the aggregate labour supply has changed (if it did indeed change). For labour demand the CES production function will be used. The thesis will first look at the labour supply side and then at the demand for labour. The type of analysis that will be done is in the form of a quantitative data analysis, and most of the data that is used stems from Statistics Netherlands (CBS in Dutch). Lastly it is identified that COVID-19 did have a significant effect on the data, it is for this reason that when comparing data from right before COVID-19 will be compared to data points that happened as far away as possible from COVID-19 (so the most recent data).

4 LABOUR SUPPLY

In this chapter sub-question 3 *'Did a change in labour supply cause the labour shortage?'* will sought to be answered. Since a potential cause for the tension in the labour market is that the amount of supplied labour in the Netherlands has decreased. To find an answer to the sub question 3 the total number of hours that has been worked in the Netherlands is the most important figure. If the number of hours worked in the economy has risen, a lack is labour supply is not a plausible answer for the current labour shortage. Apart from this key parameter there are several other tentative reasons for why a decrease in supplied labour may have occurred after 2021, some of which are identified in the literature overview.

The first potential reason is that COVID-19 has increased the sick leave ratio. This because more individuals are getting directly sick by COVID-19, because individuals are more careful when getting sick and stay home earlier than in pre-pandemic times, or because individuals are affected by long COVID. To test whether this hypothesis is true the sick leave ratio will be analysed. The effect of a change in the sick leave ratio will be compared to the change in the total number of hours that have been worked in the Netherlands.

The second potential reason why the supply of labour has decreased is due to changing demographics, since the Netherlands is an aging economy the demographic could have a negative impact on labour supply. That the change in demographics would play an important role at the moment is because of the 'baby boom' generation. The baby boom happened in the period after the second world war (after 1945), since 2010 (when the first 'baby boomers' turned 65) this generation has gained the right to them retire welfare program and as a result a relatively large number of workers has retired for the last 13 years. Not unimportant there are a lot of individuals that still work after they have reached their age of retirement.

The third potential labour supply issue is that part time work has gained popularity in the Netherlands. This could have a serious effect on the number of hours that are worked on average by a worker.

All above informal hypothesis will be tested using the framework provided in chapter 3. But first we will look at the total number of hours that is worked in the Netherlands (called the labour volume) for each quarter for the past years. This is the most important step because for each of the individual hypothesis above applies that in order to have caused the labour shortage it not only has to be noticeable in the data, but it should also have had a large enough impact to decrease the total labour supply. The labour volume will furthermore be divided into separate factors to see whether each of the separate hypothesis did at least have some impact on the labour market.

Usage of the framework as described in chapter 3 has the additional advantaged that it could reveal causes of labour shortage that have not been identified beforehand. It is also a complete description of the labour supply as a whole; this is because it is an identity so all possible hypothesis that would impact the total hours that are worked in the Dutch economy will be visible. The limitation however is that there is no guarantee

that equation 3.4 is separated in enough variables to see the exact cause of some unknown cause of the labour shortage, we can only see its effects on a higher aggregated level (but at least we will know that there is some unknown cause).

There are two other variables that are related to labour supply that will be studied in this chapter. The first variable is the unemployment. If the unemployment falls because unemployed individuals decide to stop looking for work the labour supply decreases. It will be analysis whether the unemployment declined, and whether this decline can be attributed to individuals who dropped out of the labour force or whether this decline was simply because unemployed individuals found a job.

The second important variable is the labour productivity. A change in the labour productivity might have an impact because when the number of worked hours has remained the same, but the productivity decreased, a labour shortage could be formed. A plausible scenario for this could be that working from home has decreased efficiency significantly. Another scenario could be that we are starting to see the effects of increasing administration pressures, where more and more time of workers is consumed by filling in administration instead of performing their core tasks.

These two other variables will be studied at the end oof this chapter, this because they are not represented by the identity used to study the other variables.

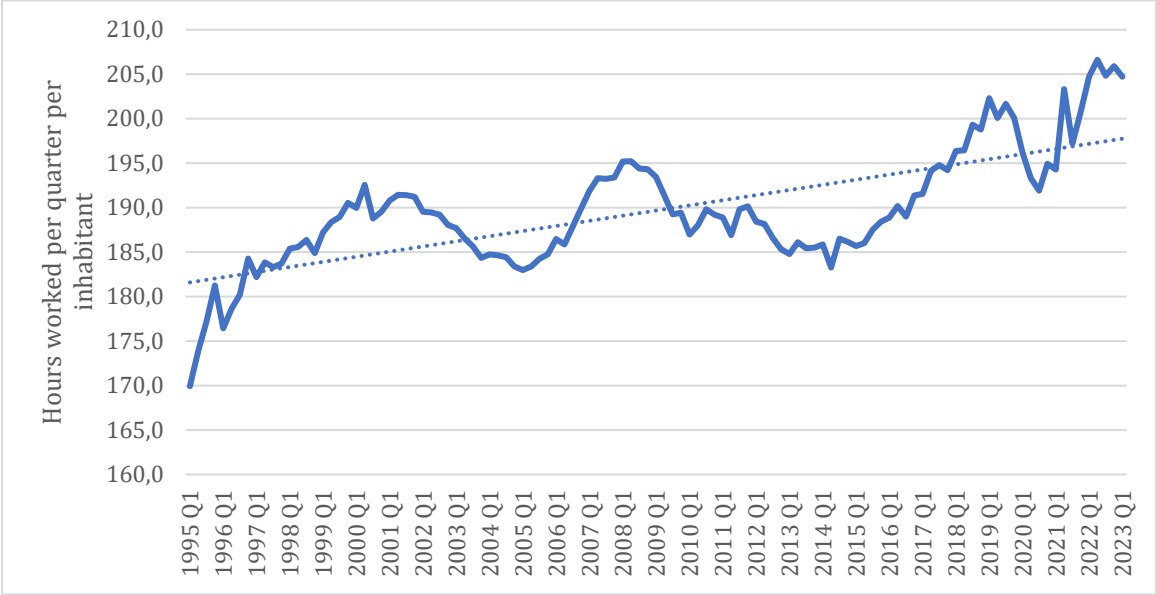
The conclusion of this chapter will give answer to the question whether the labour supply side could have caused the current labour shortage. It will furthermore sum all significant changes in the labour supply side that have caused the current supply of labour in the labour market.

4.1 WORKED HOURS

The total labour supply is formed by labour that is actually supplied and work that (potential) workers desire to supply (mostly unemployed individuals and workers that want to work more hours). The labour that is actually supplied is often called the labour volume. If a dip in the supplied labour is the cause of the current labour shortage, we would expect to see a decline in the total labour volume. First a graph will be presented that shows the developments of the labour volume over time, then the change from the labour volume from 2019 Q4 until 2022 Q4 will be calculated. For the labour volume the proportional change caused by each individual component of labour volume will be calculated (the components being: working population, labour force participation rate and average workload). In appendix A the mathematical calculation that is done in order to get the proportional change of the components is shown.

For the total number of hours that is worked, data from the CBS is used. The measure for total worked hours by the CBS aims to only count hours that are actually worked, it does so by looking at the total number of hours that have been paid out by companies (the contract hours plus paid overtime). This figure is then corrected by adding unpaid overtime and by subtracting hours that have been paid but where no work has been done (such as sick leave or sikes). The hours worked by self-employed is determined by looking at the self-reported hours by the self-employed. The hours are seasonally adjusted.

Figure 4.1
Labour volume



Data from: Statistics Netherlands and authors calculations
Numbers are seasonally adjusted

Figure 4.1 shows the number of hours that have been worked in the Netherlands. The labour volume has on average been increasing for the duration of the dataset. From 2019 Q4 the labour volume has deceased until 2020 Q3, this happened during the beginning of the COVID-19 pandemic. The labour volume increased again after 2020 Q3 and is currently at an all-time high.

The proportional changes of the three components with respect to the total labour volume are given in table 4.1. The table shows the absolute values and then the proportional change that each component of labour volume has had on the total labour volume between 2019 Q4 (right before COVID-19) and 2022 Q4 (the latest acquired datapoint). It also shows how much the total labour volume changed in the same period.

Table 4.1
Change and contribution to change of components of labour volume

	2019 Q4	**2022 Q4**	**Change (%)**	**Proportional change (%)**
H	3486000000	3657000000	4,91	
P[15-75]	13209013	13422119	1,61	1,76
LFPR.n	78,3 %	80,5 %	2,78	2,95
WL.n	360,3	357,1	-0,88	-0,94

Data from: Statistics Netherlands and authors calculations

Table 4.1 depicts that the total number of hours worked in the Dutch economy has risen by 4,9% from which most can be attributed to a change in the nett labour force participation rate. The rise in worker population attributes for about 1.8 percentage

points to the change in labour volume. The workload deceased with 0,9 % points resulting in some downwards pressure on the labour volume.

The fact that the labour volume is currently at an all-time high suggest that the labour shortage is not because there is a shortage of labour. Labour volume is not the same as the total labour supply, since it does not include unemployed and underemployed (workers that want to work more) individuals, the labour volume is however by far the most prominent factor of total labour supply. To give an idea the CBS (2023) reported that in 2023 Q1 there are 9,7 million workers, 0,4 million unemployed and 0,5 million underemployed individuals. The unemployment will be analysed further on in this chapter, but for now the prudent conclusion can be made that a change in labour supply did not cause the tension in the labour market that occurred after 2021.

4.2 COMPONENTS OF LABOUR VOLUME

So, the total labour volume increased during the period of 2019 Q4 - 2022 Q4. But why did the total labour volume increase and are there also factors that limited this increasing labour supply? To answer this question, the separate components that make up the total labour volume will be studied. These components of labour volume are described in the methodology chapter, but to iterate these components and the subcomponents that makeup the components of labour volume are:

- Working population (aged 15 - 75)
    - Total population
    - Green population (aged 0 - 15)
    - Grey population (aged 75->)
- Net labour force participation rate
    - Gross labour force participation rate
    - Unemployment (U3)
- Net workload
    - Gross workload
    - Sick leave ratio

4.2.1 Working population

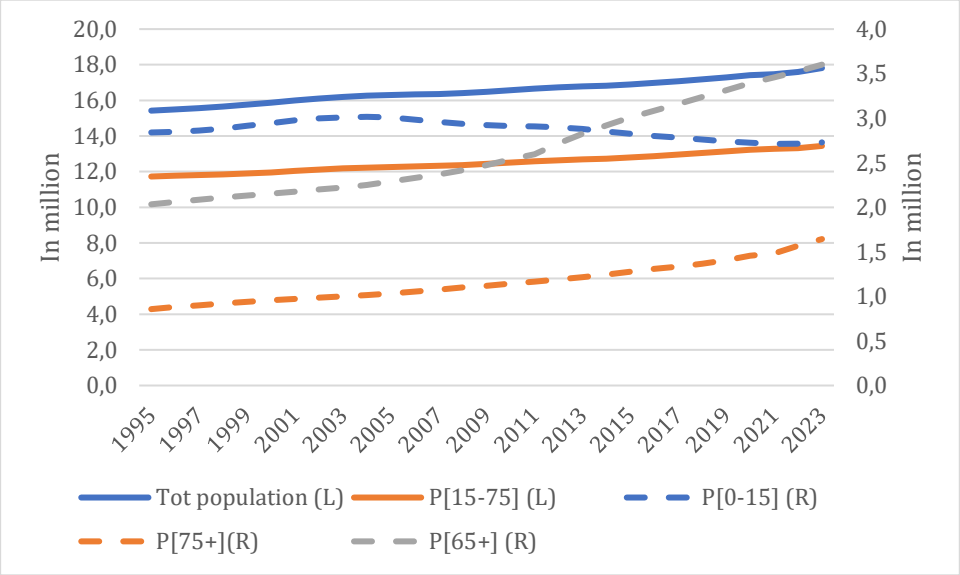
The total number of hours worked in an economy is partially determined by the total population and its demographic composition (the number of people aged 15-75, in particular). The definition for the 'working population' used in the identity (equation 3.4) is the population aged between 15 and 75 years, the rationale behind grouping these particular ages together (which is arguably an arbitrary choice) is that it is the same age group that the CBS uses as definition for the labour force participation rate. To generate a more complete picture the number of persons aged between 15 and 65 years will be investigated as well as the number of individuals aged between 15 and the (moving) age of retirement. Changes in this worker group can be either caused by a change in total population or a change in demographic composition (thus changing the non-working population), equation 4.1 shows this relation.

P[worker] = P[total] – P[non-worker] eq 4.1

Figure 4.2 gives an overview of the total population, worker population, and non-working population. The total population has been rising and the worker population has also been rising albeit at a slower pace. The population older than 65 and older than 75 has increased, while the non-working population age below 15 has slightly decreased.

Figure 4.2

Size of population groups



Data from: Statistics Netherlands and authors calculations
(L) demarks left axis, (R) demarks right axis

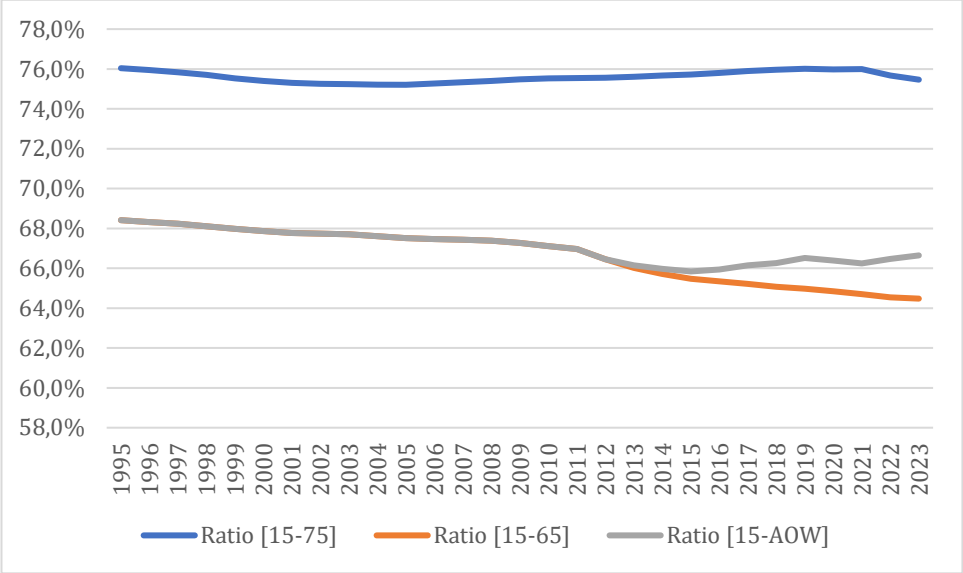
From figure 4.2 it can be concluded that the deficit in the number of workers due to a demographic change is unlikely. This because there are more individuals aged between 15 and 75 than there where before 2021. Figure 4.2 also shows that the group of individuals older than 65 and the group of individuals older than 75 are becoming larger, this could negatively affect the labour supply because older individuals tent to have a lower labour force participation rate and tent to be sick more often. Whether above hypothesis indeed have a significant effect on the labour volume can be seen in the following sub-chapter about the labour force participation rate and about the average workload (which includes the sick leave ratio).

Figure 4.3 (below) gives an overview of the ratios between different definitions of 'worker population' and the total population. In terms of working age proportional to the whole population the narrow definition of worker population ([15-65]) is on a decline since the beginning of the dataset. This decline has accelerated after 2011, a possible cause for this acceleration is the so-called baby boom generation started to surpass the age of 65. In broader definition of worker population (15-75) this decline can be seen from 2021 (exactly 10 years later), again probably due to the baby boom generation surpassing the age of 75. A final definition of the worker population considers the changes made to the age at which individuals have the right to receive state pension (called the Algemene Ouderdoms Wet [AOW] in the Netherlands). Following this definition, the worker population [15-AOW] has stopped decreasing since 2013. Note that all these different theoretical notions of worker population do not

necessarily tell whether more individuals are actually working, only that an age group has been increasing or decreasing in number with respect to the total population size.

Figure 4.3

Worker to population ratios



Data from: Statistics Netherlands and authors calculations

From figure 4.3 it can be concluded that more and more individuals fall outside the two static worker population age categories. The moving age of retirement seems to work in terms that it keeps the ratio between workers and non-working age groups the stable or even increases the worker group relative to total population.

Table 4.2 shows the proportional contribution of the different factors to the working population, the worker population growth is 1,65% in total. It can be seen that the working population did increase in size, but that this is because the population as a whole grew enough. In the table it is clear that the age group older than 75 is growing rapid, while the age group younger than 15 is stagnating.

Table 4.2

Change and contribution to change of (components of) population

	2020 Jan 1	**2023 Jan 1**	**Change (%)**	**Proportional change (%)**
P[15-75]	13226198	13444550	1,65	
P[0-15]	2726099	2727573	0,05	0,01
P[75->]	1455288	1643385	12,93	1,08
P total	17407585	17815508	2,34	1,25

Data from: Statistics Netherlands and authors calculations

In conclusion the working population (aged between 15 and 75) has increased, making it unplausible that the ageing of the population is responsible for the current lack in labour supply and thereby causing the current tension on the labour market. The number of individuals between 15 and the moving AOW age (between 65 and 67) has

risen slowly during since 2015, making it even more unplausible that there is a shortage of workers due to an ageing population.

4.2.2 Labour force participation rate

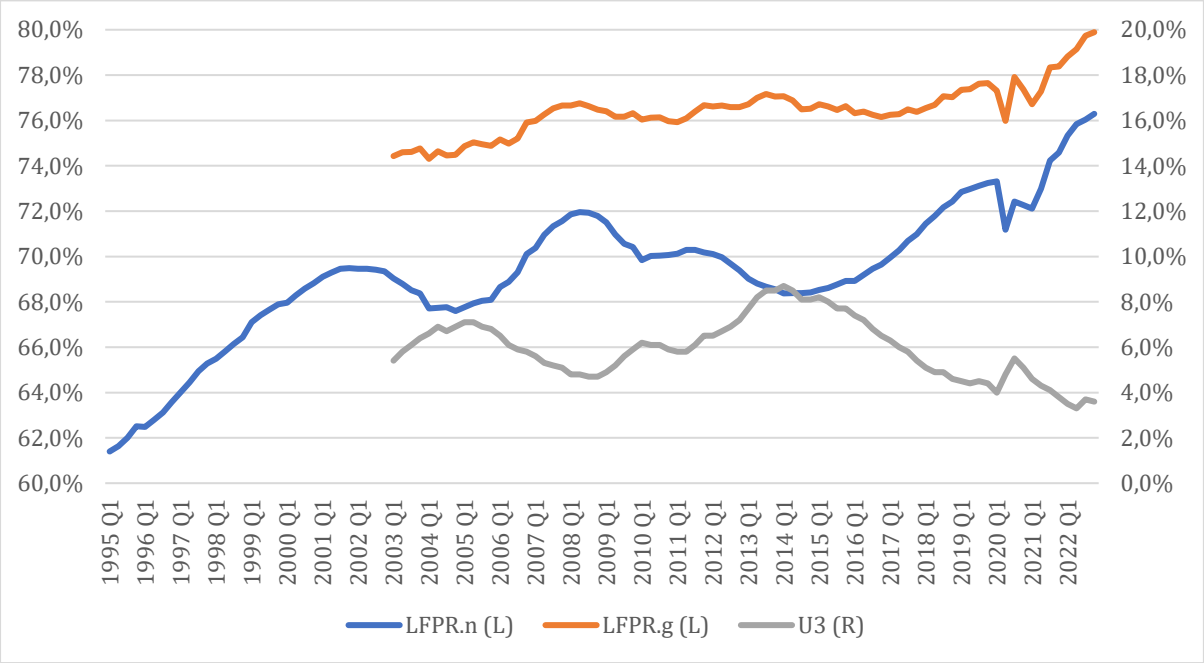
To know how much of the working population (aged between 15 and 75) is actually working we must consider the labour force participation rate (LFPR). By studying this figure it can be seen whether a shortage of labour supply is caused by a drop in the number of people that is actually working. Examples of causes that could have had an impact on the LFPR could be young individuals who study longer due to COVID-19 delays, elders that retire early, a drop in elders that work after the lawful age of retirement or because individuals dropped from the labour force due to (perceived) COVID-19 risks or permanent sickness (sicknesses that are not long term are considered in the parameter 'workload', discussed next sub-chapter). For all these possible causes to have actually caused the labour shortage, it must be true that the labour force participation rate as a whole has dropped.

The gross LFPR is acquired by dividing the number of individuals who are working by the total worker population size. The worker population size will be defined as all citizens aged 15 to 75. Individuals who are working but do not fall into the age category of 15 – 75 will still be count as workers (so theoretically a LFPR of more than 100% can be reached). For the number of workers, the definition of the CBS is used, this includes employers, self-employed, individuals who only do legal undeclared work, individuals who are on a payroll but currently do not carry out work or workers who are on unpaid leave.

A distinction will be made between the gross LFPR (denotated by LFPR.g) and the net LFPR (denotated by LFPR.n), the difference between the two is the unemployment rate (U3). The LFPR.n excludes unemployed individuals from the numerator while the LFPR.g includes unemployed individuals in the numerator.

Figure 4.4

Labour force participation rates and unemployment rate



Data from: Statistics Netherlands and authors calculations
(L) demarks left axis, (R) demarks right axis, All numbers are seasonally adjusted

During the COVID-19 pandemic the unemployment and the net LFPR changed (and therefore by definition also the gross LFPR). The unemployment rose from 2020 Q1 (when it was at the lowest point at that time inside the dataset) until 2020 Q4. After this increase the unemployment fell again, this time to a new lowest point of 3,3%. Interestingly the gross LFPR is at its highest point during this dataset, apparently there has been an increase in individuals seeking for work or working (total number of workers + the unemployed) while the unemployment simultaneously dropped. This can be seen in the net LFPR which is also at an all-time high of 80%. This high labour force participation rate is even more impressive when considering that to calculate the LFPR the total population of 15-75 is used, while the age at which state pension becomes available in the Netherlands is 66 and 10 months in 2023 (Ministerie van Algemene Zaken, 2023b).

The changes of the components that make up the net LFPR and the extend in which to contribute to a change the net LFPR are shown in table 4.3. First the change of net LFPR is shown, then it is shown how much the gross labour force participation growth and unemployment contributed to the change of net labour force participation rate.

It can be seen that the change in the nett labour force participation rate is caused by a decreasing unemployment (note that the U3 in the table has been inversed) and a simultaneously increase in the gross labour force participation rate. In other words, less individuals willing to work are without work, while simultaneously relative more people (aged between 15 and 75) desire to work. Both of these factors contribute to upwards pressure in the supply of labour.

Table 4.3

Change and contribution to change of (components of) the labour force participation rate

	2019 Q4	2022 Q4	Change (%)	Proportional change
LFPR.n	55,6%	57,5%	3,46	
LFPR.g	60,7%	61,7%	1,74	1,90
U3	5,1%	4,2%	-17,16	1,56

Data from: Statistics Netherlands and authors calculations

In conclusion the labour force participation rate is at a historically high level, resulting in an upwards potential for the labour supply. It is not possible that a decline in labour participation rate caused tensions in the labour market since the LFPR increased. Even with the fall in unemployment the gross labour force participation rate still increased, this means that the unemployment fell because more unemployed individuals found a job, instead of unemployed individuals becoming discouraged workers.

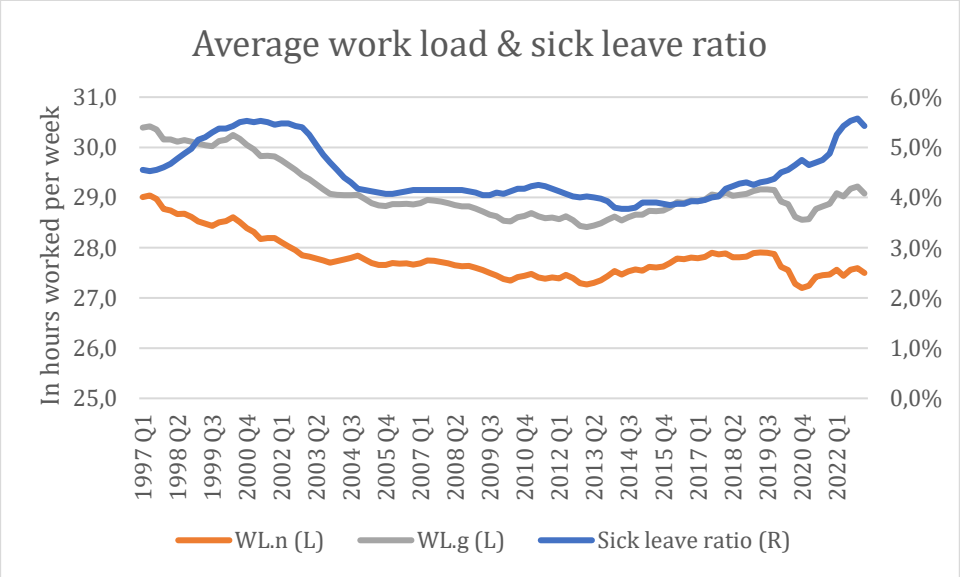
4.2.3 Workload

The workload is defined as the average actual number of hours worked by the average working individual. To determine this figure the actual total number of hours that are worked are divided by the total number of workers.

The actual average number of hours that is worked (in this thesis labelled net workload) can be spilt into the sick leave ratio and the number of hours that that is not compensated for sick leave (labelled gross workload). The gross workload is similar to the workload depicted in the worker's contract, but without compensating for overwork or other factors that can influence the difference in actual number of hours worked and contracted hours.

Figure 4.5

Average workload and sick leave ratio



Data from: Statistics Netherlands and authors calculations

(L) demarks left axis, (R) demarks right axis, all numbers are rolling averages

In the graph the average number of hours worked per week and the average sick leave ratio are used. The data points are on a yearly interval, this due the seasonally behaviour of the sick leave and workload which makes the graph difficult to interpreted when displayed on a quarterly interval.

The graph shows that during 2020, when the COVID-19 pandemic became a factor in the Netherlands, the workload decreased sharply. The sick leave was already increasing and increased more between 2021 and 2022 than it increased between 2020 and 2021. It would be interesting to study whether this is because of long COVID-19, since long term sicknesses have a higher impact on the sick leave ratio than short term illness (52 individuals must be sick for a week per year to have the same impact as 1 person who cannot work for a year). At the moment the gross workload is at roughly the same level as it was before COVID-19, due to the increased sick leave ratio the net workload is still below that of pre-pandemic levels. The average workload in the Netherlands has declined since the beginning of this dataset.

The proportional change that the components of the net workload attributed to the net workload is depicted in table 4.4. The negative change in the nett workload is caused by an increasing sick leave. The gross workload (a proxy for the number of hours that workers work as depicted int their contract) increased slightly, giving a small upwards pressure for the nett workload.

Table 4.4

Change and contribution to change of (components of) the workload

	2019 Q4	**2022 Q4**	**Change (%)**	**Proportional change (%)**
WL.n	360,3	357,1	-0,88	
WL.g	377,3	378,3	0,27	0,27
A (= 1 – SL)	95,5%	94,4%	-1.15	-1,15

Data from: Statistics Netherlands and authors calculations

In conclusion the net workload did decrease during the COVID-19 pandemic. This is due to the increasing sick leave ratio, the number of hours worked if the sick leave ratio is not considered has remained quite constant. The decrease in net workload could have attributed to a decrease in labour supply. And has had a negative effect on the total hours worked in the Dutch economy.

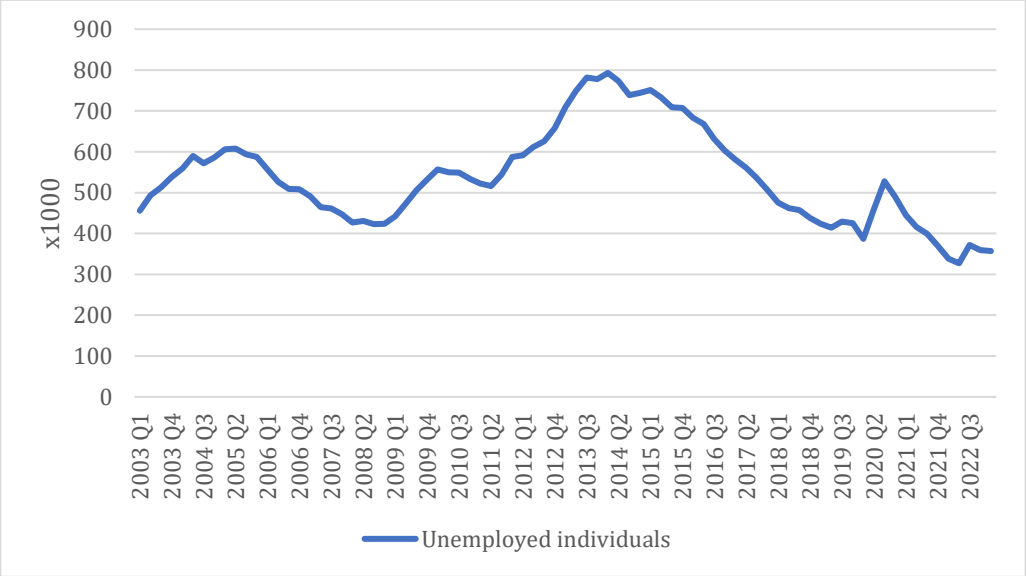
4.3 UNEMPLOYMENT

As mentioned at the beginning of this chapter the labour supply is the sum of labour volume and unfulfilled work. The unemployment is deemed the most important factor of unfulfilled work. But the unemployment does not show the whole picture of the labour supply. This is because it shows the number of unemployed individuals but not the total number of hours that the unemployed individuals would desire to work. Furthermore, it does not show individuals who are working but who would desire to work more hours.

The number unemployed individual in the Netherlands is depicted in figure 4.6. The number of unemployed individuals is at the lowest level since the beginning of the dataset. In 2020 Q1 the unemployment was for at that time the lowest it has been since 2003. The unemployment spiked in 2020 Q2 during the COVID-19 pandemic, but in 2021 Q3 it was again at same low level as before COVID-19. It is furthermore interesting to see that even during the highest peak in the COVID-19 pandemic the unemployment was historically speaking still low. Another trend that is noticed is that the unemployment has been on decline since 2014 (apart from the first year of COVID-19).

Figure 4.6

Unemployment



Data from: Statistics Netherlands and authors calculations
Numbers are seasonally adjusted

In the previous sub-chapters of this chapter it is shown that the labour volume did not decrease, but rather increased. And, that therefore total labour supply probably also increased, the only thing missing in the puzzle was whether the unemployment rate increased in such a significant way that the increase in labour volume was counteracted, resulting in a decrease in total labour supply. Figure 4.6 shows without a doubt that unemployment rate between after 2020 Q3 decreased, and therefore cannot be the reasons of a shortage of workers. Note that (as is explained in 4.2.2.) that the decline in

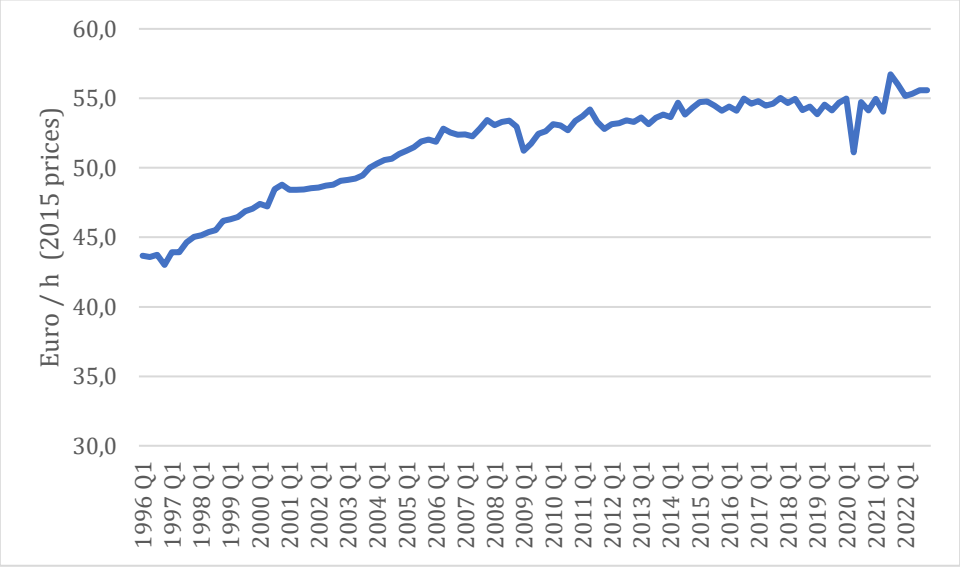
unemployment is due to unemployed individuals that have found a job, and not due to an increase in the number of discouraged or non-workers.

4.4 LABOUR PRODUCTIVITY

The labour productivity is an important factor in the labour market. When there is a sudden change in the productivity demand for workers might increase or decrease. An increase in the productivity for example might lead to less demand for workers (since the same amount of work can be done with less workers), and the opposite could also happen. During COVID-19 the labour productivity could have dropped due to a variety of reasons, including: travel restrictions, labour delays due to sickness, supply chain issues, working from home, etc. A drop in productivity could have led to more labour demand when the same number of services and products are desired, this because there are more workers needed in order to get the same amount of work done. IN figure 4.7 the labour productivity is depicted from 1996 until 2022, the labour productivity is defined as total GDP divided by the labour volume.

Figure 4.7

Labour productivity



Data from: Statistics Netherlands and authors calculations
Numbers are seasonally adjusted

Figure 4.7 shows that the productivity fell in the second quarter of 2020, just when the COVID-19 pandemic started to affect the Netherlands. Interestingly this dip was short lived, and the productivity was up again in the third quarter of 2020. A year later the productivity peaked. The productivity is as of 2023 still a little higher than it was before 2020 Q1. In the longer term it is interesting that the productivity seems to be on a concave downwards slope, where the productivity seems to rise slower and slower.

In conclusion it seems that the productivity did not cause the change in labour market tension in the last five years. This conclusion can be made because the productivity is higher in 2022 than it was before COVID-19, so less labour is needed to supply the same amount of products and services. There are of course some side marks

that can be made. On side mark is that the decreasing marginal productivity, can put some pressure on the labour market. Whether this pressure is put in place is mainly dependent on one's assumptions of how aggregate demand increases. If it is assumed that aggregate demand increases due to increased productivity, then no pressure is introduced into the labour market. If aggregate demand is assumed to be more exogenous and not entirely dependent on productivity increases, than a lack of productivity increases will have to be compensated by working more hours (this to meet the rising aggregate demand). In the latter case the decline in the marginal productivity does put pressure on the labour market.

4.5 CONCLUDING REMARKS LABOUR SUPPLY

Central to this chapter was the question: *Did a change in labour supply cause the labour shortage?* In conclusion the labour supply does not seem to be the reason behind the current shortage of labour. This because the total supply of labour in the Dutch economy has risen in the same period that the labour shortage increased. The rise in total supply of labour can be attributed to an increase in the worker population, a higher labour force participation rate and less unemployment. The sick leave ratio did increase but its effect on the total supply of labour have been more than offset by other factors, resulting in an increase of total labour supply.

Labour productivity has also been analysed in this chapter. It is concluded that the labour productivity did not fall significantly for a long period of time and is thus unlikely to explain the current labour shortage. On the contrary, it even rose a little bit and thus should give some relief for the tense labour market.

5 LABOUR DEMAND

Labour demand is the total number of hours work that an economy desires from workers. The largest part of this demand is actually supplied by workers and constitutes the total number of hours worked (or labour volume) in an economy. A small part exists of unfulfilled work that is desired by the economy. The number of hours of work desired by the economy, but not supplied, can be estimated by looking at the number of vacancies in combination with the average workload (the number of hours of work that is asked in the vacancy) of the vacancies. Since the labour demand is defined as the combination of the amount fulfilled work and desired unfulfilled work, the direct reason of a higher labour demand is a rise in one or both two factors (in chapter 4.1 figure 4.1 it the labour volume has already been depicted and shows that the labour volume is historically speaking very high). Studying these measures of labour demand gives insight onto whether the labour demand has increased.

This chapter will begin by providing evidence that the labour demand has indeed increased. This analysis will be done be looking at the number of hours worked in the economy and the number of open vacancies. Then the reasons behind this increased labour demand will be unravelled, this will be done by looking at the main driver of labour demand, which is assumed to be demand for goods and services. This will be done by testing several tentative hypotheses about the causes for an increase in demand for goods and services.

The theory behind this chapter is developed in an iterative way, first the literature and some brainstormed ideas have been used to create some broad tentative answers on what could have happened that created more labour demand. Then a lot of different data sets were analysed to gain more insights in which factors could have impacted labour demand, and to form more concrete hypothesis. after which the hypothesises where tested. This chapter will predominantly depict the last iteration, by doing so a clear picture will be formed giving away probable key causes of an increased labour demand. The following topics will be discussed inside this chapter:

- The CES production function
- National spending, savings, loans, and subsidies
- Difference in labour demand in different sectors and occupation categories
- The export and import
- Business surveys about expected demand for labour.

Apart from demand for goods and services, labour productivity can also impact labour demand. When for example the labour productivity increases and demand for goods and services remains the same, the demand for labour decreases. This relationship is depicted in figure 3.1. Because labour productivity is already described in the previous chapter it will not be further analysed in this chapter. Note however that this is an arbitrary decision and labour productivity can be analysed in the light of labour demand and labour supply. When labour productivity is mentioned in this chapter it is based on the analysis of labour productivity in the previous chapter.

This chapter will conclude by giving evidence whether labour demand or labour supply has caused the current labour shortage. It will then present the most important factors that are believed to have caused the change in labour demand, this is however not an exhaustive list of all possible causes for the increase in labour demand.

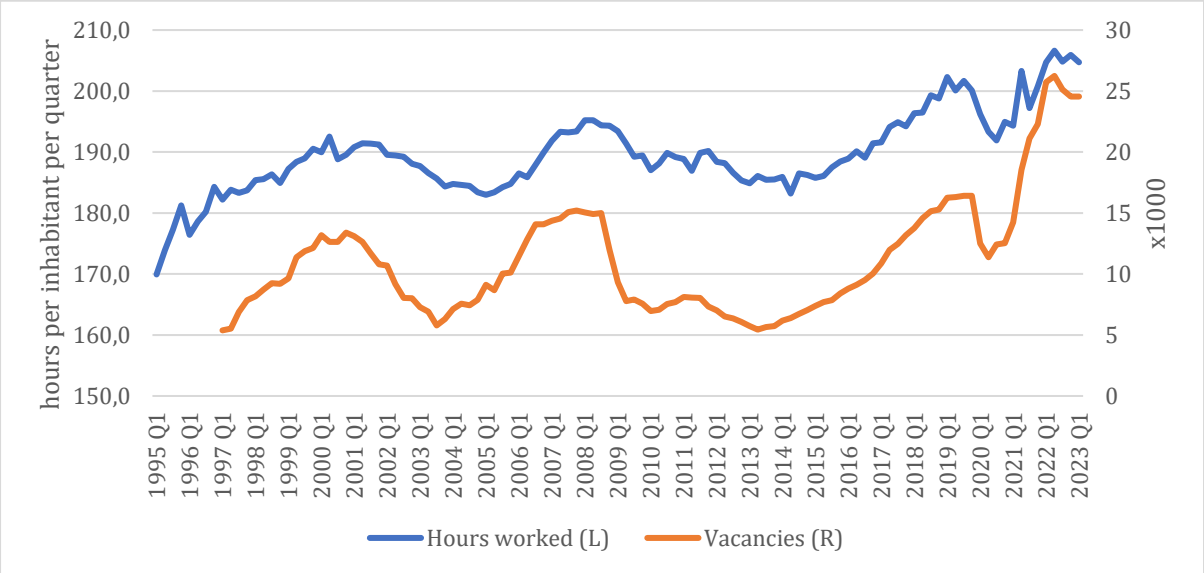
5.1 TOTAL LABOUR DEMAND

Total labour demand is the total number of hours that is worked plus the total hours of work that is desired by companies but not fulfilled by workers. The total number of hours that is worked in the Dutch economy has already been depicted in the chapter 4 about labour supply but is again shown in figure 5.1 below. From the figure it can be concluded that the total number of hours worked per person in the Netherlands has been historically high since 2021 Q2.

But what happened to the labour demand that could not be fulfilled? It is hard to determine the exact number of hours that is desired by the economy, but a could proxy is looking at the number of vacancies. By looking at the number of vacancies it is assumed that the average number of hours demanded in a vacancy has remained the same. The number of vacancies in the Dutch economy are depicted in figure 5.1.

Figure 5.1

Demand for labour per inhabitant



Data from: Statistics Netherlands and authors calculations
All numbers are seasonally adjusted

It is very clear that both the total labour volume and the unfulfilled amount of labour are at historically speaking very high. The moment when the number of vacancies became larger than the number of unemployed individuals was in 2021 Q4, and it reached its peak in 2022 Q1. In the same time period, it can be seen that the demand for labour (measured in the number of vacancies and total labour volume) is historically very high. As seen in chapter 4 the supply of labour is also historically high. This is strong evidence that the tension in the labour market is caused by a high demand for

labour rather than a shortage in the supply of labour. The reason why this conclusion can be made is that it does not make sense that a high labour supply has led to a shortage of the supply of labour. But it does make perfect sense that the high demand for labour is the reasons why there is a shortage of workers, and it can simultaneously explain why labour supply is so high. In other words high demand leads to more, but not enough (to prevent the current labour market tension), supply of labour. however, the question of why the labour supply increased still remains unanswered. In the next sub-chapters, the reasons behind the increase in labour demand will be studied.

5.2 PRODUCTION FUNCTION

To be able to understand the dynamics behind the labour market and what drives the demand for labour, one function that will be used is the CES production function. Originally this function describes the growth in an economy as function of capital and labour and can be transformed in a way that it describes the labour demand as function of economic growth, wage and price level. In this thesis it is assumed that theta and sigma are constants (at least during the period of 2019 – 2023). Based on this assumption three variables remain that predict labour demand, these are aggregate demand, nominal wages, and price levels. The nominal wage and price level can also be shown in one number which is the real wage, reducing the variables that describe labour demand to two.

$$L^D = \theta\, y\, (\frac{w}{p})^{-\sigma} \qquad \textit{eq 5.1}$$

(Hamermesh, 1993)

First the real wage will be studied to see whether changes happened during the years preluding the labour shortage. Then it will be studied whether a change in aggregate demand happened, an increase in aggregate demand could unveil further question labour why aggregate demand increased.

Aggregate demand will be studied by analysing it by looking at the different parts that make up GDP. The components of GDP can be seen in equation 5.2. The GDP will be approached from the production side of the economy because it is here that demand for labour arises.

$$GDP = Y = G + C + I + E - M \qquad \textit{eq 5.2}$$

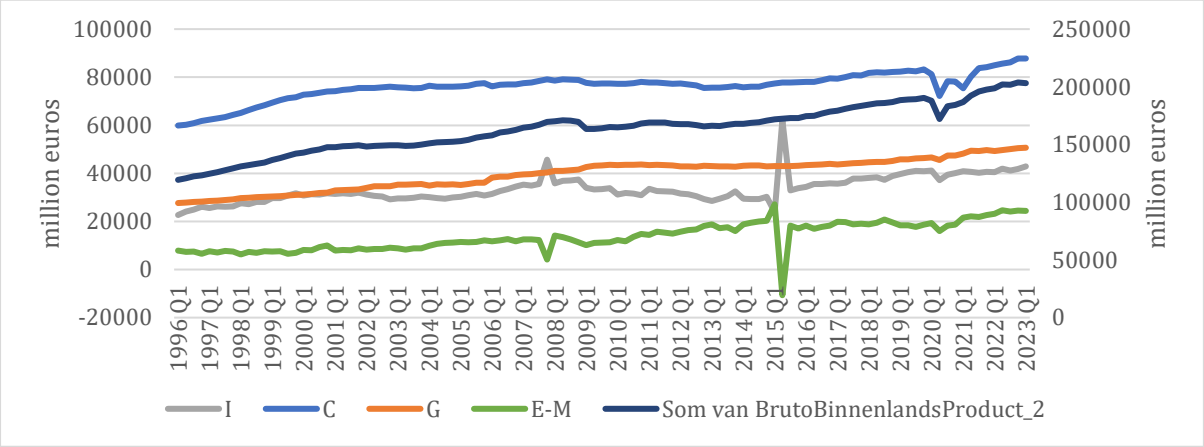
A potential problem with using a production function is that it might not fully capture the actual labour demand. This because it is likely that there are more factors that cause labour demand, in theory these factors can be attributed for by changing sigma and theta, but in practice it is hard and out of scope for this thesis to link structural economic changes that happened during COVID-19 to sigma and theta. Furthermore, using GDP as definition for aggregate demand for products and services might also be somewhat problematic. This because GDP is ultimately limited by the supply of labour, whereas (short term) demand for products and service can be higher than what is ultimately supplied.

5.2.1 Gross domestic product

As shown above GDP can be divided into the sum of 5 variables, and when the difference between export and import is used there are 4 variables remaining that determine GDP. The total GDP can is shown in figure 5.2. In figure 5.2 the 4 variables are depicted, from 1996 quarter 1 until 2023 quarter 1. The prices are all given in 2015 price levels.

Figure 5.2

Gross Domestic Product from demand



Data from: Statistics Netherlands and authors calculations
(L) demarks left axis, (R) demarks right axis

GDP fell during quarter 2 of 2020, this was during the COVID-19 pandemic. GDP has recovered quite sharply, this in the same time period in which the labour shortage increased. The outbursts of investments and simultaneous decrease in net exports during 2007 Q4 and 2015 Q3 are ignored, since these seem rather strange and did not occurring during the time period in which we are interested.

In general, the figure shows that all of the variables that make up GDP have been rising after the COVID-19 shock in 2020. Furthermore, all variables are in 2022 Q4 (the last data point) on a higher level than it was before the COVID-19 pandemic (which started in 2020 Q1) The rise of the variables that make up GDP during the period from 2019 Q4 until 2022 Q4 are shown in table 5.1.

Total investments (I) have an interesting development, after 7-year period with declining investments (2008 – 2015) investments have started a rising trend from 2015 onwards.

Net exports (E-M) have been on a stable level during the period from 2015 until 2020, after 2020 the net exports show an upwards trend.

Government spending (G) seem to be on a more or less stable rising trend. It seems however that after 2008 the government spending has not increased until 2019. After 2019 government spending has started to increase again.

Consummation (C) has had the most notable dip in absolute terms from all components of GDP during 2020 and 2021 (during COVID-19). After 2008 consummation was on a decreasing / stable trend. After 2014 consumer spending

started to rise again. A trend that, except for the COVID-19 years 2020 and 2021, is still continuing in 2023.

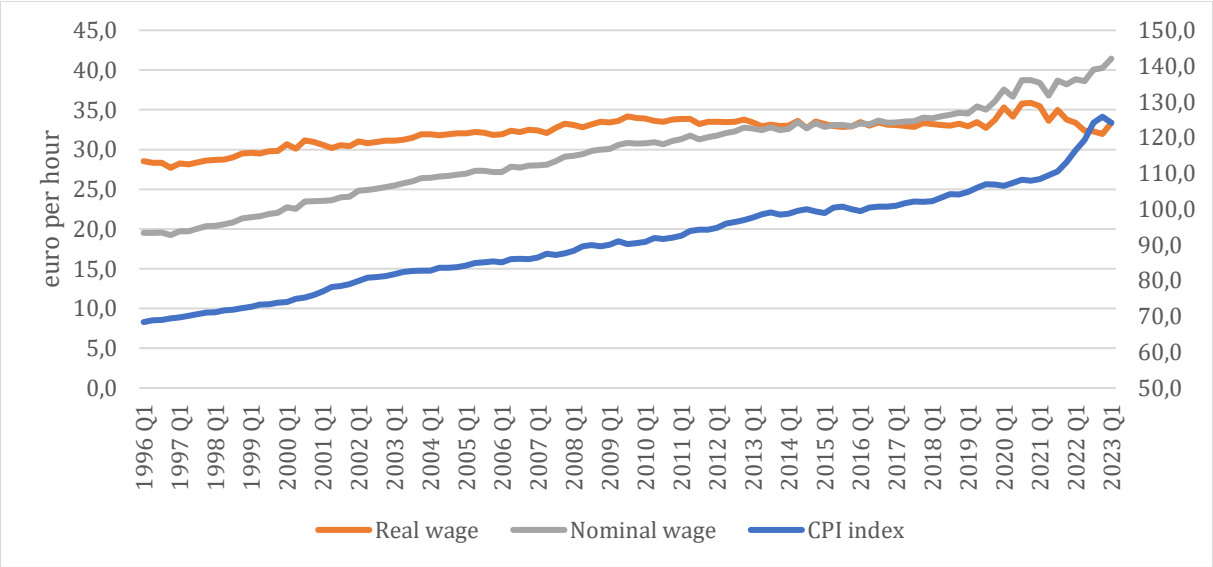
5.2.2 Wage & price level

A change in wage can change business demand for labour, this by making it more or less attractive to hire workers compared to invest in capital intensive means of production (such as machinery). So, a decreasing wage can put an upwards pressure on labour demand.

The relation between the price level and labour demand is more indirect and there are multiple ways in which this relation could take form. The first way of looking at this relation is that businesses do not look at nominal wages but rather use real wages to determine their preferred labour needs. By dividing the nominal wage by the price level, the real wage is calculated. Another way to approach the relation between price level and labour demand is that an increasing price level (inflation) indicates an increase in the demand for goods and services relative to the output of goods and services. This gap between demand and supply is solved by an increase in the price level of goods and services. The increased demand for goods and services results in a higher demand for labour (assumed productivity does not change).

Figure 5.3

Price index and wage



Data from: Statistics Netherlands and authors calculations
(L) demarks left axis, (R) demarks right axis

The nominal wage per hour is calculated by taking the total worker compensation in the Netherlands and divide it by the actual hours that have been worked in the country. Because the working hours that have actually been worked are used, which compensates for overtime and sick leave, the nominal wage is not the same as the nominal wage depicted on the average worker contract. The reason to calculate the wage this way is that it better reflects the cost of labour for businesses (e.g., when the sick leave increases, and all other factors remain the same, businesses pay the same for less labour).

In figure 5.3 it can be seen that the real wage has experienced a decline from 2020 onwards, at the moment (2023) it is at a similar level as it was in 2007. This could potentially have a positive effect on labour demand. The first reason for this is because a low price of anything increases its demand, this because more people, business or organisation can afford it, labour is no exception to this rule. The second reason is that when labour is relatively cheap businesses have a lower incentive to invest in labour saving technologies, in other words the labour for capital substitution is slower (or in the worst-case capital for labour substitution can even take place). The latter effect is expected to work in the long term, and it is doubted that it already caused an increase in the labour demand.

5.2.3 Production function analysis

The way price level (CPI), wage, GDP and the components of GDP changed during the period 2019 Q4 and 2022 Q4 is shown in table 5.1.

Table 5.1

Changes in variables of the production function

	CPI index	**Nominal wage** MM €/quarter	**GDP** MM €	**C** MM €	**G** MM €	**I** MM €	**E** MM €	**-M** MM €
2019 Q4	106,90	10219	189311	83253	46377	40872	165122	146492
2022 Q4	125,85	11332	202859	87770	50505	41775	179039	154583
Changes	17,73%	10,89%	7,16%	5,43%	8,90%	2,21%	8,43%	5,52%

Data from: Statistics Netherlands and authors calculations

The variables from the CES production function which according to the CES production function should explain increases in labour demand changed as well. GDP increased, giving an upwards pressure to labour demand. The nominal wage also increased; this should give a negative pressure to labour demand. The price level also increased giving an upwards pressure to labour demand. Because the price level rose more than the nominal wage, the real wage decreased, which gives the same upwards pressure to labour demand as nominal wage and price level increase together (since real wage is nominal wage divided by price level).

To conclude this sub chapter, it can we seen that the CES production function indicates that it can be expected that labour demand is relatively high. This because aggregate demand is relatively high (since it increased) and real wages are relatively low (since it decreased). If one look further is taken at the components that make up aggregate demand it can be seen that all the components are relatively high at the moment, so it is hard to pinpoint only one reason for the increase in GDP, it seems rather that the increase in GDP is due an increase in components that make up GDP. When looking at the real wage it is interesting to note that the real wage is at the same level as it was in 2002. The reason for a relatively low real wage at the moment is that the inflation is relatively high, offsetting the increased nominal wage (another way of looking at this is that the nominal wage growth has not been enough to keep up with inflation). It is interesting to see why aggregate demand is relatively high at the moment and why the real wages are relatively low, in the next paragraphs some tentative answer will be given to these questions.

As stated at the beginning of this chapter the demand for labour has been increasing because the total number of hours that has been worked increased as well as the number of vacancies. But why are companies in the need for more labour? In general this is because of 3 things, either customers (or other entities) demand more products & services, productivity has fallen, or companies increase production without a rising demand from customers. The last scenario could exist for a short period of time when businesses expect consumer demand to rise in the future, but it is not expected that businesses retain overproduction for long periods of time since this will seriously undercut their profits. As mentioned in chapter 4 the productivity did not fell for a significantly long time. So, the most probable cause of high labour demand would be more demand for goods and services. It is however not so easy to measure total aggregate demand, since GDP only counts goods and services that are produced instead of counting produced and demanded goods & services (although it is often assumed that in the long run aggregate demand equals GDP). Aggregate demand is the number of products actually produced plus the number that is demanded by customers. In order to see how and why total aggregate demand increased 3 different hypotheses will be formed and tested in the following sub-chapters.

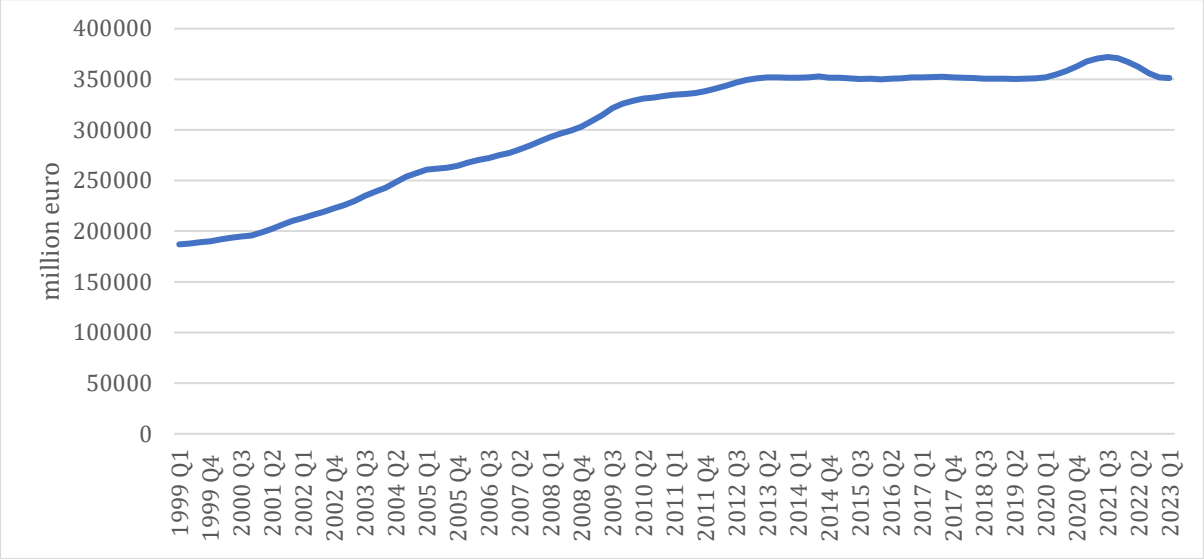
5.3 NATIONAL SAVING, SPENDING, LOANS AND SUBSIDIES

The first hypothesis that will be tested is that labour demand after COVID-19 is high because consummation and investments by households and businesses have been relatively high. The proposed reason for this is that households / individuals saved more during the COVID-19 years. This because they could physically not spend their money on a large variety of products and services, but most still received the same income as before COVID-19 at least partially thanks to extensive support packages from the government. These support packages included loans and subsidies.

To test this hypothesis firs the amount of savings and expenditures of households will be analysed. This is to confirm whether the households where indeed unable (or unwilling) to spend a large amount of their income, and whether they indeed increased their expenditure after the COVID-19 pandemic ended. So, in the following figures an increase in the amount of saving is expected during the pandemic years 2020 and 2021, followed by an increase in expenditures after the pandemic in 2021 – 2022.

Figure 5.4

Household savings and other deposits

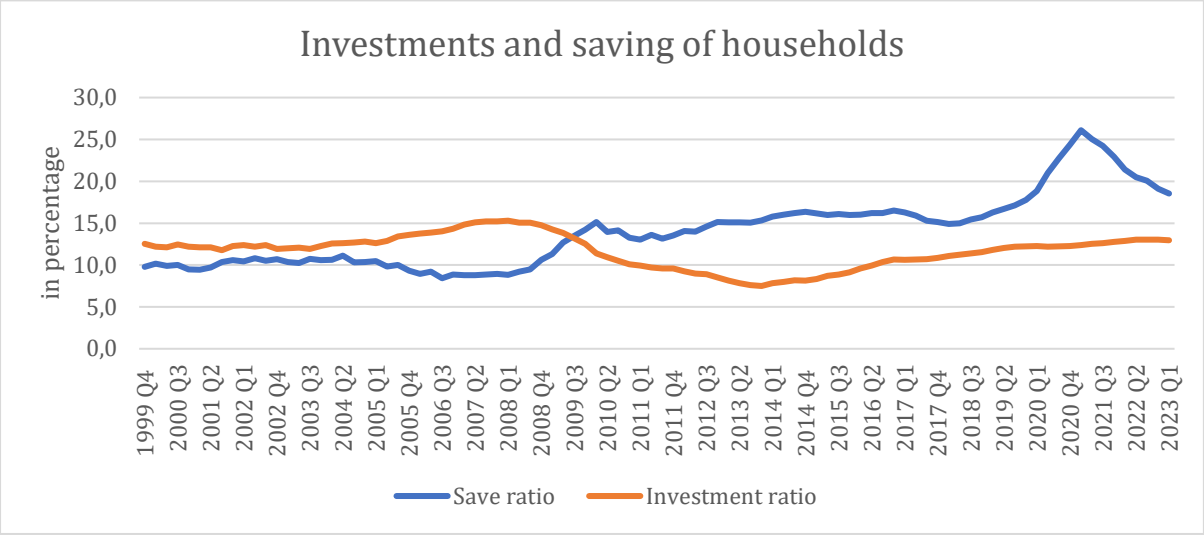


Data from: Statistics Netherlands and authors calculations
The number is a rolling average, in million euro, in 2015 prices

As can be seen in figure 5.4 the total savings went up in the years 2020 and 2021, it stated declining again at the beginning of 2022 (in quarter 1). It is furthermore interesting to see that savings have remained on an increasing trend until 2012, after which the amount of savings remained stagnant until COVID-19 became relevant in the Netherlands. As for our hypothesis it seems true that savings increased during the COVID-19 pandemic, especially in the years when the lockdown and similar measure where the strongest. The figure furthermore shows that the amount of savings decreased after the worst part of the COVID-19 pandemic was over.

Another interesting graph shows the percentage that households save and the percentage that households invest, see figure 5.5. the figure show that the percentage of income that is saved increased during the COVID-19 pandemic.

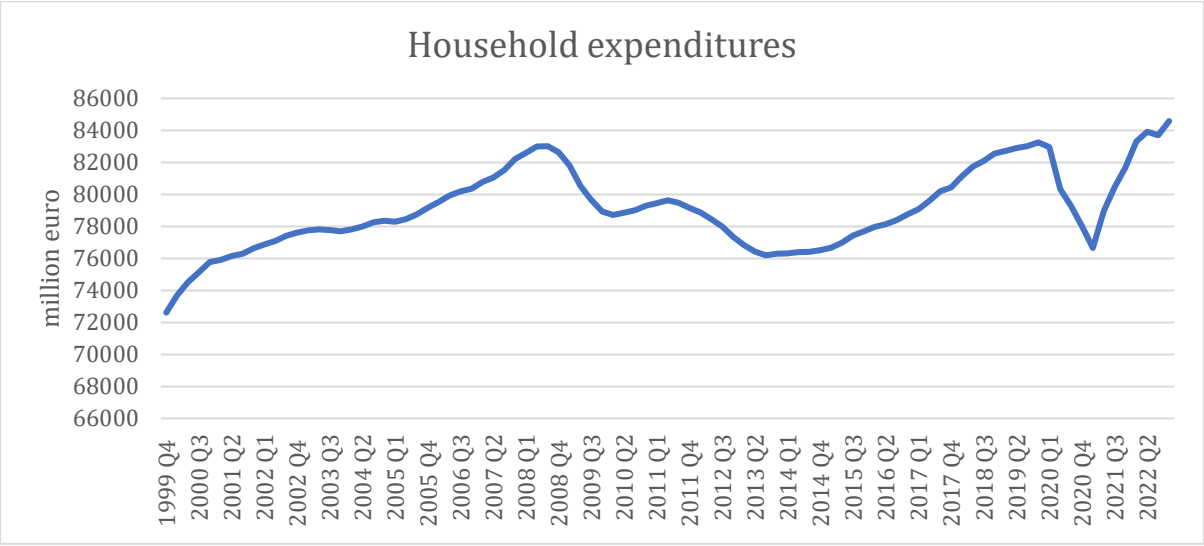
Figure 5.5
Investments and savings from households



Data from: Statistics Netherlands and authors calculations
Numbers are rolling averages in percentage

It can be seen that, as is congruent with the savings and deposits levels, the saving quote went up during the COVID-19 pandemic and went down afterwards. Interestingly the saving quote is still higher than before the COVID-19 pandemic, meaning that a larger percentage of income is saved, this could potentially indicate the inability to spend all savings due not enough production capacity. The percentage of income that households invest has been on a steady rising trend since 2013.

Figure 5.6
Household expenditures



Data from: Statistics Netherlands and authors calculations
Number is a rolling average, in million euro in 2015 prices

Figure 5.6 above shows the household expenditures, it can be seen that at the moment the total expenditure of household is at an all-time high. Thus, indicating that households aggregate demand indeed might be higher.

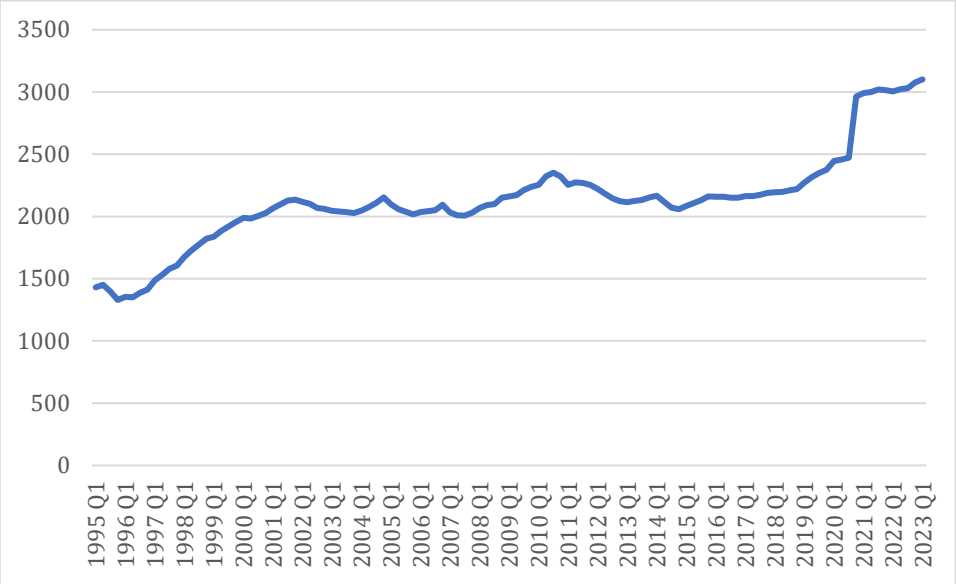
Analysing figures 5.4, 5.5, and 5.6 altogether we see that after COVID-19 households spend more on consumptions and invested a larger part of their income in comparison with the situation before COVID-19. The percentage of income that is saved is still higher than before COVID-19, but because households are using their relative full saving accounts, enabling them to consume and invest more than before COVID-19.

Now that it is clear that households increased their saving deposits during COVID-19, and that they used this to fuel consummation and investments, we shall turn to the question of how household where able to gather such relative high saving deposits. The first part of the puzzle as already mentioned is probably the inability of households to spend as much on products and services during COVID-19 as they would spend on products and services in 'normal' years. The other part of the picture must answer why most households where able to retain most of their income. The hypothesis for this answer is that government subsidies and loans enabled companies to keep paying salaries to their employers, even when they were struck relative hard by the COVID-19 pandemic or the measurements in place to fight COVID-19. To see whether it is plausible that government subsidies could have played an important role the total amount of subsidies and loans provided by the government around the time of the pandemic will be analysed.

To keep businesses afloat and to keep paying all workers the Government in the Netherlands introduced a vast number of support packages. These support packages where mostly in the form of a cheap loan for businesses through the government. Subsidies that the government gave can be considered indirect loans since the government has to lend the amount of the subsidy, assumed other expenses stayed the same. Furthermore, businesses can lend from banks or investors. The net effect from all these loans and subsidies could have a positive impact on labour demand since businesses are able to use those funds to retain their personal during the COVID-19 pandemic. The boast in cheap loans and subsidies can also be seen as fiscal stimulus, fiscal stimulus generally has a positive impact on aggregate demand and thus also on labour demand.

The subsidies in the Netherlands did increase from roughly 9500 (million euros) in 2019 to 1200 (million euros) in 2020. This is an increase of 24.8% in one year, and afterwards the subsidies did not decrease but rather stayed at the new high level.

Figure 5.7
Subsidies provided by the government



Data from: Statistics Netherlands and authors calculations
Number is in million euro in 2015 prices

The increase in subsidies is only part of the story as there have also been COVID-19 support on the form of loans. These loans have a size of around 4000 million euros (or 4 billion euros) (Statistics Netherlands, n.d. B), and could have an increased effect on the fiscal stimulus hypothesis.

Savings of households have increased from 2019 Q4 until 2021 Q4, from 350000 to 370000 million euros. Indicating that their savings increased with a total of 20000 million euros. Government subsidies increased from 2500 million euros in 2019 to 3000 million euros in 2020 and 2021 per quarter. So over three years there have been given 4500 million euros more subsidy than normal, this in combination with 4000 million euros loans given to businesses, this substantial amount of money could have played an important role enabling companies to keep paying workers their loans. There is of course no guaranty that these funds have indeed been to a large extend transformed into household savings, the only thing that the above rough calculation shows is that the increase in subsidies and loans is large enough to have impacted the ability of households to retain their income. It should also be noted that a large part of sectors was not affected very badly in the COVID-19 pandemic and could pay out workers without any help from the government, so only a percentage of the 20000 million of increased savings is because of workers who kept their jobs because of COVID-19 support packages. Last point to make is that funds that have not been attributed to paying out loans for customers still impacted labour demand because it enabled the benefiters of the loan or subsidy to spend it on something else than paying loans.

In conclusion households have increased savings during the COVID-19 pandemic and used those savings after the pandemic to consume and invest more. It is possible that households desire to spend even more but cannot do so because of capacity problems,

this because the saving ratio still higher than before COVID-19. The reason why households on average have been able to save so much funds is twofold. The first reason is because households where not able to spend a large part of their income during the COVID-19 pandemic. The other reason is that businesses received a tremendous amount of subsidies and loans from the government allowing them to keep paying their employers, even when no turnover was created.

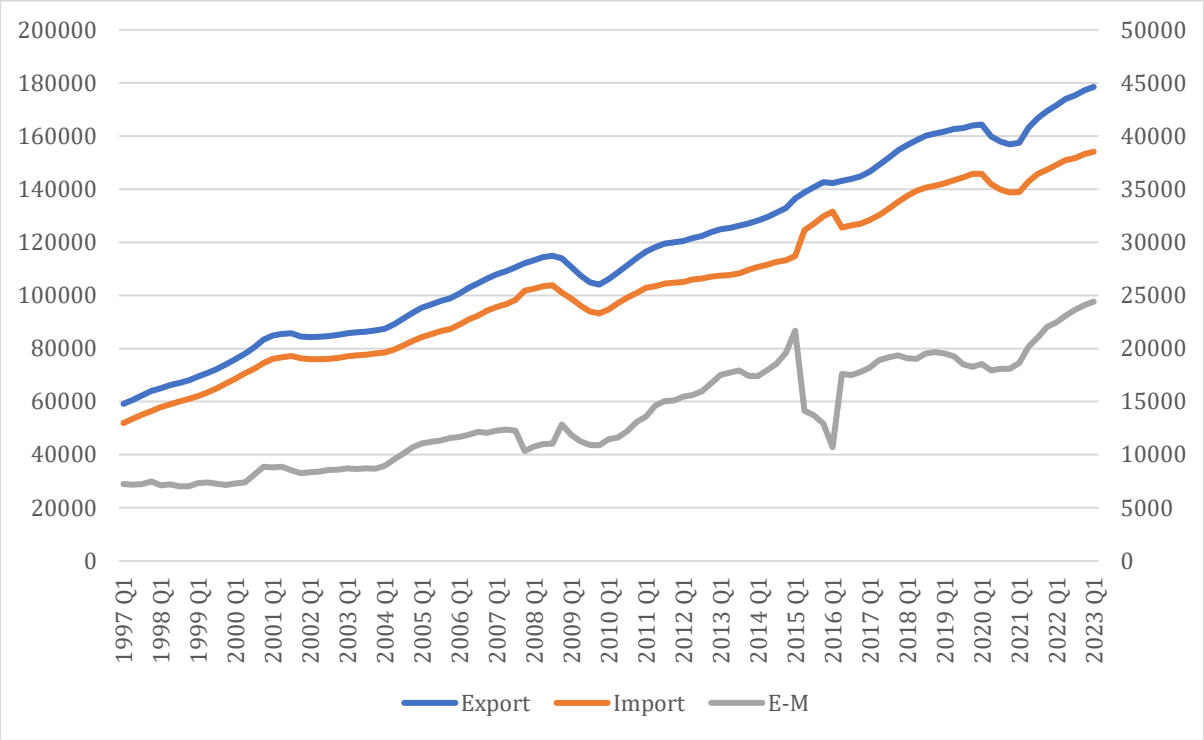
It is not argued that all subsidies and cheap loans provided by the government has gone into household savings, but rather that there are two ways in which the subsidies and loans affected the labour demand. The first route is that the loans did indeed enable companies to keep paying all their employees. The second route is that the subsidies and loans were used during or after COVID-19 by businesses to invest or consume, which also creates an upwards pressure to labour demand. In reality both of these factors probably played a role, since it is clear that subsidies and loans have in fact risen substantially during and after COVID-19 and money has to go somewhere (it is deemed unlikely that a significant number of businesses used loans to save money).

5.4 EXPORT AND IMPORT

As indicated by Bonadio et al. (2021) due to COVID-19 restriction in other exporting countries the export could increase in countries with relative less restrictions. Such a cause could be seen by the increase in the export, which will be analysed in this sub chapter. The export of the Netherlands is for an important part dependent on re-exports, so the import is also analysed.

Figure 5.8

International trade



Data from: Statistics Netherlands and authors calculations
Numbers are rolling averages in million euro in 2015 prices

In the figure above it can be seen that the exports and imports have been on an increasing line since the beginning of the dataset (1997). The exports are increasing faster than the imports, resulting in increasing net exports. The dip seen in 2015 and some of the dip in 2007 should be ignored since this is a fault in the data (same as in figure 5.2), because the above figure uses a rolling average of 4 quarters the data fault is less visible.

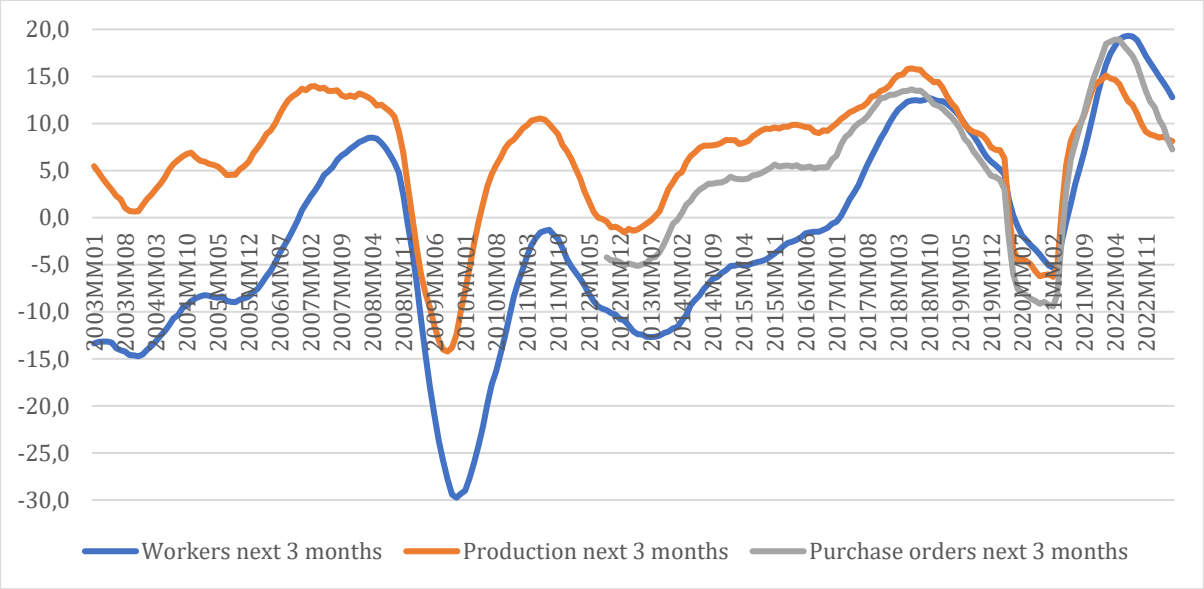
The net export has been quite stagnant from 2016 until 2021, from 2022 the net export increased again, and is currently at an all-time high. Since all products that are exported have to produced or at least handled more export means that more labour is required to be able to export more products. Importing more can result in less demand for labour since less products have to be produced inside the country. When looking at net export it can be seen very clearly in figure 5.8 that the net export in the Netherlands increased, likely resulting in more demand for labour inside the Netherlands.

5.5 BUSINESS SURVEYS

To check whether labour demand increased because of an exogenous increase in demand by businesses, business surveys are analysed. Using business surveys as proxy for labour demand is also done by (Ruth, 2012), in his paper the production impediments caused by a shortage of labour and the production impediments caused by a lack of demand are used as indicators for the labour market. When the labour market is tight a high number of businesses is expected to report impediments by a lack of labour while in the case where the labour market is loose a high number of businesses is expected to report less production because of a lack of demand for its products.

Figure 5.9

Business surveys



Data from: Statistics Netherlands and authors calculations
Balance of companies answering yes versus companies answering no to specific questions.

Figure 5.9 represents three figures based on surveys; the three questions are:

- Does the company think that the in the coming 3 months there will be more personal needed?
- Does the company think that the in the coming 3 months there will occur more production?
- Does the company think that the in the coming 3 months there will be more purchase orders?

The figure presented in the graph is the difference between the number of companies that answer the question with a yes, and the number of companies that answer the question with no.

Figure 5.9 shows that companies in the manufacturing sector where quite positive about the amount of personal, purchase orders and production orders coming three months during 2022. It is however hard to say whether the expectations of businesses

have amounted to an overshoot in the labour demand, or that businesses rightly foresaw the increasing labour demand and demand for products and services. It is furthermore interesting to see that there seem to be a strong correlation between the balance of companies that expect more production and the balance of companies that expect to need more personal, for businesses the link between more demand for products and more needed labour seems to be very natural.

In conclusion the business survey is hard to interpret, it could be the case that businesses where too optimistic about the future after COVID-19 and in turn hired too much personal or at least put out too many vacancies. But the surveys do not contain enough information to support or falsify this hypothesis as the alternative explanation that businesses did have realistic expectations, and therefore increased their demand for labour is just as likely.

5.6 LABOUR DEMAND IN DIFFERENT BRANCHES AND OCCUPATIONS

In this sub-chapter it will be studied whether some specific occupation or sector is more responsible for the increase in labour demand than other occupations or sectors. This provides insights and hypothesis for which demand for products and services is most responsible for the current increase in labour demand. One hypothesis that can be tested by analysing sector data, is that the rise in labour demand is due to an increase in some sectors which are known to be expanding due to current developments. Those sectors include healthcare, education, defence, and the energy transition. This hypothesis will be further developed in this chapter. First the occupations will be analysed, then the sectors will be analysed.

5.6.1 Labour demand by occupation

Statistics Netherlands distinguishes 13 different main occupation categories, each group exists out of multiple subcategories. By studying the different groups over time, it can be seen which specific main category or subcategory has changed the most in a specific time period. This can give clues on why this specific category has risen since different reasons can be connected to different rises in occupation categories. An example of this would be a sudden rise in health care occupation, which could be related to the COVID-19 pandemic and a population that is becoming older.

Because there is no data available about the number of vacancies for each different occupation, data about the number of workers will be used. The CBS distinguishes 13 different main occupations categories, each main category is further divided into multiple subcategories. In table 5.2 the change in the number of workers that are active inside an occupation category is depicted. The table is sorted by the change a certain category experienced between 2020 Q1 and 2023 Q1. In the second column it is shown how much each category contributed to the total change in number of workers. In table 5.2 only the main categories are depicted, in appendix B all sub-categories are shown.

Table 5.2

Change and contribution to change of (components of) number of workers, per occupation

Occupation	Change of workers	Contribution to total change
Total	**5,38%**	
08 IT professions	40,10%	1,72%.
04 Business, economics, and administrative services	12,97%	2,35%.
01 Pedagogical professions	10,61%	0,76%.
03 Commercial professions	10,56%	1,13%.
02 Creative and linguistic professions	9,57%	0,24%.
10 Health and welfare professions	7,84%	1,09%.
05 Managers	5,88%	0,29%.
06 Public administration, security, and justice professions	2,82%	0,10%.
07 Technical professions	1,38%	0,20%.
12 Transport and logistics professions	-7,25%	-0,55%.
11 Service professions	-12,15%	-1,13%.
09 Agricultural professions	-15,84%	-0,35%.
13 Other occupational class	-31,58%	-0,46%.

Data from: Statistics Netherlands and authors calculations

In table 5.2 the total number of workers has risen with 5,38%. It is surprising to see that there are large differences between the different occupations. One surprising change in workers is in the service professions, where the number of workers declined by 12,15% and, responsible for -1,13% point decline in the overall change in workers.

The data about the number of originated vacancies in different occupation sectors is depicted in table 5.3. Unfortunately, the data in table 1 does not include all occupation categories, is in yearly data (the displayed change is from 2019 to 2022) and is about originated vacancies rather than number of open vacancies. It can however still provide some answers. One interesting fact is that all categories experienced a rise in originated vacancies.

Table 5.3

Change and contribution to change of (components of) originated vacancies, per occupation

Occupation	Change	Proportional change
Total	**25,94%**	**25,94%**
04 Business, economics, and administrative services	38,85%	5,60%
08 IT professions	29,00%	1,40%
10 Health and welfare professions	27,79%	2,33%
11 Service professions	24,15%	2,29%
01 Pedagogical professions	18,42%	0,83%
03 Commercial professions	16,90%	1,97%
12 Transport and logistics professions	11,44%	0,78%

Data from: Statistics Netherlands and authors calculations

Data from table 5.2 and table 5.3 suggest that IT labour demand in IT professions; Business, economics, and administrative services; health and welfare; pedagogical; and commercial professions contributed the most to the total increase in labour demand, since all of these occupations experienced a rise in originated vacancies and number of workers.

Table 5.4

Change and contribution to change of (components of) number of workers, per occupation skill level

Occupation	Change	Proportional change
Total	**5,38%**	**5,38%**
Occupation skill level 1 (ISCO 2008)	-10,28%	-0,93%
Occupation skill level 2 (ISCO 2008)	-4,84%	-2,02%
Occupation skill level 3 (ISCO 2008)	14,59%	2,46%
Occupation skill level 4 (ISCO 2008)	20,31%	6,37%
Occupation skill level unknown (ISCO 2008)	-48,48%	-0,52%

Data from: Statistics Netherlands and authors calculations

Table 5.4 shows the change in occupation in 4 different skill level classes, these skill levels are defined by the International Labour Organization (2018), and are defined as follows:

Skill level 1: '*Occupations at Skill Level 1 typically involve the performance of simple and routine; physical or manual tasks.*' (International Labour Organization, 2018)

Skill level 2: '*occupations at Skill Level 2 typically involve the performance of tasks such as operating machinery and electronic equipment; driving vehicles; maintenance and repair of electrical and mechanical equipment; and manipulation, ordering and storage of information.*' (International Labour Organization, 2018)

Skill level 3: '*Occupations at Skill Level 3 typically involve the performance of complex technical and practical tasks that require an extensive body of factual, technical and procedural knowledge in a specialized field' (International Labour Organization, 2018)*

Skill level 4: '*Occupations at Skill Level 4 typically involve the performance of tasks that require complex problem-solving, decision-making and creativity based on an extensive body of theoretical and factual knowledge in a specialized field*.' (International Labour Organization, 2018)

Table 5.4 shows a very significant change in the number of workers in each occupation level, it is very clear that during the period from 2020 Q1 until 2023 Q1 the workforce shifted to occupations associated with a higher skill level. It is however not possible that a shift in occupation level is the ultimate cause for an overall labour shortage, this because the decrease in labourers in the lower skill level is fully compensated by the increase in workers in higher skill levels. A more plausible explanation based on the numbers in table 5.4 is that a tight labour market caused the shift in occupation skill

level. This because individuals have more bargaining power to gain access to a profession with a higher needed skill level (and thus gaining access to the associated higher benefits).

On the aggregate level a shift from lower skill occupations to higher skill occupations would not lead to lower labour supply. However, on a more local level a shift in occupation skill level can and probably is creating an increase in the labour shortage. But if the number of workers stays the same this effect must be compensated in another skill level where more workers are available.

Due to this 'skill rise effect' the data from table 5.2 (first table) should be interpreted with care. Since a rise (decline) in number of workers in a certain occupational category could be due to its relative attractiveness (non-attractiveness) instead of an increase (decrease) in the labour demand in the specific occupation category. An example of this is possibly the service occupations, where the number of workers declined by 12% while the originated vacancies rose by 24% in a similar period. This indicates that although demand for labour has remained (since the vacancies rose), there were less workers active in the occupation category.

In conclusion the occupation categories give some insight into which occupation experienced a growth in the number of workers and / or in the number of originated vacancies. Furthermore, the data shows a shift from relative less complex work to more complex work. Some occupation categories seem to be more responsible for the increased labour demand, but the data should be treated with care since it is hard to distinguish the 'skill rise effect' from the effect that decreased labour demand would have. No significant reason is identified that can explain why the aggregate demand for labour increased.

5.6.2 Labour demand by branch

Different branches can have a different impact on the overall labour demand. In this subchapter it will be studied whether a labour shortage emerged in all branches, or whether branches experienced the labour shortage in a heterogeneous way. Data about the number of vacancies, the number of worked hours and the number of companies in each branch is used.

Table 5.5

Change of labour volume, vacancies, and number of companies, per sector

Sector	Worked hours (%)	Vacancies (%)	Number of companies (%)
A-U All economic activities	**6,0**	**95,3**	**16,8**
D Energy supply	25,3	91,7	60,3
J Information and communication	14,4	54,7	15,1
O Public administration and government services	11,3	70,5	3,7
M Specialized business services	10,2	94,0	12,5
P Education	9,5	104,8	27,7
R Culture, sports, and recreation	9,0	109,4	12,9
I Hospitality	8,5	253,5	16,9
Q Health and welfare services	6,8	78,4	28,0
K Financial services	6,3	57,1	5,6
E Water supply and waste management	6,1	125,0	4,3
F Construction industry	6,0	82,7	25,3
L Rental and real estate trading	5,4	120,0	10,4
G Trade	4,9	102,2	13,2
H Transportation and storage	4,2	116,7	25,5
C Manufacturing	1,7	86,1	13,7
A Agriculture, forestry, and fishing	1,3	54,5	3,8
N Rental and other business services	0,4	91,7	29,9
S Other services	-1,8	180,8	10,9
B Mining	-4,2	100,0	25,3

Data from: Statistics Netherlands and authors calculations

Table 5.5 shows the change of vacancies, labour volume and number of companies during the period from 2020 Q1 until 2023 Q1.

The table is sorted from sectors that experienced a large change in labour volume to sectors that have experienced a small change in labour volume. The first interesting fact is that all sectors have increased the number of vacancies and in all sectors more companies became active (especially interesting that apparently no sector experienced a lot of bankrupts during or after the COVID-19 pandemic), in only 2 sectors the labour volume has decreased. It is interesting to see that education, healthcare, governmental services and energy production have increased, these sectors are not expected to expand just because households have more money to spend or because international demand has risen. These sectors seem rather dependent on exogenous factors, which is also the hypothesis that I want to present here.

First the healthcare sector. Demand for this sector is probably not affected that much by the business cycle (at least not in the Netherlands where a healthcare insurance is mandatory). It seems plausible that other factors such as demographics and the occurrence of pandemic play a more important role, in determining the total demand. In the period 0f 2019 until 2023 there was a pandemic and the Netherlands is

an aging economy, these are seen as exogenous factors that are likely to have increased labour demand in the healthcare sector.

For the education sector it does also not make a lot of sense to expect more demand for education because the economy is in an upswing. Rather demographics and policy choices are the main driver behind the demand for teachers. In 2015 the government took a decision to improve education, this by cancellation of scholarships and promising to invest the saved budget in better education. This could be an example of why schools have increased their demand for labour. Interestingly if one only looks at demographics one would expect the demand for teacher to fall, this since the age group of individuals age between 0 and 15 has been declining since 2005, see figure 4.2 in chapter 4 (note that since 2015 the age group of 0 – 25 should have also started declining).

The energy production could be for some part dependent on the business cycle for the amount energy it sells. However, I think it is implausible that the business cycle is the main driver behind the rise of labour demand in the energy sector, mainly because it is impossible to supply more energy in a short term (~ years or less) by employing more individuals. It seems rather more plausible that the increased demand in the energy sector is because of the enormous transition to green energy.

Government offices also should in theory not be affected by the business cycle but is rather decided by exogenous factors.

Rises in other sectors can be due to a mix of exogenous factors and factors related to the increased aggregate demand (which, as is explained in chapter 5.3 and 5.4, is likely a result of increased spending by consumers and increased net exports). The information and technology sector is an important example of this, on one hand the increase of worked hours in this sector is likely to be related to the increased need for these services during and after COVID-19. But the increased demand for labour supply in this sector might also stem from increased demand by consumers.

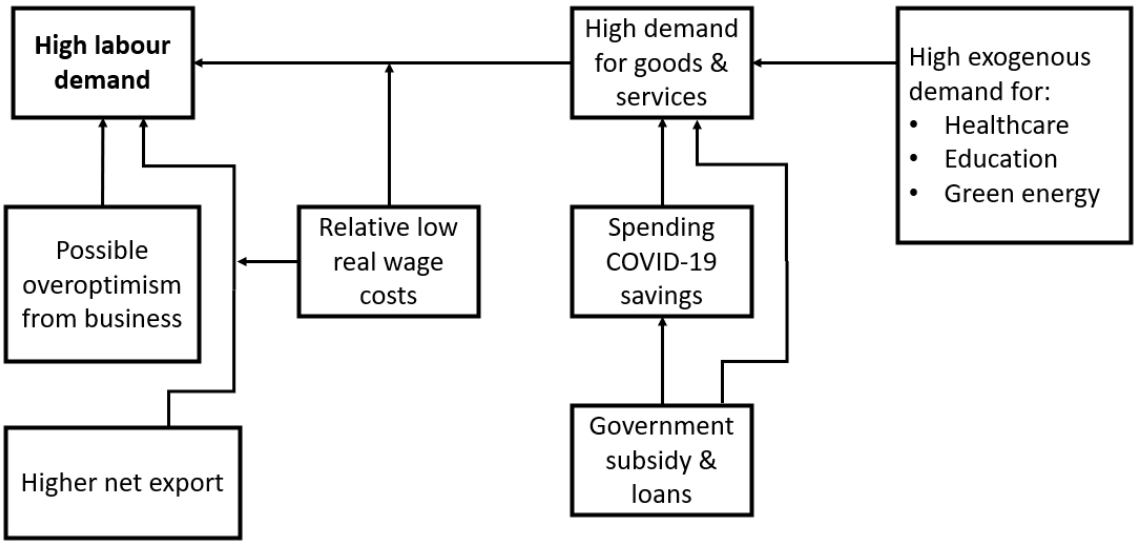
In conclusion it is clear that almost all sectors demanded more labour than before the COVID-19 crisis. For most sectors this rise in demand can probably be attributed to the rise in aggregate demand, which is fuelled by a rise in household expenditures, fiscal stimulus and an increased net export. For some sectors this line of reasoning seems off, and other exogenous reasons that explain the increased demand for labour seem more plausible.

5.7 CONCLUDING REMARKS LABOUR DEMAND

Central to this chapter was the question: *Did a change in labour demand cause the labour shortage?* In conclusion the labour demand is responsible for the current labour shortage in the Netherlands. This can clearly be seen in the concurrent rise of vacancies and labour volume. Furthermore, labour supply has risen, and is at a historically speaking low point so cannot be the reason for the labour shortage. Labour productivity is also relatively high so is unlikely to have caused the labour shortage. There are several reasons hypothesized that can explain why the demand for labour has risen after the COVID-19 pandemic. In figure 5.10 a complete overview of the hypothesized reasons for the current high labour demand is given.

Figure 5.10

Scheme of causal relationships of the drivers of a high labour demand



The first reason is because real wages have fallen and GDP has risen in recent years. Following the CES production such a change in real wage and GDP are associated with a rise in labour demand. The CES production function however still does not really answer why real wage but especially GDP has risen.

To explain why aggregate demand (GDP plus desired but not executed spending) has risen there are two hypotheses given that work together. The first is that households save more during COVID-19, due to the inability to spend during the lockdowns. These savings were used after the pandemic contributing to more aggregate demand. This is supported with data that shows an increase in savings during the COVID-19 pandemic and data that shows increased expenditures after the COVID-19 pandemic. The second hypothesis is that governments enabled companies to pay their workers during the pandemic, even when no revenue was created, this directly increased aggregate demand because businesses had easy access to funds. But the stimulus packages also enabled workers, that would have been fired if businesses did not receive stimulus packages, to keep their income and save a large part of it. So delayed expenditure funded by 'COVID' savings and fiscal stimulus might have been important drivers of the current increased aggregate demand.

Aggregate demand (and therefore also labour demand) is also impacted by net exports, the data clearly shows that the net exports have increased quite significant in after COVID-19 in the Netherlands.

When analysing the different sectors it is clear that all sectors experienced an increase in labour demand. For some sectors this increase can be linked to the reasons for more labour demand given above, but there are three sectors for which the above hypothesis does not seem to hold. These sectors are the energy, healthcare and education sector, it seems that exogenous reasons are more likely to have caused an increased labour demand in these sectors. Respectively the green energy transition, pandemic & aging population and policy changes seem to be important exogenous driver behind the increased labour demand in the energy, healthcare and education sector.

6 LABOUR SHORTAGES IN THE LAST 26 YEARS

In this chapter it will be studied why tense and loose labour market states are formed, this will be done by looking at historical precedents of these labour market states in the Netherlands. The correlation between labour volume and excess labour demand (vacancies) will be studied. This because it gives important insight in how supplied labour responds to excess demand for labour.

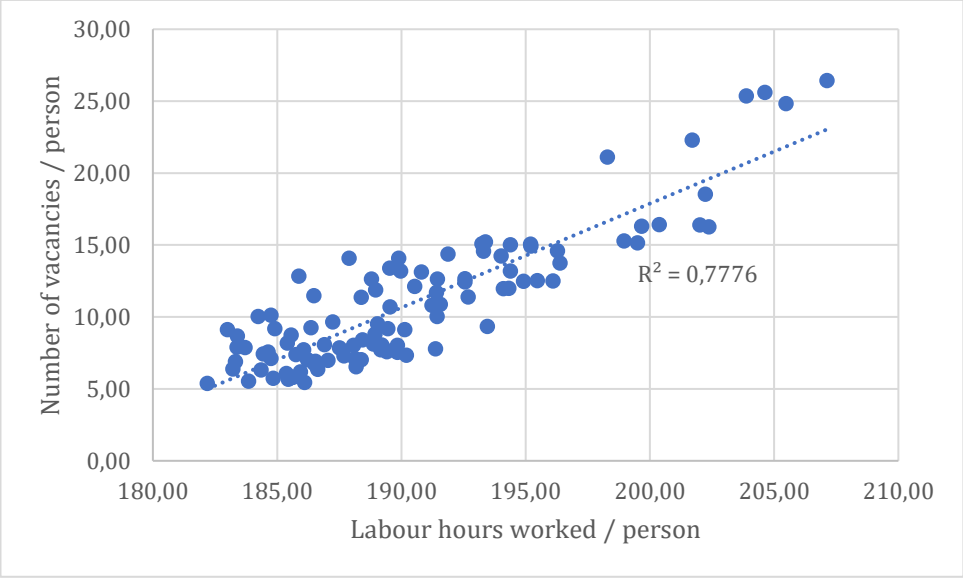
A tight labour market occurs when unemployment is low, and the number of vacancies is high. The number of vacancies per person is positively correlated with the amount of work supplied per person in hours (see figure 6.1), this suggests that an increase in labour demand is the cause for labour shortages. The proposed causal relationship in this case is that many vacancies make it easier of unemployed individuals to find work, and more attractive to work for individuals marginally attached to the labour force (because with more vacancies the labour shortage of a company is higher, and it is incentivised to put more effort into attracting new personal).

If (instead of the observed correlation) a shortage in the labour supply would be the leading cause for a tight labour market the correlation between labour volume and vacancies would be inverse. This because in this case when the labour volume is very low causing a labour shortage, it is expected that the number of vacancies would be high. And when the labour volume is high, causing a loose labour market the number of vacancies would be low because there is enough labour supplied.

The observed correlation, shown in figure 6.1, favours the first explanation that is giving rather than the latter one. Based on this correlation it is expected that an exogenous demand for labour is most of the time the reason for tense labour market. This opposes the view that a decreasing supply of labour is often the cause for a labour shortage.

Figure 6.1

Correlation vacancies and labour volume

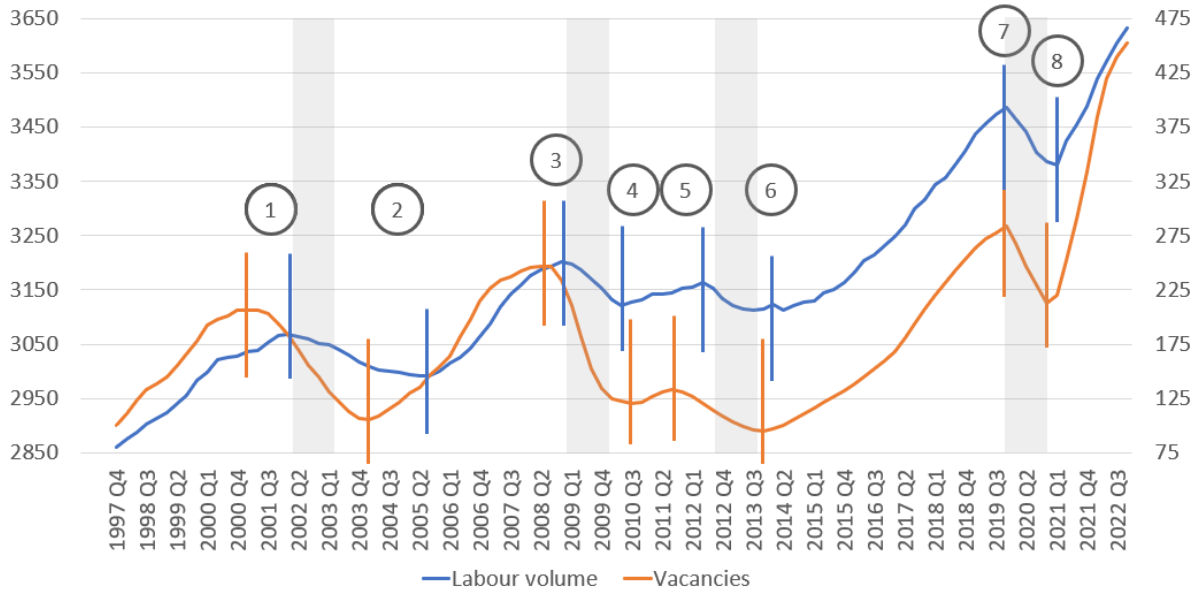


Data from: Statistics Netherlands and authors calculations

If the argument made above, that an increase in the demand for labour is often the cause of a tight labour market, is indeed true one might expect that the demand for labour (in this case measured by the number of vacancies), increases first. After which the supply of labour (measure by the total amount of hours worked) will follow suit. Furthermore, when the labour demand starts decreasing one might expect that again the labour supply will follow suit. In order to test the above statements, the labour volume and number of vacancies are depicted in figure 6.2.

Figure 6.2

Labour volume and number of vacancies



Data from: Statistics Netherlands and authors calculations

From 1997 there have been 8 transitions where the number of vacancies went from rising to falling or the other way around, and there have been 8 transitions where the labour volume went from rising to falling or the other way around. From these 8 transitions 5 times the number of vacancies clearly changed before the labour volume changed (number 1, 2, 3, 5 and 8). During the first quarter of the COVID pandemic vacancies and labour volume dropped at the same moment (number 8). Then there has been one instance (number 6) where the labour volume has two minimums, giving some ambiguity, here the average is taken between the two minimum. And there is one instance (number 4) where the minimum in vacancies is after a minimum in labour volume.

To conclude, in the last 26 years there have been 8 transitions from periods with rising / declining vacancies and labour volume to periods with respectively declining / rising vacancies and labour volume. There has been 1 instance where the labour volume rose prior to the number of vacancies, 5 instances where the vacancies rose prior to the labour volume and 2 instances where the timing is not clear. This in combination with the fact that the correlation is not inverse makes is quite plausible that most of the time changes in labour demand causes changes in labour market tightness for the period

since 1997. Reversely it is unplausible that a changes in labour supply caused labour market shortages in the last 26 years.

A natural question that arises is why the labour demand is dictating when labour tightness occurs rather than a shortage of labour supply causing labour tightness. The main goal of this thesis is to give answer to why the current labour tightness occurred, so an exhaustive answer to the question of why labour tightness occurs in general is outside the scope of this thesis. However, during the writing process of this thesis a potential plausible hypothesis was formed based on the abovementioned evidence. This hypothesis will be summarized below.

A potential answer to the question of why labour demand seems to dictate the occurrence of labour markets tightness lies in the fact that most main drivers of labour supply, which are population growth, demographics, labour force participation rate and average workload, tend to change at a rather slow pace. Labour supply drivers that tend to change more rapidly are unemployment and the sick leave ratio. The unemployment rate can change quite fast, but the question here is why it changes. Where demographics, population growth, labour force participation rate or the average workload change to a large extend exogenously, the unemployment is not determined exogenously (people do not decide en masse to become unemployed, and unemployed individuals cannot just start working when they decide to since if this where the case unemployment would not exist in the first place). Rather the unemployment rate is determined by the willingness of businesses and other job demanding institutions to hire workers, or in other word the unemployment rate is determined by the labour demand. The sick leave ratio is a driver of labour supply that can change fast (as is seen during and in the aftermath of the COVID-19 pandemic) and is determined exogenously, so in theory the sick leave ratio is able to cause labour tightness. But to put things into perspective even the change in sick leave ratio was not significant enough after the COVID-19 pandemic to decrease the total labour supply, so changes in sick leave ratio might often not be significant enough to change the labour market state.

On the other hand, labour demand is predominantly driven by factors that can change in a relative short time span. The most important driver is the national and international aggregate demand. With in turn correlates with recessions and periods of economic growth. This can clearly be seen in figure 6.2, the number of vacancies and the labour volume decline after the periods of economic slowdowns that happened in 2002-2003, 2009, 2012-2013 and 2020 (CPB, n.d.).

6.1 CONCLUDING REMARKS HISTORICAL LABOUR SHORTAGES

Central to this chapter was the question: *How did found causes relate to the historical course of the status of the labour market?* The answer to this question is that the found correlation between a measure for labour demand and a measure for labour supply is positive. It is concluded that it is likely that a rising labour demand causes more labour supply, and that a declining labour demand causes a declining labour supply.

7 DISCUSSION

In this chapter the results from chapter 2 to 6 will be discussed, after which some policy advise is given, then some limitations will be brought to light and lastly some possible interesting questions that can be researched further will be stated.

7.1 THE RESULTS

Central to this whole thesis is the research question with is: *Which factors caused the labour market tightness in the Netherlands after 2021?* In order to answer this question first existing literature is studied, and it was soon found that for the Netherlands there did not exist a readily answer to the research question. Even for all OECD countries the body of literature was very slim and no consensus could be found on why so many countries experienced a tight labour market. The literature did help identify some potential explanations on how why labour shortages occurred after COVID-19.

In the methodology of this thesis we have seen that the labour market can be studied by considering the labour productivity, supply of labour and the demand of labour. The difference between the latter two is the labour market tension, i.e., when there is more demand for labour than there is supply of labour the labour market is 'tense'. Changes in productivity can also induce changes in the state of the labour market, i.e., a decrease in productivity can cause labour shortage because more workers are needed to produce the same amount of products and services.

The total labour supply increased between 2019 and 2022, this due to an increase in the number hours worked in the economy. The unemployment fell but did not lead to a decrease of the total labour supply (which could have been the case if enough unemployed individuals became discouraged workers). The rise in labour supplied can further be contributed to the fact that the population between 15 and 75 increased and because the labour force participation rate increased. The average workload decreases a little bit due to an increase in the sick leave ratio. Because the labour supply has increased it is expected that the labour market would be less tense, the opposite is true. It is therefore that that the labour supply is not the cause of the current labour shortage.

The labour productivity (in GDP per worked hour) did not change significantly in the period the labour shortage grew. It is therefore concluded that the labour productivity did not cause the labour tension.

The demand for labour did increase significant during the same time the labour shortage increased. This can be measured by looking at the total number of hours worked in the economy and the total number of vacancies, which both increased. It is therefore concluded that the labour shortage that emerged primarily because the demand for labour increased. The slow productivity growth and increase in the sick leave ratio could have contributed to the labour market tension but are not primary causes.

The exact reason for the increased labour demand is unsure but a few hypotheses are formed. The first hypothesis is that the increase in labour demand is due to a stagnant real wage level. A second hypothesis is that aggregate demand (leading to an increase in labour demand) increased because households savings went up during

COVID-19 and where spend after the pandemic and associated restrictions ended. The savings of households were potentially made possible by the government supporting companies with subsidies and loans (which increased a lot during COVID-19). The third hypothesis is that demand for some sectors have increased exogenously, the most important sectors are the (green) energy sector (due to climate change), health care (due to ageing and the pandemic) and education (due to politics). The last hypothesis is that the net export increased, increasing the labour demand.

For the past 26 years the excess demand for labour (number of vacancies) and labour volume are negatively correlated. Furthermore, it seems that most of the time the number of vacancies changes first, the labour volume changes after the number of vacancies changed. It is concluded from these two facts that the demand for labour determines how much labour is supplied. And, that changes in demand for labour cause periods of a relative loose or tight labour market states.

It is furthermore hypothesized that labour supply and labour productivity are not responsible for changes in tension of the labour market because they both often take a relative long time to change, whereas labour demand can change much quicker. In short, the labour supply and productivity are not unimportant factors, they dictate the speed at which the aggregate supply can grow (which in turn dictates how fast aggregate demand can grow). But it is rapidly changing factors that cause labour market tension, which is most often caused by labour demand side factors.

7.2 POLICY ADVISE

If one wishes to stop or mitigate the current labour tension one could alter one of the three factors determining the labour market: productivity, labour supply or labour demand. A change in labour demand caused the current labour tension, but that does not mean that altering the supply of labour or the productivity cannot help mitigating the labour tension. However, it seems that planning a sudden significant change in productivity is not possible since if this was possible it would have been better to increase the productivity earlier, but policies that might increase productivity can help mitigate the labour tension. Changing the labour supply is possible and, as is shown in this thesis, has happened during the same period as the labour market tension increased. Policies aimed at further increasing the labour supply might mitigate the labour market tension further, it should be noted that altering the supply of labour might be hard since most of the factors determining the labour supply are long term processes (such as demographics and whether households prefer one or two workers). But policies aimed at factors that might increase labour supply on a short term might help to mitigate the tension in the labour market, examples are policies aimed at making overwork more attractive or attracting workers from outside the Netherlands. A measure that can both incentivise companies to increase the labour productivity and incentivise more labour supply is by increasing wages.

Changing the demand for labour, which is the primary cause for the current tension in the labour market, is also an option. To change demand for labour governments and central banks can resort to countercyclical policies. And the given subsidies and loans during but also after the pandemic can be questioned, these potentially caused more labour market tension. This is important for next crises in

which case a more balanced decision might be made between saving the economy from a recession and introducing to more pressure to the labour market. Furthermore, it should be recognised that some policies (e.g., green energy transition and healthcare) will have an increasing effect on the labour market tension.

The future is always uncertain and it is impossible to predict how it will unfold exactly, all we can hope for is that identified historical mechanisms will remain similar enough to at least form some kind of idea of possibilities that lie ahead. On the other hand it would be almost useless to form model if they did not possess any predictive power. Using the ideas developed in this thesis I will try to give some idea about how recent developments in the labour market can unfold.

The recent development that will be discussed it the development of artificial intelligence (AI). In the short-term AI can be seen as means to increase labour productivity, this means that the aggregate labour productivity will rise, and as a consequence people will have to work less or we can consume more. Looking at last 25 years that have been described in this thesis (but this will probably even hold until 1950) it can be seen that the number of hours that is worked did not decline in the past 25 years, while the productivity did increase. The opposite is even true, despite an increase in productivity of roughly 27% between 1997 and 2022, the worked hours per inhabitant increased with roughly 12%. So, it seems that, at least for the last 25 years, increases of productivity are not traded for more leisure time, but are instead used to consume more. So, if AI does bring huge productivity changes with it (maybe we even return to growth rates similar to rates in 1996 – 2000, see figure 4.7) there is a good change that consummation will also rise quite a lot, and that it will not lead to long term labour surplus. However, it can have negative effects for workers in specific sectors that will have to reschool themselves for jobs that cannot be taken over by AI.

On the long term there is the speculative possibility that AI in combination with robotics becomes better and cheaper in virtually every job that nowadays exist, if this does happen (and it is even speculative if this is even possible) there is a possibility that the labour market is completely terraformed or even ceases to exist.

In short policy maker must take into account the possibility that a significant number of workers might need reschooling if AI becomes more and more advanced. Historically speaking policy makers do not have to be afraid for mass unemployment when AI increases aggregate labour productivity. Some effort could be put into exploratory research on how advanced AI might get and what kind of significant risks or changes this would introduce to the labour market.

7.3 LIMITATIONS

There are some important limitations in this thesis, in this paragraph these limitations will be discussed.

An important limitation is that not all factors that increase aggregate demand have been studied in a lot of detail. For example, investments made by businesses or government expenditures have not been considered in great detail. Although consumer expenditure, which has been considered in more detail, has a larger impact on

aggregate demand studying investments by businesses and government expenditure might also reveal interesting information.

Another limitation is that data about aggregate demand such as used in the notion of GDP does not include 'excess' demand. This because supply is ultimately limited by supply of labour and productivity. to give an oversimplified example there is more aggregate demand when the economy demands 12 products than when the economy demands 11 products, but if supply is only 10 products the data about aggregate demand only shows an aggregate demand of 10 in both cases. This is important because the rise in aggregate demand (so including excess demand) might be larger than is depicted by the GDP. This aggregate demand is not visible by studying GDP but businesses to notice this extra demand, because they receive more orders which they cannot fulfil. This results in more demand for labour without increasing aggregate demand. This situation becomes more likely as the labour market tension is increasing.

A third limitation is that the seen correlations in combination with a logical argument are still not enough to prove a causation, it only makes it more likely. For example, the rise in subsidies at the same time when the labour tension increases is suspicious, but it cannot be proven to be a significant cause of the current labour tension.

7.4 FURTHER RESEARCH

It would be very interesting to see what further studies have to say about the presented frameworks, arguments, and conclusions. In this paragraph some interesting questions that remain open will be proposed.

It would be interesting to see whether the correlation between excess labour demand (vacancies) and labour volume holds when studying a larger period (so before 1997). In addition, it would be nice to see whether there are also clear instances where labour supply changes quickly (for example the mass emigration after WW2), this can provide insights whether it is indeed the 'normally' slow changing nature of labour supply that makes labour demand more often responsible for changes of labour market tension.

It would be interesting to study government expenditure and business investment more. This might give more hypotheses about why the aggregate demand increased.

The last interesting topic that could be further investigated is whether fiscal stimulus and rapid changes in savings and expenditure behaviour of households are indeed the correct and significant explanation for the change in aggregate demand and labour demand. To test these hypothesis', it would be nice to study occasions that have similar characteristics during other time periods or in other countries. It would furthermore be interested to see whether counterfactuals exist, are there for example countries where no fiscal stimulus was given and individuals did not save more during COVID-19, and is the labour market less tense than in the Netherlands?

8 CONCLUSION

The aim of this thesis is to answer the research question: *Which factors cause the labour market tightness in the Netherlands after 2021?* The short answer is that an increase in demand for labour causes it. A longer answer is given below, and an even longer answer is found in chapter 5. However, to answer this question first, the literature is reviewed to find whether there are already hypotheses or even direct answers to this question. Although some interesting potential causes are already identified in the literature, there is no complete answer, and none of the papers describe the specific situation in the Netherlands. This indicates that there is currently a knowledge gap, and because a well-functioning labour market is an important factor for a well-functioning economy, answering this question is significant.

The following causes are found in the literature that could have led to the labour shortage: a lower labour force participation rate due to COVID-19 related health issues, fiscal stimulus, migration changes, a (nominal) wealth gain, changes in desired type of work and increased export. Some of these found causes suggest that the supply of labour is responsible for the current labour market tension, while other found potential causes of the labour market tension point to an increased labour demand. Literature about the labour shortage occurring after the COVID-19 pandemic proposed different explanations. Most of these articles describe the labour shortage in the U.S., U.K., and OECD in general.

The labour market is studied by looking at the supply of labour and the demand for labour, the difference between the two is regarded as labour shortage. In order to analyse these two key drivers the labour supply is split into smaller components, while the CES production function is used to analyse labour demand. Labour productivity also in potential an important driver of the state of the labour market and is therefore also analysed.

So, in order to understand which drivers ultimately led to the tight labour market, the supply side and the demand side of the labour market is studied.

The first important conclusion that can be made from the data is that the total amount of labour measured in hours supplied in the Netherlands is historically high during the period in which the labour 'shortage' takes places. Furthermore, the unemployment is historically very low. This indicates that the tightness in the labour market cannot be caused by a lack of labour supply. So, the labour tightness must have been caused by some other factor.

The components of labour supply did show some changes. It can be seen clearly in the data that the increased number of hours supplied is mostly because the population increased and because the labour force participation rate increased. COVID-19 did probably impact the labour supply side negatively as can be seen in the increased sick leave ratio. However, this downwards pressure on the labour supply was not enough to cause a decrease in the hours of labour that have been supplied.

The demand for labour clearly did increase and is seen as the proximate cause of the current labour shortage. The number of vacancies and the total number of worked hours in the Netherlands are at a historically high level. This demand for labour seems to be the answer to the question of why a tight labour market formed in the Netherlands after 2021.

The direct reason for more labour demand is an increase in the demand for products and services. This effect seems to be moderated by relative stagnant real salaries. Why however there this increase in demand for products and services is occurring is less clear. There are three important hypotheses formed inside this thesis.

The first hypothesis is that during COVID-19 households saved more than during normal periods, having more savings allowed households to consume (or desire to consume) more products and services after COVID-19 ended, causing more demand for products and services. The reason why households could save more during COVID-19 is twofold. The first reason is that they could physically spend a lot less money due to COVID-19 restrictions or risks. The second reason is that the government ensured that most households would retain at least most of their income, they did this by providing subsidies and loans primarily to businesses in the form of COVID-19 support packages. It is also possible that some of the loans and subside did not reach workers but where instead used by businesses themselves, loans subsidies are typically spent so this still would have increased aggregate demand.

The second hypothesis is that there are a lot of exogenous factors that cause an increasing demand for labour. This exogenous demand is relevant for the healthcare sector due to an aging population and the recent pandemic. For the energy sector the transition to green energy demands more labour. For the education sector policy choices could have had an impact on the demand for teachers. And at last, it is seen that the government has also increased its demand for labour which seems to be exogenous rather than dependent on a raised aggregate demand.

The third hypothesis states that the net export has risen causing more demand for labour. This factor could be caused by COVID-19 since some large exporting countries experienced longer and more severe lockdowns than the Netherlands (most notably China), resulting in a decrease of supplied products on the international market.

Whether businesses overreacted and caused more labour demand than was needed for the amount of work, cannot be determined.

In the last 26 years there have been more periods of a tense labour market. It seems that in each case these have been caused by an increased demand for labour, rather than a shortage of labour supply. Evidence for this fact includes the observation that the correlation between labour volume and the number of vacancies is positive, a fact that can only be logically explained if more vacancies cause more hours worked. If changes in supply would be causing labour tightness labour volume would be expected the correlate negatively with the number of vacancies. The other piece of evidence in favour of the hypothesis that changes in labour demand primarily causes changes labour market tightness is that the number of vacancies changes prior to a change in the labour supply.

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APPENDIX A – DERIVATION OF CONTRIBUTED CHANGE

One of the quantitative analyses tools that is used throughout this thesis is the calculation of how much certain variables attributed to the total amount of change.
To give simple example take 3 individuals with each a different amount of money e.g. A250, B1000 and C750 euro, the total amount of money is now 2000 euro. When each account receives 5% interest the total money supply goes to 2100 euro. But how much did each person contribute to the extra 100 euro? Person B contributed 50 euro or 2.5%. , Person A contributed 12,5 euro or 0,6125%., and person C contributed 37,5 euro or 1,8875%. .

As is given in this simple example the percentage of each amount of money changed with the same percentage, however, because the amounts of money did not have the same weight they did not contribute the same amount of money to the overall change. In this thesis there are multiple occurrences where multiple variables that explain a total do not have the same weight and their absolute contribution needs to be calculated.

The proportionality is calculated by setting up the equation for two different points in time and subtracting these equations from one another.

$$H1 - H0 = P[15\text{-}75]1 * LFPR.n1 * WL.n1 - P[15\text{-}75]0 * LFPR.n0 * WL.n0$$

This equation can be rewritten as the following function.

$$H1 - H0 =$$

$$(P[15\text{-}75]1-P[15\text{-}75]0) * LFPR.n1 * WL.n1 + (LFPR.n1-LFPR.n0) * P[15\text{-}75]0 * WL.n1 + (WL.n1-WL.n0) * P[15\text{-}75]0 * WL.n0$$

The formula decomposes the change in hours worked into three different components: the contribution of population growth, the contribution of the change in the labour force participation rate, and the contribution of changes in the workload.

By dividing both sides of the equation by H0, we obtain the proportional change in hours worked that the variable between brackets has had on the change in total hours worked. Note that the order in which this equation has been derived is arbitrary; starting for example with the workload instead of the population will render slightly different results; this is because the different parts of the equation can be scaled by either variable from the second or first point in time.

APPENDIX B – CHANGE OF WORKERS PER OCCUPATION

Table B.1

Change and contribution to change of (components of) number of workers, per occupation

Occupation	Change	Contribution to change in total
Total of all occupations	**5,38%**	**5,38%**
01 Pedagogical professions	**10,61%**	**0,76%**
011 Teachers	7,08%	0,35%
012 Sports instructors	31,82%	0,15%
013 Childcare and education leaders	14,63%	0,26%
02 Creative and linguistic professions	**9,57%**	**0,24%**
021 Authors and artists	1,40%	0,02%
022 Artistic and cultural sector specialists	22,99%	0,22%
03 Commercial professions	**10,56%**	**1,13%**
031 Marketing and public relations advisors	43,45%	0,80%
032 Sales representatives and purchasers	25,81%	0,44%
033 Salespeople	-1,36%	-0,10%
04 Business, economics, and administrative services	**12,97%**	**2,35%**
041 Business management and administration specialists	27,72%	1,53%
042 Business management specialists	12,46%	0,47%
043 Administrative staff	4,05%	0,36%
05 Managers	**5,88%**	**0,29%**
051 General directors	-64,94%	-0,55%
052 Administrative and commercial managers	17,32%	0,24%
053 Production managers	40,14%	0,64%
054 Hospitality, retail, and service managers	21,79%	0,19%
055 Other managers	-67,74%	-0,23%
06 Public administration, security, and justice professions	**2,82%**	**0,10%**
061 Government officials and administrators	21,00%	0,23%
062 Legal professionals	8,82%	0,07%
063 Security workers	-11,92%	-0,20%
07 Technical professions	**1,38%**	**0,20%**
071 Engineers and mathematical researchers	34,60%	0,89%
072 Natural and technical specialists	21,16%	0,44%
073 Construction workers	-7,28%	-0,21%
074 Metal workers and machine assemblers	-11,52%	-0,24%
075 Food processing professions and others	-15,08%	-0,21%
076 Electricians and electronics assemblers	3,30%	0,03%
077 Production machine operators and assemblers	-24,64%	-0,37%
078 Construction and industry laborers	-16,67%	-0,13%
08 IT professions	**40,10%**	**1,72%**
081 IT specialists	39,64%	1,44%
082 IT specialists	42,62%	0,28%
09 Agricultural professions	**-15,84%**	**-0,35%**
091 Horticulturists, farmers, and livestock breeders	-17,96%	-0,33%

092 Agricultural laborers	-5,71%	-0,02%
10 Health and welfare professions	**7,84%**	**1,09%**
101 Physicians, therapists, and specialized professionals	14,12%	0,52%
102 Social and community professionals	17,09%	0,29%
103 Healthcare specialists	19,01%	0,50%
104 Social workers, group and residential care workers	-5,47%	-0,16%
105 Caregivers	-1,92%	-0,05%
11 Service professions	**-12,15%**	**-1,13%**
111 Personal service workers	-12,84%	-0,73%
112 Cleaners and kitchen assistants	-11,08%	-0,40%
12 Transport and logistics professions	**-7,25%**	**-0,55%**
121 Vehicle drivers and machine operators	-6,90%	-0,24%
122 Transport and logistics laborers	-7,55%	-0,31%
13 Other occupational class	**-31,58%**	**-0,46%**
131 Other occupational segments	-31,58%	-0,46%

Data from: Statistics Netherlands and authors calculations