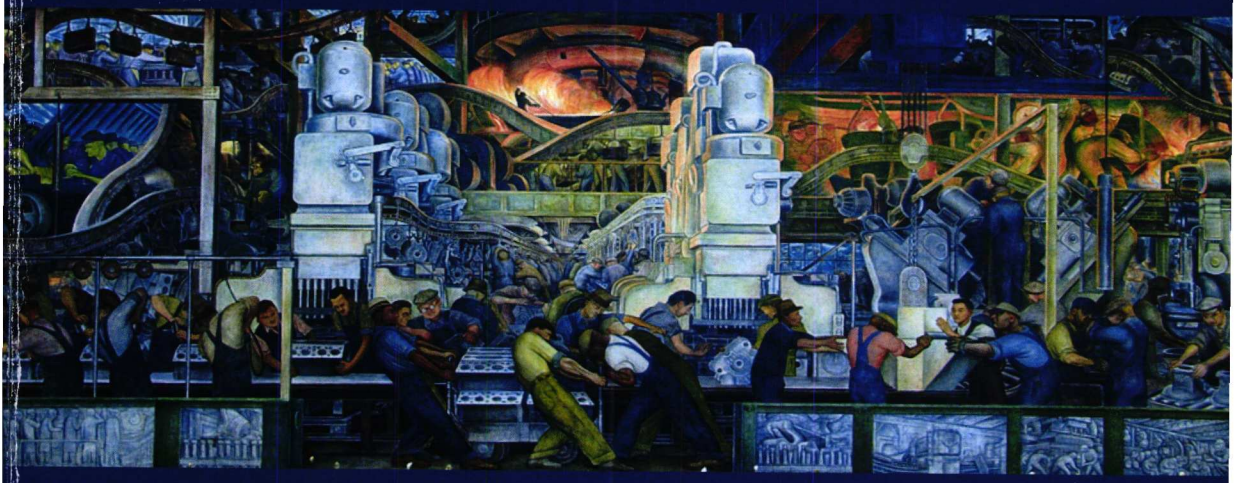
Labour market flexibility, productivity and employment

Robert Vergeer



Eigendom van
Robert Vergeer

Labour market flexibility, productivity and employment

Proefschrift

ter verkrijging van de graad van doctor
aan de Technische Universiteit Delft,
op gezag van de Rector Magnificus prof. ir. K. C. A. M. Luyben,
voorzitter van het College voor Promoties
in het openbaar te verdedigen op dinsdag 24 augustus 2010 om 15:00 uur

door Robert VERGEER
ingenieur Technische Bestuurskunde

geboren te Leiden

Dit proefschrift is goedgekeurd door de promotor:
Prof. dr. A. H. Kleinknecht

Samenstelling promotiecommissie:

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ISBN/EAN 978-90-9025557-6

Cover: Diego Rivera, *Detroit Industry*, North Wall, 1932 – 33, Detroit Institute of Arts

Printed by Sieca Repro, Delft, The Netherlands

Aan delen van dit onderzoek is financieel bijgedragen door NWO

Acknowledgement

Although writing a dissertation is a solitary task, without the invaluable contribution of many people, this thesis would not have seen the light.
First of all, I am very grateful to my supervising team Prof. dr. Alfred Kleinknecht, dr. Ro Naastepad and dr. Servaas Storm. The continuous support of the team was crucial for the project. We had many debates, from which I gained valuable insights.
Furthermore, I would like to thank the teachers of the econometrics courses I followed: Dr. Christiaan Heij, Dr. Marius Ooms (both Tinbergen Institute) and Prof. dr. Arthur van Soest (Tilburg University). Special thanks go to the latter for his comments on several parts of the thesis. I would also like to thank Federico Lucidi (University La Sapienza, Rome), Prof. dr. Andreas Pyka (University of Bremen) and dr. Geert Reuten (Universiteit van Amsterdam) for their comments on parts of the thesis. Furthermore, I would like to thank my new colleagues from the SP. Their flexibility allowed me to put in the time and effort needed to finish the thesis.
Next, I would like to thank my friends from the sections ECI and TSE for their stimulating remarks during seminars, coffee breaks and lunch. Adriana, Cees, Claire, Claudia, Dani, El, Elisa, Erik, Fardad, Geerten, Helen, Herman, Jafar, Joan, Marian, Marina, Michel, Pablo, Patrick, Roland, Ronald, Rossitza, Sergey, Victor and Zenlin: thank you for being a patient ear and for your motivating company. The same goes for my friends from the PhD-council: Bauke, Claire, Martijn, Michiel and Monica: thanks!
Also, I would like to thank Lotte, Niek and Paula for their support. Your contributions were more than crucial for the project. Thank you so much.
Of course, my friends and family supported me all the way through the dissertation project. Thank you for your endurance and tolerance with me. On balance, I suppose I should consider myself lucky: it seems that I managed to keep the friends I had when I started, and I may even have gained a few. Anyone who feels addressed: thank you so much! And I'm looking forward to going skiing, cycling, camping, hiking and playing UNO!
Special thanks go to my parents and brother. They were always there when I needed them, and provided me with their loving support.
Finally, I would like to give special thanks to Jorien. Jorien, I feel a privileged man that I can mention your name in this context, for I love you very much and feel very lucky to have you by my side. I think it is fair to say that this thesis was as much a challenge for me as it was for you in some aspects. Jorien, thank you for your kind and loving support!

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1. Introduction

This thesis is about the impact of labour market regulation on economic performance. This is a hotly debated issue, both in the policy arena as well as among economic scholars. Two topics surfaced at the centre of attention recently: First, does de-regulation of the labour market reduce unemployment as proposed by OECD (2006a), IMF (2003a) and Nickell *et al.* (2005)? Second, does deregulation of labour markets positively influence labour productivity growth and innovation as suggested by OECD (2007a) and Nicoletti and Scarpetta (2003)? This thesis will address these two questions.

The mainstream, orthodox[1], economic view has a clear answer to these questions. As the IMF (2003a, p. 129) puts it: "leading international institutions — the IMF, OECD and the European Commission — have long argued that the causes of unemployment can be found in labor market institutions. Accordingly, countries with high unemployment have been repeatedly urged to undertake comprehensive structural reforms to reduce labor market rigidities."

With regard to negative effects of rigid labour markets on productivity, Cohen *et al.* (2004) state: "The basic hypothesis relating policy and regulations to incentives for innovation and adoption is non-controversial, that is, policy barriers to resources being allocated to their highest valued use may have an adverse impact on economic performance in general, and on productivity growth in particular" (p. 77).

Bassanini and Ernst (2002b, p. 391) put it like this: "Institutions that make post-innovation employment adjustment more difficult or costly are likely to reduce innovation rents accruing to firms and hence innovative effort."

Following the mainstream literature, the debate on the effect of labour market institutions on productivity and employment can be short. The policy advice says: Governments should make labour markets more flexible. This thesis questions the plea for flexible labour markets.

Mainstream economics recognizes that there are 'good' as well as 'bad' institutions. In general, 'bad' institutions are supposed to cause frictions in the market: they hamper the adjustment process of the free market. They make the labour market more rigid. Hence in the orthodox parlance, they are called "rigid labour market institutions." They are, for instance, hypothesised to deter potentially growing firms from hiring new labour, or to prevent firms from experimenting with more efficient production techniques. Among labour market institutions that are typically suspected to cause rigidity are firing protection legislation, strong unions, minimum wages, taxes and unemployment benefits. The 'good' labour market institutions help the market to adjust more smoothly. Activating labour market policies designed to help unemployed people into new jobs are an example of a 'good' institution.

[1] 'Orthodox' refers to the neoclassical approach. The distinctive characteristic of the neoclassical approach is its emphasis on the existence and properties of a stable and optimal equilibrium in a clearing (labour) market. This broad definition encompasses approaches like the Walrasian, New Classical and New Keynesian theory.

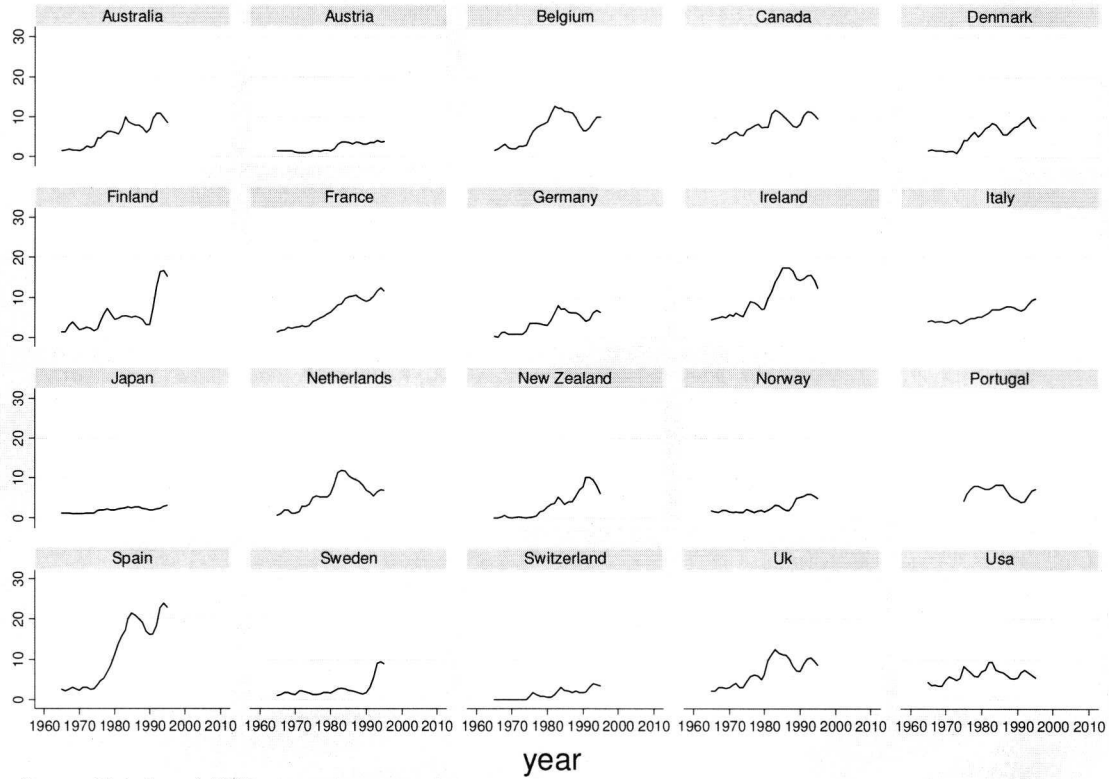
This thesis will focus on rigid labour market institutions. This choice is motivated with an eye to practical relevance, because many policy recommendations of international organisations like the OECD, EU and IMF centre around them. Governments' attempts to remove these rigid labour market institutions encounter societal resistance. This is not surprising when we realise that rigid institutions, are – for most workers – "protective labour market institutions" (Howell *et al.* 2007). Employment protection reduces job uncertainty, strong unions help to raise workers' incomes, minimum wages function as a wage-floor, etcetera.

The focus of the thesis will be on 20 OECD countries from the 1960s to the present. This makes the study relevant for contemporary policy discussions. The mainstream economic approach will be compared with alternative, heterodox, economic approaches. The point of departure will be to introduce the mainstream explanation for a phenomenon. Then we will critically investigate this explanation both on theoretical and empirical grounds.

1.1. The development of unemployment

Figure 1.1 depicts the development of unemployment for the 20 OECD countries that are the focus of the thesis.

Figure 1.1. Development of unemployment for 20 OECD countries, 1960s to the 1990s



Source: Nickell *et al.* 2005

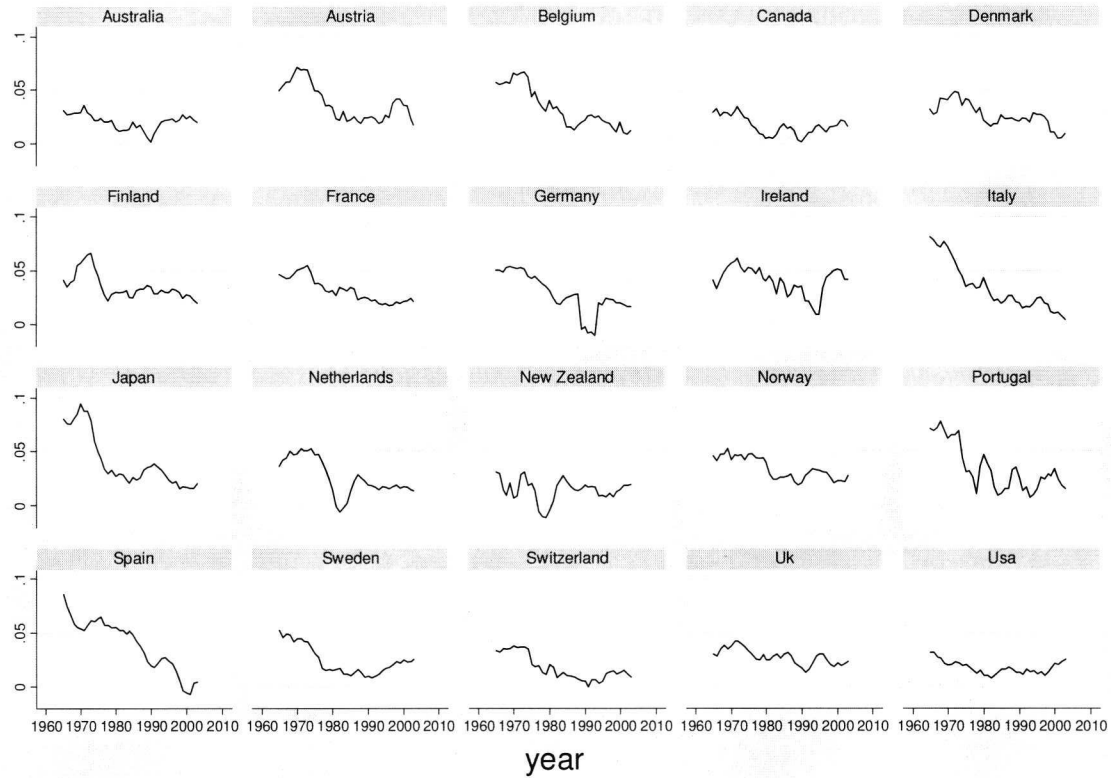
We observe that nearly all countries had a low unemployment rate in the 1960s and the first half of the 1970s. Unemployment started to rise during the oil crisis in the second half of the 1970s, in nearly all countries. The rise continued up to the 1980s. During the 1980s, the experience of different countries started to divert.
In the US, for instance, unemployment returned to "normal" values over the 1980s. In France and Germany, on the other hand, unemployment remained high or climbed even further, reaching a rate of 7.2% (Germany 1985) or 12.3% (France 1994). Mainstream economists have attributed the sluggish unemployment performance of Germany and France to excessive rigidity in the labour market (Nickell *et al.* 2005; Blanchard and Wolfers 2000).
Indeed, Germany and France do exhibit more rigid labour markets than the US, in the sense that they have stricter employment protection legislation, more powerful unions and higher unemployment benefits. However, a closer look at Figure 1.1 would inspire a more nuanced view on whether rigid labour markets cause unemployment. Comparing Canada and the US, we see that unemployment kept rising in Canada (to a rate of 11.8% in 1983) and hardly came down. This happened in spite of Canadian labour markets being nearly as flexible as that of the US[2]. On the other hand, countries like The Netherlands and Austria show low unemployment rates, in spite of having labour markets that are approximately as rigid as those in Germany and France. Such observations inspire a critical stance toward the mainstream explanation of unemployment.

1.2. The development of labour productivity

Figure 1.2 depicts the growth of labour productivity for the same countries as in Figure 1.1 over roughly the same period.

[2] Also, Howell (2005, figure 1.1) points out that, in the 1950s, the US had the highest unemployment rate of this group of countries, while at that time European labour markets would have to be considered more rigid already.

Figure 1.2. Development of labour productivity growth for 20 OECD countries, 1960s to the 2000s, 5-year moving averages

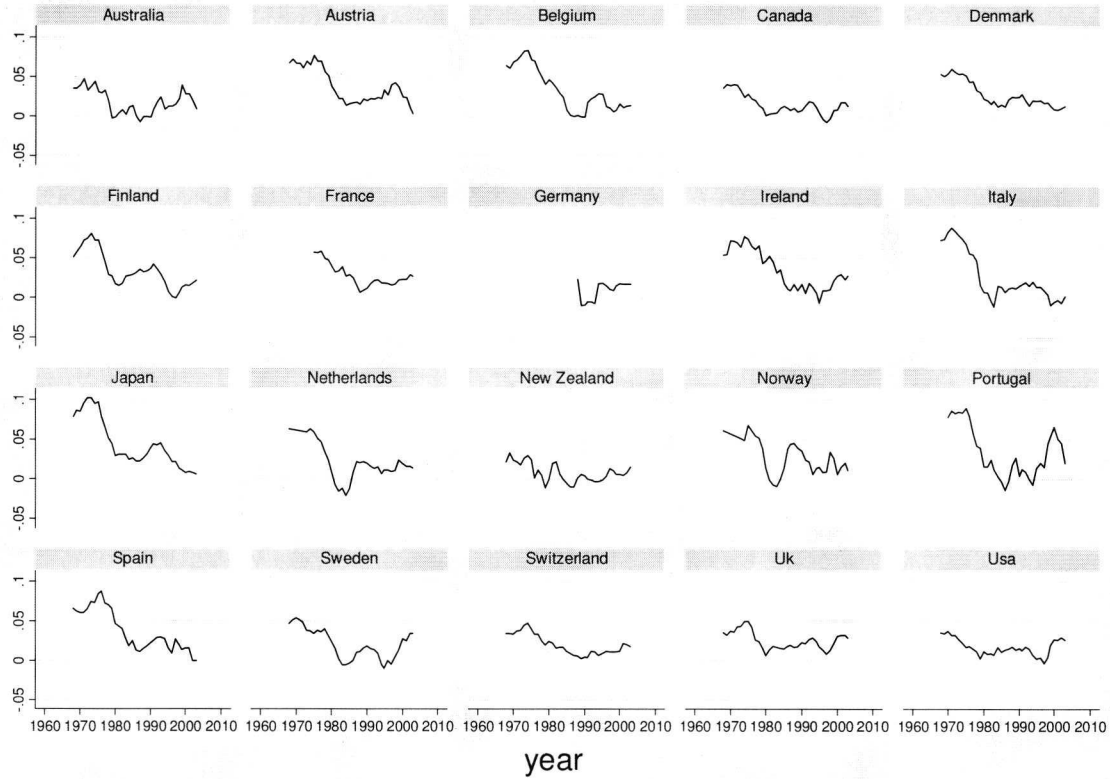


Source: "The Conference Board, Total Economy Database http://www.conference-board.org/economics", version from January 2009 (author's calculations).

We observe that most countries have suffered a productivity growth slowdown over the 1970s and the 1980s. On first inspection this holds both for countries with rigid labour markets as well as for countries with flexible labour markets, although the decline in countries with rigid labour markets started from higher growth rates. The mainstream hypothesis would predict the more flexible countries like the US, UK, Australia and New Zealand to run ahead of the more rigid countries in terms of productivity growth (see for instance Siebert 1997; Nicoletti and Scarpetta 2003; Cohen *et al.* 2004; OECD 2003b; OECD 2007a). The data presented in Figure 1.2 do not suggest that this hypothesis holds empirically.

However, if we compare the development of the growth of real wages (see Figure 1.3) with the development of productivity growth, some commonalities can be observed.

Figure 1.3. Development of real wage growth for 20 OECD countries, 1960s to the 2000s, 5-year moving averages



Source: author's calculations based upon the "Extended Penn World Tables", version from May 2009 and "The Conference Board, Total Economy Database http://www.conference-board.org/economics", version from January 2009.

We see that, akin to productivity growth, wage growth has dropped over this period for most countries. In this thesis, it will be argued that this is not a coincidence. While neoclassical economists would see the drop in wage growth as a consequence of the drop in labour productivity growth, this thesis will make arguments in favour of considering that there might *also* be an opposite causality: The drop in wage growth may have contributed to a slowdown in labour productivity growth. A mainstream economist would hypothesise that the causality runs exclusively the other way around. Although we do not deny that causality runs this way, we do point out that there might also be a causal link from wages to productivity. This seems logical, for instance if we acknowledge that a wage rise is a strong incentive for firms to economise on labour. In other words: to increase labour productivity. Chapter 5 addresses this topic.

1.3. Research approach

Inspired by the initial observations sketched above, research questions will be developed by critically reviewing the mainstream theoretical explanation for unemployment and productivity growth respectively. We will discuss some critical assumptions of these explanations: what assumptions are vital for the predictions of the model? How realistic are those assumptions? What happens if the assumptions are altered? The research methodology combines both a deductive and an inductive approach. It is deductive in the critical examination of key assumptions and their consequences. It is inductive in empirically testing the relevance of critical assumptions. In other words, next to critically reviewing theory, mainstream hypotheses will be empirically tested and contrasted with alternative hypotheses that follow from altering some of the fundamental assumptions. Econometrics is employed as a research tool.

1.4. Outline of the thesis

Chapters 2 and 4 deal with the question whether we need more flexible labour markets for the sake of reducing unemployment. Chapter 2 provides the reader with a review of theoretical and empirical considerations that surround the NAIRU (Non Accelerating Inflation Rate of Unemployment) hypothesis. The NAIRU hypothesis reads that unemployment is caused by too rigid labour markets (Carlin and Soskice 1990, Layard *et al.* 1991). Furthermore, NAIRU theory assumes that unemployment is needed to discipline wage earners: when unemployment is too low, their wage demands will cause a wage-price spiral.

The discussion of the NAIRU is structured around developments in theoretical and empirical literature since the appearance of the OECD Jobs Study (1994b). This study propagated very influential policy recommendations. The recommendations spurred member countries to deregulate labour markets. Apart from its policy impact, the study had a profound effect on scholarly research, inspiring efforts at acquiring relevant data for testing the NAIRU hypothesis.

It will be argued that the OECD Jobs Study recommendations are based on theoretical beliefs rather than on empirical evidence. This leads us to dive into the theoretical structure behind the NAIRU hypothesis. We will spell out critical assumptions that support this theory. Next, the validity of these assumptions will be assessed. And we will see what is left over of the NAIRU hypothesis when they are changed.

The empirical part of chapter 2 reviews the most influential studies that test the NAIRU hypothesis. We will see that the evidence for the hypothesis suffers from a lack of robustness. For example, Baker *et al.* (2005) show that small changes into the empirical set up - like adding a few years, or updating an indicator – lead to substantial changes in the estimation results, with parameters becoming (in)significant or sometimes even changing sign.
Chapter 4 deals with a robustness contest of a NAIRU explanation of unemployment and compares it to a Keynesian explanation of unemployment. It will be demonstrated that the influential study of Nickell *et al.* (2005) lacks robustness even if the same model is applied to the same dataset, but with small and seemingly innocent (but plausible) changes made to the exact specification, like adding an extra lag of unemployment. This finding will be compared with a Keynesian explanation of unemployment that centres on effective demand.

Chapters 3, 5 and 6 deal with the effect of rigid labour markets on productivity growth. Chapter 3 reviews theoretical and empirical studies. The theoretical part contrasts the neoclassical approach with heterodox approaches. It will be shown that even within neoclassical theory, there are arguments in favour of rigid labour markets. The empirical evidence leads us to support the idea that rigid labour markets spur labour productivity.
Chapter 5 theoretically and empirically analyses the question: what is the impact of wage growth on labour productivity? We find that a higher wage growth contributes to a higher productivity growth. This finding challenges the mainstream contention that flexible labour markets allow for downwardly adjustable wages and thereby spur labour productivity.
Chapter 6 provides a robustness analysis of the results found in chapter 5. We estimate the same relationship using a different estimation approach. Furthermore, we broaden the analysis by including the share of wages in National Income in the model. We confirm the results found in chapter 5. On top of this, we find that a higher wage share raises productivity. Chapter 7 covers our conclusions.

2. Do we really need more flexible labour markets to solve the unemployment problem?

2.1. Introduction: A first look at the unemployment problem

"The persistence of high unemployment in a number of industrial countries - notably in continental Europe - is arguably one of the most striking economic policy failures of the last two decades. A wide range of analysts and international organisations - including the European Commission, the Organisation for Economic Cooperation and Development (OECD), and the International Monetary Fund (IMF) - have argued that the causes of high unemployment can be found in labor market institutions. (...) Accordingly, countries with high unemployment have been repeatedly urged to undertake comprehensive structural reforms to reduce 'labor market rigidities'." (IMF 2003b, p. 129)

The quote above illustrates the dominant view on the incidence and cause of unemployment. It holds that labour markets are too rigid (Saint-Paul 2004; IMF 1999a) and points to the following institutions as primary suspects for causing unemployment: extensive firing restrictions, strong trade unions, high unemployment benefits of long duration, high labour taxes and the absence of activating labour market policies. All these institutional arrangements are supposed to hamper the clearing function of the labour market, impeding supply as well as demand (OECD 2007b);
The diagnosis that unemployment is caused by labour market rigidities is not new. It was earlier advanced by the OECD Jobs Study (OECD 1994b). The latter inspired a wide literature arguing that the European unemployment problem is due to labour market rigidity.

This chapter critically assesses the claim that unemployment is caused by rigid labour markets. The structure of the chapter is as follows. We start by looking in more detail into the OECD Jobs Study (1994b) and how it arrived at the labour market rigidity diagnosis. Next, we deal with the theoretical foundations of the diagnosis. Then, we discuss recent attempts at testing the diagnosis of rigidity as a cause of unemployment. In paragraph 2.4 we conclude that the empirical evidence is rather weak. This leads us to the question: is the evidence wrong (as some scholars have suggested) and/or is there something wrong with the theory that backs the rigidity view?

2.2. The OECD Jobs Study: unemployment through rigid labour markets

Faced with persistently high unemployment in a number of its member states, the governments of the OECD member states mandated the OECD to start research on the underlying causes and possible solutions of this problem. This research crystallised in the OECD Jobs Study (1994b). In its policy recommendations, the report sketches the strategy to resolve the unemployment problem. 5 out of the 9 recommendations concern the labour market; as is illustrated by the following quote:

"3. Increase flexibility of working time (both short-term and life-time) voluntarily sought by workers and employers.

5. Make wage and labour costs more flexible by removing restrictions that prevent wages from reflecting local conditions and individual skill levels, in particular of younger workers.
6. Reform employment security provisions that inhibit the expansion of employment in the private sector.
7. Strengthen the emphasis on active labour market policies and reinforce their effectiveness.
9. Reform unemployment and related benefit systems - and their interaction with the tax system - such that societies' fundamental equity goals are achieved in ways that impinge far less on the efficient functioning of labour markets." (OECD 1994b).

The language of these recommendations is rather diplomatic. A second reading tells us in what direction the OECD report intends to push reforms. Recommendations 5, 6 and 9 aim at making wages more flexible in *downward* direction. Recommendation 3 aims at enlarging the supply of labour. This reinforces the effect of the other recommendations because a larger labour supply keeps wage demands in check. Recommendation 7 can also be seen in this light: active labour market policies increase labour supply.

In spite of the force by which the policy recommendations are presented, the OECD recognises in its introduction that it actually misses a number of relevant data for testing backing their diagnosis and for an empirical assessment of the effect of the proposed policy recommendations: "No avenue of research was excluded in seeking both the causes of unemployment and appropriate solutions. Numerous gaps in available data made this task more difficult, and a number of questions persist." (OECD 1994b, foreword). In fact, the recommendations of the OECD in 1994 were almost entirely based on theory. The search for empirical "justification" has subsequently inspired economic research.

Table 2.1 is intended as a substantiation of the point that the OECD's (1994b) recommendations were mainly theory-driven. The table summarizes the availability of data on labour market institutions, those institutions being broadly defined as affecting behaviour on the market that brings together demand for and supply of jobs.

The 1994 Jobs Study dataset consists of a cross section of 20 OECD-countries for the mid 1980s period and has observations for activating labour market policies, union coverage, coordination in wage bargaining, the duration of unemployment benefits and the benefit replacement ratio related to the median wage. The estimates by Layard *et al.* (1991, p. 55) employ the same cross section dataset or amend it (p. 433-434) with the time-varying replacement rate developed by Emerson (1988). For most labour market institutions only one cross-section of just 20 observations existed at the time of the Jobs Study. For the strictness of employment protection, judging from the fact that they were not used in the regressions, no measures of the desired quality were yet available[3].

The table below provides an overview of a number of relevant measures of labour market institutions and when they became available. We observe that the appearance

[3] This chapter mainly deals with the quantity of data available. Quality of the data, however, is also an issue. More on this below and see Howell *et al.* 2007.

of the OECD Jobs Study spurred an explosion in the effort to come up with relevant data, both by the OECD and by other researchers. As Howell *et al.* (2007) concluded: "The 1994 Jobs Study triggered a major OECD effort to produce better quality institutional measures." (p. 11).

Table 2.1. Development of the availability of data on labour market institutions

Study	LMI's[(a)]	Coverage of dataset	
McCallum 1983	ud	19 OECD countries, 1965-1977	Data on LIM's before OECD jobs study
Tarantelli 1986	coord	19 OECD countries, cross section early 1980s	
OECD 1988	almp	20 OECD countries, cross section, 1987	
Emerson 1988	brr	19 OECD countries, 1956 - 1988	
Calmfors and Driffil 1988	coord	17 OECD countries, cross section early 1980s	
Lazear 1990	epl	22 OECD countries, 1956 - 1984	
OECD 1991	ud, brr	ud: 24 OECD countries, 1970, 1975, 1980,1985,1988; brr: 20 OECD countries, late 1980s	
Layard *et al.* 1991	almp, bd, brr, cov, coord[(b)]	20 OECD countries, cross section 1985	
OECD 1993	almp added with Layard *et al.* 1991	almp: 20 OECD countries, 2 early 1990s observations	
OECD Jobs study (1994b)	brr	20 OECD countries, 1961 – 1995, every odd year; combination of data form studies above.	
OECD 1994a	coord, cov, ud	17 OECD countries, 1 observation for 1990	
OECD 1995	almp	20 OECD countries, 1990 – 1993/94, yearly observations	
Scarpetta 1996	almp, brr, epl, ud, coord	17 OECD countries, 1983 - 1995	
OECD 1997	ud, cov, coord,	19 OECD countries, observations for 1980, 1990, 1994	
Nickell 1997	epl, brr, bd, t, almp, ud, cov, coord	20 OECD countries, average 1989-1994 period	Data on LIM's after OECD jobs study
Elmeskov *et al.* 1998	epl, brr, almp, ud, coord, t	19 OECD countries, 1983-1995	
OECD 1999a	epl, brr, bd, almp, t added with OECD 1997	20 OECD countries, 2 observations per country (late 1980s, late 1990s)	
Blanchard and Wolfers 2000	epl, brr, bd, almp, ud, coord, t, partly based on Nickell 1997	20 OECD countries, 1960-1995, 8 5-year average observations.	
Belot and van Ours 2004	epl, brr, ud, coord, t	18 OECD countries, 1960-1996,	
OECD 2004	epl, coord, ud	EPL: 20 OECD countries, 3 observations: late 1980s, late 1990s, 2003 Coord: 1970 – 2000, 6 cross sections of 5-year averages	
Baker *et al.* 2005	epl, brr, bd, ud, coord, t, almp, cov	20 OECD countries, 1960 – 1999, 5-year averages	
Nickell *et al.* 2005	epl, brr, bd, coord, ud, t	20 OECD countries, 1960 – 1995	
Bassanini and Duval 2006	epl, coord, ud, cov, almp, t	21 OECD countries, 1982 – 2003	

Notes:
(a) ud=union density; almp=activating labour market policies, brr=benefit replacement rate, coord=bargaining coordination, epl=employment protection legislation, cov=union coverage, t=labour taxes
(b) This dataset is compiled from various sources mentioned above; see Layard *et al.* 1991, p. 55 and 514-515, 517-524.

The effort of data gathering in order to empirically test the hypothesis that rigid labour markets are responsible for high unemployment is admirable. While before 1994, only

poor data on labour market institutions were available, research after 1994 produced much richer data on such important indicators as unemployment benefits, union density and employment protection legislation. However, this also raises the question: if hypotheses at that time could not be properly tested, then why were the policy recommendations so forcefully advanced? Seemingly, researchers must have been driven by theoretical arguments and a priori beliefs. An example of the 'faith' of the authors is cited by Howell *et al.* (2007, p. 13-14):

"Although no evidence of a statistically significant relationship between unemployment benefit generosity and unemployment is presented for any particular point in time, Chapter 5 of the Jobs Study states confidently:
'Increases in (...) unemployment compensation have typically been followed by an increase in unemployment." (OECD 1994b, p. 44) "In Canada, entitlements rose in 1972 and unemployment rose unusually in 1978 (...). In Finland, entitlements rose in 1972 and unemployment rose sharply (in contrast to its Scandinavian neighbors) through to 1978; in Ireland, changes increasing entitlements occurred over 1971 to 1985, and its rise in unemployment was particularly large (as compared to other European countries) from 1980 to 1985. (...) Entitlements rose in Sweden in 1974 and in Switzerland in 1977, with major rises in unemployment in 1991 in both cases. (OECD 1994b, p. 178)'"
Note that the periods of rising unemployment mentioned in the text, are mostly periods of (global) recessions. The unemployment rise in Canada and Finland in 1978 is at the peak of the oil crisis. The rise in Ireland from 1980 to 1985 is well within of the 80s slump. And the unemployment rise in Sweden and Switzerland in 1991 falls into a period of recession caused by factors other than labour market institutions.
In spite of the loose connection between labour market institutions and the rise of unemployment and in spite of the large time-lags (sometimes over 10 years) between the increase of rigidity in the labour market and the rise in unemployment and in spite of the lack of a rigorous statistical testing of the relationship, OECD researchers connect these incidences of unemployment with labour market rigidity. That leads Howell *et al.* to conclude: "Such breathtaking leaps in association must require extremely strong theoretical priors." (Howell *et al.*, 2007, p. 14). In the following, we closely examine the theory that lies behind these priors.

2.3. Theory behind the OECD Jobs Study: NAIRU theory

The OECD (1994b) Jobs Study focuses on explaining the "structural" rate of unemployment. The term "structural" refers to this unemployment rate being the equilibrium of the economy in the sense that it is consistent with stable inflation. Hence it is a NAIRU (Non-Accelerating Inflation Rate of Unemployment).
In this thesis, we refer to the NAIRU theory as it is prominently propagated by Layard *et al.* (1991) and Carlin and Soskice (1990). It resembles the neoclassical labour market theory (Blanchard 2007) in two respects. First, it employs a downward sloping labour demand and an upward sloping labour supply curve, assuming that the intersection of both curves represents a stable equilibrium in the labour market with a corresponding unemployment rate. Second, the intersection (i. e. both or one of the curves) shifts upwards when the labour market becomes more "rigid". Hence equilibrium unemployment shifts upwards when the labour market becomes more "rigid".

The main difference between neoclassical labour market theory and NAIRU theory is that the latter allows for an involuntary unemployment equilibrium even in the absence of minimum wage legislation while the former does not. That is, in NAIRU theory, the labour market is not completely competitive. Workers have market power, hence they can push up wages above the reservation wage of the unemployed. Unemployment then is considered involuntary, in the sense that the reservation wage is below wages actually earned by workers. In neoclassical theory workers cannot exercise market power. Hence labour market rigidities just push up the reservation wage, indeed pushing up unemployment as well. This unemployment is considered voluntary in that workers choose a higher reservation wage when, for instance, unemployment benefits are high. However, to solve unemployment, both theories would point to removing rigidities in the labour market. The results of orthodox NAIRU theory are what Stockhammer (2004b, p. 62; 2008, p. 3) refers to as the "NAIRU story".

The orthodox theory behind the NAIRU concept supposes a trade-off between inflation and unemployment: there is only one unemployment rate consistent with a stable inflation. This will be treated in more detail later on in this thesis. In the OECD Jobs Study chapter about the macro-economic environment, it is mentioned that: "Experience suggests that setting macroeconomic policy in a way that aims to boost growth at the cost of higher inflation, would be likely to result in accelerating inflation." (OECD 1994b p. 31). This statement implicitly employs a NAIRU concept. In the OECD's 1993 employment outlook, the empirical model used to estimate the effects of different labour market institutions on long run (structural) unemployment is based on the work of Layard *et al.* (1991), which employs orthodox NAIRU theory (p. 377). This work has remained the main reference until at least as recent as the OECD's employment outlook (OECD, 2006, box 7.1). The reduced form equation that is estimated in Bassanini and Duval (2006) – on which OECD (2006a) is based - is derived using the canonical wage-setting/price-setting model that produces a NAIRU as the structural unemployment rate.

The theory behind the NAIRU supposes that the NAIRU is the equilibrium rate of unemployment in the economy: the economy naturally converges to this rate. The reasoning is that if the unemployment rate is below the NAIRU, then inflation will rise. A rising inflation leads to a slowdown of the economy and thus a rising level of unemployment. This process continues until the rate of unemployment coincides with the NAIRU. Vice versa, if the rate of unemployment happens to be higher than the NAIRU equilibrium level, then falling inflation rates will stimulate the economy until unemployment drops to the level of the NAIRU. Eventually, the theory predicts, the unemployment rate will stabilise at or fluctuate around the NAIRU equilibrium level. Hence the NAIRU functions as a real anchor, always keeping the real unemployment rate close to it.

If this theory is accepted, then the question arises: what determines the value of equilibrium unemployment according to the NAIRU theory? And are we able to bring this equilibrium level down? The answer from NAIRU theory is: it all depends on labour market institutions. If you want to reduce unemployment, try to remove rigidities in the labour market. In other words, remove firing protection legislation, reduce minimum wages, bring down social benefits (and reduce their duration), and weaken trade unions that are responsible for such rigidities.

Why is, in orthodox NAIRU theory, rigidity in the labour market responsible for high unemployment? NAIRU theory models inflation as the outcome of a distributional conflict between wage-earners and profit-earners. The basic idea is that total output that is produced in the economy is divided between these two groups as reflected in the shares of capital income vis-à-vis wage income in National Income. If workers try to increase their share in National Income at the cost of the share of profits, then profit-earners will react by raising prices to reclaim their original share in National Product. So the inflation-generating process consists of two separate mechanisms: one that explains wage formation, and one that explains price formation. The price formation mechanism is very simple: if nominal wages grow with a certain rate then workers would claim a higher portion of total output. When setting prices, profit earners let prices grow with exactly the same rate, so the original income distribution remains. Hence we see that the growth of nominal wages (wage-inflation) is directly translated into price-inflation. The crucial question thus becomes: how does wage-inflation arise? There are two versions of NAIRU theory that differ in the exact mechanisms that are responsible for wage inflation.
The first is based on a bargaining model: it models nominal wage formation as the outcome of a bargaining process between labour unions and employers' organisations (see for instance Layard et al, 1991, p. 100 – 111 or Carlin and Soskice, 1990). It hypothesises that – for instance – more rigid employment protection, higher benefits and more powerful unions strengthen the bargaining power of labour. Thus – everything else equal – they will obtain a higher bargained nominal wage increase.
The second is based on a search model (see for instance: Pissarides 1990). It models nominal wage formation as the outcome of a search process, i.e. search for employees by firms and search for jobs by employees. Employees only accept jobs with wages significantly above the level of benefits. So if benefits are higher or their duration is longer, then nominal wages will increase.

From this we can see how rigid labour markets cause inflation. In the next step, the question arises: how does NAIRU-theory connect inflation to unemployment? The answer is that in both versions of the wage setting mechanism, a high existing rate of unemployment has a dampening effect on nominal wage growth. Why? On the one hand, the high number of unemployed people that compete for jobs keep trade union wage demands in check. On the other hand, the prospects for a unionized worker becoming unemployed are more dim when unemployment is high. Hence, wage demands will go down with a higher unemployment rate. The opposite holds for lower unemployment.

Summarizing, the NAIRU theory supposes that there is a trade off between wage demands and unemployment, while rigid labour markets increase wage demands. The wage growth is reflected in price growth because of a distributional conflict. Hence we are confronted with a higher rate of inflation in the case of more rigid labour markets. Higher inflation causes the economy to slow down[4], which raises unemployment. The increased number of unemployed quells wage demands and slows down inflation. At the equilibrium rate of unemployment, inflation is stable. This rate is called the NAIRU. It is characterised by a trade-off between the rigidity of labour market institutions (inflation-accelerating) and the unemployment rate

[4] The transfer mechanism from higher inflation to higher unemployment will be discussed below.

(inflation-decelerating). Hence if we want to reduce unemployment, we have to make labour markets more flexible.

For our critical review of NAIRU theory we will first summarize NAIRU theory in a wage setting and a price setting model. With this model, we follow Storm and Naastepad 2007a and OECD 2006a, (p. 10). Models that can be summarized like this (under a wage-setting and a price-setting model) go back to the work by Layard *et al.* 1991 and Carlin and Soskice 1990. We start from the basic assumptions on wage and price setting on which NAIRU theory rests.

2.3.1. Assumptions behind orthodox NAIRU theory

This paragraph lists the assumptions behind orthodox NAIRU theory. Later on, we will critically examine the appropriateness of these assumptions.

Assumption on price setting: prices grow proportionately with wages

To start with, there is an assumption on the behaviour of firms with regard to how they determine their prices: prices grow in line with the growth of nominal wages as summarized in equation 2.1.

$$\hat{p} = \hat{W} - \hat{\lambda} \qquad \text{equation 2.1}$$

here, $\hat{p}$ denotes price growth, $\hat{W}$ denotes the growth of nominal wages and $\hat{\lambda}$ denotes the growth of labour productivity.

The idea behind this equation is that profit earners will defend their share in National Income. Hence they will rise prices just enough to keep this share constant.

Assumption on wage setting: wages grow proportionately with productivity and prices

Next, there is an assumption on wage setting, where wage claims grow faster if workers are not so much in fear of loosing their jobs. Thus wages grow faster when labour productivity and prices grow faster, and when there is more rigidity in the labour market or when unemployment (u) is lower[5]. See equation 2.2.

$$\hat{W} = \hat{W}_0 + \hat{\lambda} + \hat{p} - \beta_{u,\hat{W}} u + \beta_z' Z \qquad \text{equation 2.2}$$

where $\hat{W}_0$ denotes autonomous wage claims, Z denotes a vector of indicators for rigidity in the labour market and the β's are the respective (vectors of) coefficients. Note that in NAIRU theory, autonomous wage claims are assumed constant. The wage equation implies that workers will raise the wage share if unemployment goes down and/or rigidity in the labour market goes up.

[5] Note that the rational expectations hypothesis is implicit in this equation, as it is assumed that workers "know" future inflation. One may wonder whether this is a realistic hypothesis. This is, however, not the subject of this thesis.

Assumptions on the negative feedback from inflation to unemployment through the real balance effect

NAIRU theory offers two mechanisms that are responsible for the feedback from inflation to the unemployment rate. The first is the real balance effect, the second is the central bank reaction function. We first deal with the real balance effect.

The real balance effect (Pigou 1943; Sweeney 1988) hypothesises that people consume out of expected real income ($\overline{Y}$) and the real value of financial wealth (We/P). Furthermore, it assumes that unemployment is a negative function of consumption (equation 2.4). In other words, consumption depends on current wage income plus accumulated savings and unemployment depends on consumption.

$$C = f(\overset{+}{\overline{Y}}, \overset{+}{We/P}) = C_0 + \beta_y \overline{Y} + \beta_{We} We/P \qquad \text{equation 2.3}$$

$$u = f(\overset{-}{C}) = \beta_c / C \qquad \text{equation 2.4}$$

In equation 2.3, We denotes private sector financial wealth, P denotes the price level and C denotes consumption. Pigou (1943) left out the effect of investment on demand because he considered a stationary state (equilibrium) where net investment is zero.

In general terms, the real balance effect hypothesises that people will spend more of their financial wealth when they see its real value unexpectedly increased (due to an unexpected fall in inflation). The real balance effect stabilises unemployment, because demand is stimulated when inflation unexpectedly slows down due to an unemployment rate that is above the NAIRU.

The real balance effect invokes three assumptions:
1. People have a stable notion of an exogenously given expected income. This implies that people have a notion of the income they expect to receive over their lifetime. This expected income is exogenously given.
2. People consume in a time consistent manner: they distribute the total income they (expect) to receive in their life over their lifetime according to their preferences. Hence people who currently have acquired a certain financial wealth did this because they want to add the real value of this wealth to their future consumption or to the bequest for their offspring.
3. The monetary value of private sector financial wealth is exogenously given and stable. If prices increase, the real value of financial wealth in the economy drops below the level people prefer in relation to their (expected) real income. This happens because their real wealth declines, while their real income does not change.

The three assumptions result in the effect that people will react to an unexpected increase in inflation by diminishing current consumption to restore (or rebalance) the ratio between real savings and real income. So the effect of unexpected inflation (caused by unemployment being below the NAIRU) is a reduction in current spending, hence a reduction in current demand for output and thus an increase in unemployment towards the "equilibrium rate" of the NAIRU. This process continues until inflation stabilises and unemployment settles at the NAIRU.

Assumptions on central bank behaviour: the central bank's interest rate policy helps the economy to reach the NAIRU

This stabilizing mechanism hypothesises that central banks intervene to stabilise inflation through an interest rate reaction. Taylor's (1993) widely used model of the central bank reaction function is the corollary of this mechanism. The central bank reaction function supposes that the interest rate is a positive function of (expected) inflation and a negative function of the unemployment gap (the difference between unemployment and the NAIRU). A higher interest rate causes demand to fall and hence, ceteris paribus, unemployment to rise.

Thus, we can model a simple version of the central bank reaction function using the Taylor rule as follows (Taylor 1993; equation 2.5):

$$i = r_0 + \hat{p} + \beta_{\hat{p}}(\hat{p} - \hat{p}_T) - \beta_{u,i}(u - \bar{u}) \qquad \text{equation 2.5}$$

$$Y = I(\bar{i}) + C(\bar{i}) \qquad \text{equation 2.6}$$

$$u = f(\bar{Y}) \qquad \text{equation 2.7}$$

Where i denotes the interest rate targeted by the central bank (i.e. the short run interbank lending rate), r_0 the natural rate of interest[6] (Wicksell 1898), $\hat{p}$ inflation and $\hat{p}_T$ the inflation target, u the actual unemployment rate and $\bar{u}$ is the NAIRU.

equation 2.6 reflects the effect of interest rate changes on aggregate demand (Y). A rise in interest makes investment (I) less profitable. Furthermore, it encourages savings and discourages consumer credit. Hence, consumption (C) slows down with a rising interest rate. equation 2.7 states that unemployment is a negative function of aggregate demand.

The three equations above imply that if inflation is above the Central Bank's target, the central bank will raise its interest rate. This will reduce investment and consumption. Hence demand will fall and unemployment will increase. This delivers the desired feedback mechanism that brings unemployment back to the NAIRU.

2.3.2. Summary and conclusions from NAIRU theory

We can summarize the above as follows: The NAIRU is the equilibrium size of the buffer stock of unemployed people needed to keep inflation constant. This equilibrium is stable in the sense that disturbances that push the unemployment rate out of the equilibrium are "automatically" corrected

The assumptions on wage setting and price setting (as reflected in their respective equations) generate an equilibrium level of unemployment as a function of exogenous variables only. We can find the expression for equilibrium unemployment by

[6] The natural rate of interest is the real interest rate that is associated with equilibrium in the real economy. Hence if unemployment and inflation are at their targets, this is the interest rate the central bank should set to keep the economy in that position. Orthodox NAIRU theory assumes that the natural rate of interest is stable. More on this below.

substituting the price setting equation 2.1 into the wage setting equation 2.2 and rearranging:

$$\bar{u} = \frac{\hat{W}_0 + \beta_Z Z}{\beta_{u,\hat{W}}} \qquad \text{equation 2.8}$$

Here, $\bar{u}$ denotes the NAIRU. If we substitute the NAIRU for unemployment in the wage equation 2.2, we see that price inflation implied by wage setting equals price inflation implied by price setting (i.e. both wage earners and profit earners are content with their shares in income). Hence inflation is stable.

The unemployment rate can be interpreted as a buffer stock[7] of unemployed people that can be readily employed. They are competitors for people who occupy a job and for other unemployed. They serve to keep wage demands and thus inflation down. The real balance effect and/or the central bank interest rate policy ensure that the NAIRU equilibrium is stable.

There is a trade-off between the size of this buffer stock and the rigidity of the labour market

Above, it was stated that the buffer stock of unemployed people serves to keep wage demands down by assuring that there is enough competition for jobs. Labour market rigidities diminish the effectiveness of this competition: they can either limit the labour supply (for instance when social benefits are high or of long duration), limit the labour demand (when taxes and firing costs are high) or they can push up wages above the reservation wage of the unemployed (workers' wage demands go up when union bargaining power increases or when workers are less afraid of being fired when firing protection is stronger). In conclusion, rigid labour market institutions limit the downward effect on wage demands of the buffer stock of unemployed people.

Hence we arrive at the result that the size of the buffer stock of unemployed people needed to stabilise inflation (the quantity of competition for jobs) is reverse proportional with rigidity in the labour market (a measure for the quality of competition for jobs).

No other factors – like demand, the history of unemployment or productivity – influence the size of this buffer stock

From equation 2.8 that expresses the NAIRU in terms of autonomous wage demands, labour market rigidity and a few parameters, we see that all other factors are ruled out as causes for long run unemployment. The NAIRU is a supply-side equilibrium: only measures that influence the supply of labour affect the NAIRU. Factors like prices, expectations, demand, the history of unemployment, productivity or interest rates do not influence it. In the long run, the unemployment rate converges towards the NAIRU.

[7] The term buffer stock is used here, because below we will distinguish more buffer stocks that have an effect on the NAIRU.

The results of orthodox NAIRU theory resemble the results of the neoclassical theory of the labour market.

This may be an explanation for the popularity of orthodox NAIRU theory. Starting from a simple supply and demand schedule in the labour market, we would come to the same conclusions if we assume that rigidity in the labour market shifts up the supply curve[8]. But the analogy extends further. The wage setting equation can be rewritten as an upward sloping labour supply curve. And, "in the presence of decreasing returns to labor, price setting implies an increase in the price given the wage as employment increases[9]. Put another way, it implies a negative relation between employment and the real wage - just like labor demand." (Blanchard, 2007, p. 411).

The fact that the basic assumptions of the NAIRU and its results resemble the characteristics of the neoclassical model has probably contributed to the popularity of the NAIRU theory among economists. The NAIRU fits well within the paradigm of the neoclassical theory, in a Kuhnian (1962) sense. Following Lakatos (1974), we would argue that the NAIRU does not refute the hard core of the neoclassical research program, but fits well within this research program as reflected in the basic assumptions of the NAIRU. Furthermore, the results of the NAIRU are in line with the irrefutable results (hypotheses) of the neoclassical paradigm (i.e. the economy exhibits a stable equilibrium that is determined by supply side factors only; deregulation is favourable for total output).
NAIRU theory can be seen as contributing a small number of auxiliary hypotheses (reflected in the assumptions on wage and price setting) to neoclassical theory which are necessary to rigorously explain the upward shift in the labour supply function that is caused by rigidity in the labour market. On the other hand, the irrefutable hypotheses of the neoclassical research program are left unaltered. This makes it easy for economists within the neoclassical research program to accept the NAIRU theory.

Let us now turn to empirical evidence: is orthodox NAIRU theory backed up by empirical studies?

2.4. Review of empirical tests of orthodox NAIRU theory

Orthodox NAIRU theory suggests that we can solve the unemployment problem by removing rigidities in the labour market. However, before embarking on these 'structural reforms', we should have some compelling evidence that the proposed remedies really work. In other words, theories need testing before they are put into practice. This is even more important when we realise that 'structural reforms' often come at a cost. Removing firing protection introduces greater job insecurity for workers. And cutting benefits increases the poverty risk for people who become unemployed. Howell *et al.* (2007) call these institutions "Protective Labor Market Institutions". They offer a critical review of the empirical evidence that backs the

[8] Of course, in the neoclassical labour market, all unemployment is voluntary in the absence of minimum wages. The union bargaining version of the NAIRU however, entails an involuntary unemployment equilibrium because people with jobs are paid a wage that is above the reservation wage of some without jobs. The reason is that existing jobs are protected so unions can bargain for a wage that is above the reservation wage.

[9] Because of diminishing returns, the growth of labour productivity in the price equation would become a negative function of employment.

view that these institutions are at the root of unemployment. This section has benefited a lot from their research.

It has already been noted that since the appearance of the OECD Jobs Study (1994b), an array of studies that empirically assess the rigidity hypothesis have been published. Below, we will review a number of them. The main conclusion from the review is that the empirical evidence backing the hypothesis is by no means robust.

The table below summarizes a number of studies that assess the impact of labour market rigidities on unemployment. The table is partly taken from Howell *et al.* (2007, table 3) and partly based upon our own calculations. The studies are grouped pair-wise to facilitate comparison.

Table 2.2. Implied impacts[(a)] of labour market rigidity on unemployment, selected empirical studies

Implied impact of: / study	EPL + 1 unit	Brr + 10%[(b)]	Bd + 1 yr	ALMP + 10%	Ud + 10%	Cov + 10%	Coord + 1 unit	Tw +10%
Scarpetta 1996	0.37	1.3	--	NS	1.1	--	-3.07	NS
Elmeskov *et al.* 1998	NS	1.29	--	NS	NS	--	-1.48	0.94
Nickell 1997	NS	0.88	0.70	-1.92	0.96	3.60	-3.68	2.08
Baker *et al.* 2005	NS	NS	--	NS	NS	NS	NS	NS
Blanchard and Wolfers 2000 (1)	0.24	0.70	1.27	NS	0.84	NS	-1.13	0.91
Blanchard and Wolfers 2000 (2)	NS	NS	NS	NS	NS	NS	NS	NS
IMF 2003a (1)	0.52	0.51	--	--	2.37	--	-0.27	-0.51
IMF 2003a (2)	-0.44	0.57	--	--	0.21	--	0.01	1.12
Nickell *et al.* 2005	NS	1.58	0.34[(c)]	--	4.99	--	-7.21	NS
Chapt. 4 of this thesis	-1.92	NS	-0.63[(c)]	--	NS	--	NS	3.44
OECD 1993	--	1.7	0.92	-1.3	--	--	-2.85[(d)]	--
Bassanini and Duval 2006	NS	1.29	--[(e)]	-0.28	NS	--	-1.92	2.33

Notes:
(a) The coefficients show the implied impact in terms of a change in the unemployment rate of a given change in the independent variable. "NS" means that there is no statistically significant effect at the 5% level. "--" denotes that the variable is not included in the regressions.
(b) % denotes: percent points.
(c) Bd + 10%.
(d) Average effect of employer and union coordination
(e) Bassanini and Duval's measure of the benefit replacement rate is a measure which incorporates both amount and duration of unemployment benefits.
EPL=employment protection legislation, Brr=benefit replacement rate, Bd=benefit duration, ALMP=activating labour market policies , Ud=union density; Cov=union coverage, Coord=bargaining coordination, Tw=labour tax wedge
Sources: The first five rows are taken Howell *et al.* 2007 table 3, rows 7 and 8 from table 4. The impacts of the IMF studies are from Howell *et al.* 2007 table 4. Figures are based on: Scarpetta 1996: table 1, column 3; Elmeskov *et al.* 1998: table 2, column 4; Nickell 1997: table 6, column 1; Baker *et al.* 2005: table 3.6, column 2; Blanchard and Wolfers 2000 (1): table 5, column 1 and (2) Table 6, column 2; IMF 2003a (1): table 4.3, column 3 and (2) column 4; Nickell *et al.* 2005: table 5, column 1; Chapt. 4 of this thesis: Table 4.1, column 5 of this thesis; OECD 1993: table 2.A.1, column 1; Bassanini and Duval 2006: Table 1.8, column 1.

What stands out from Table 2.2 is the lack of robustness of the empirical evidence that backs the NAIRU hypothesis. The studies are grouped pairwise. Studies that form a pair are based on roughly the same database. The first study of a pair is regarded as supportive for the NAIRU hypothesis. Typically, the study is influential in the sense that is often quoted as supportive evidence. The second study shows a re-estimation of the empirical work, with minor modifications. Sometimes the re-estimation is performed within the same study, as a robustness check. Sometimes the re-estimation is performed by other authors. In the table, we can see that minor changes in the regression set-up result in major changes in significance and sometimes even sign of coefficients. Furthermore, we see that the latest attempt to empirically assess the orthodox NAIRU hypothesis (Bassanini and Duval 2006) generates mixed evidence. Two out of six included measures for rigidity turn out insignificant in their regression. Now, we will treat the studies in the table pairwise.
Scarpetta (1996) follows up on the OECD Jobs Study (1994b), which "indicates that a number of (...) institutional factors (in the labour market, R.V.) have played an important role in determining unemployment rates. This paper tries to assess the role of some of these factors." (p. 44.) Scarpetta's work is the first study that employs

annual data to empirically assess the rigidity hypothesis. It employs data on a number of institutions ranging from 1983 to 1993 for 17 OECD countries. It uses a random effects panel data estimator. It is noticeable that most of the rigidity indicators show up with the theoretically predicted sign, although activating labour market policies and the tax wedge are found to be insignificant. The paper concludes that "high levels of unemployment benefits are likely to lead to higher levels of unemployment (...). Strict employment protection regulations are likely to raise equilibrium unemployment rates significantly (...). Worker bargaining power – proxied by union density – seems to be associated with higher unemployment." (p. 71). This study played a key role for the way other researchers and policy makers proceeded in empirically assessing and understanding the role of labour market rigidity for unemployment (Howell *et al.* 2007). In a joint study of OECD researchers Elmeskov, Martin and Scarpetta (1998), the key role played by Scarpetta's (1996) results is emphasised: "The OECD work since 1994 has produced a series of additional publications. (...) this work has enabled the organisation to identify a number of country "success stories" as well as "failures" in terms of implementing the OECD recommendations and the resulting labour market outcomes. In assessing the need for reform, the work has relied heavily on the econometric work of Scarpetta (1996)..." (p. 208.) The purpose of the paper "is to distil the lessons for labour market reforms from the *successes* and *failures*." (p. 205, italics in original.) The study by Elmeskov *et al.* (1998) is essentially "an update and extension of the (...) results in Scarpetta (1996)" (p. 208), in that the empirical part uses and updates Scarpetta's original dataset, and that the estimation method is identical to the original paper (random effects panel data). It employs a dataset that covers 19 countries for the period 1983 – 1995, extending the original dataset with 2 years and 2 countries. This quite modest modification of the dataset has major implications: not only do the new results differ markedly from the original results; they also deliver quite mixed evidence for the rigidity hypothesis. Only the impact of the benefit replacement rate is similar to that in the original study and has the expected effect. Labour taxes, on the other hand, become significant, while employment protection legislation becomes insignificant, as does union density. The impact of bargaining coordination reduces by a factor two. The researchers ignore the mixed support for the rigidity hypothesis, when they conclude: "It requires strong political will and leadership to convince electorates that it is necessary to swallow the medicine (i.e. to deregulate labour markets, R.V.), and that it will take time before this treatment leads to improved labour market performance and falling unemployment." (p. 242.) Such bold policy advice based upon rather mixed results would be more convincing if the authors would provide the reader with an explanation as to why their results differ so markedly from the ones obtained with essentially the same data in the original study by Scarpetta (1996). As it stands, they leave the reader with a sense of uneasiness about the lack of robustness of their results.

Elmeskov *et al.* (1998) provide a comparison of their results with those reported by Layard and Nickell (1997), noting that "there is quite a high concordance between the two sets of results regarding the determinants of unemployment rates across OECD countries." (p. 218). However, a comparison of the two pieces of evidence reveals that only the impact of the benefit replacement rate in the Layard and Nickell study is roughly similar, the coefficient being about 2/3 of the coefficient found by Elmeskov *et al.* (1998). If we compare the Elmeskov *et al.* (1998) estimates to the results reported by Nickell (1997), we see that the indicator for activating labour market policies becomes significant and the impact of bargaining coordination and the tax

wedge is more than twice as large. Nickell (1997) also employs a random effects panel data estimator.

If we judge the "influential" (Howell *et al.* 2007, p. 23)) results of Nickell (1997) at face value, they seem to provide consistent evidence for the rigidity view, except that employment protection legislation is found to be insignificant. These results certainly are influential, judging from the fact that they (or others from slightly different regressions based on the same data) appeared in the Journal of Economic Perspectives (Nickell 1997), the Economic Journal (Nickell 1998) and in the Handbook of Labour economics (Nickell and Layard 1999). Concerning the robustness of the results, it is interesting to compare them with a study by Baker *et al.* (2005). The latter do a re-estimation of the Nickell (1997) equation using updated and improved indicators for labour market institutions from the "Labor Market Institutions Database" developed by Nickell *et al.* (2002, 2005), using the same random effects panel data estimation method. They find that using these improved indicators in the original specification leaves little of the original results. In fact there remains no effect of labour market institutions on unemployment, as all the institutions become insignificant.

Blanchard and Wolfers (2000) use a slightly different approach to assess the impact of labour market rigidities. They focus on the interaction of adverse economic shocks and labour market institutions, hypothesising that rigidity in the labour market hampers the recovery of unemployment after an upswing that follows an adverse shock. They use a panel data fixed effects estimator. The economic effects of their benchmark equation are reported in the table above. Before comparing their results with other results in the same paper, it is noteworthy to compare them with Baccaro and Rei (2007). The latter perform a re-estimation of Blanchard and Wolfers' model on slightly different institutions but covering the same period. They estimate the model in levels and first differences and employ various techniques to correct for heteroskedasticity and/or serial correlation. They conclude that "substantive conclusions about the impact of institutions vary dramatically depending on the particular way in which the data are expressed (levels or deviations) and the choice of standard errors (...)." (p. 559), thus raising doubt about the robustness of the Blanchard and Wolfers study.
Blanchard and Wolfers' (2000) regression results reported in table 5, column 1 rely heavily on Nickell's (1997) time-invariant institutional measures for the same period. Compared to Nickell's (1997) results, they show broadly similar results for the benefit replacement ratio, benefit duration and union density, but the results for employment protection (turns from insignificant to significantly positive), activating labour market policies (turns from significantly negative to insignificant) and bargaining coverage (turns from significantly positive to insignificant) are markedly different. Furthermore, the impact of bargaining coordination and taxes reduce by more than half.
Later in the same study, Blanchard and Wolfers redo their estimation (table 6), but now replacing some of the Nickell variables by OECD measures, notably the benefit replacement rate and employment protection. One striking result is that, replacing Nickell's measure of the benefit replacement rate by OECD's time-varying measure, all rigidity indicators turn insignificant (table 6, column 2). This again raises doubt about the robustness of empirical results that are supposed to back up the rigidity view.
Blanchard and Wolfers (2000) draw two conclusions from their table 6, which are "both worrisome: replacing the Nickell measures by alternative, but time invariant

measures, substantially decreases the R^2. Going from the time invariant to the time varying measures further decreases the fit (...). Luck, or data mining when the standard (taken from Nickell (1997), R. V.) set of measures is used?" (p. C31).

The IMF (2003a) acknowledges the lack of robust evidence that supports the rigidity hypothesis so far: "While there are solid theoretical arguments underpinning the call for such reforms (deregulation of the labour market, R.V.), the empirical evidence is somewhat less developed and, in some cases, unsupportive." (p. 129)
The IMF researchers intend to look "at the current state of the debate and (to, R.V.) provide(s) further analysis of the likely benefits from labor market reforms in terms of lower unemployment and higher output." (p. 129) They attempt to fill the gap in the evidence by performing a panel data regression that covers 20 OECD countries for the period 1960 – 1998, using a GLS-estimator with fixed country effects. Their database is an extension of the "Labor Market Institutions Database" developed by Nickell *et al.* (2002, 2005). The results obtained by the IMF, however, again raise doubts about robustness, as has already been demonstrated by Howell *et al.* 2007. The two rows concerning the IMF (2003a) in Table 2.2 are based on Howell *et al.* 2007 table 4. From the IMF-study, we report regression results from two slightly different specifications. The first one is arguably the one preferred by the IMF (it has the highest R^2). Employment protection, benefits, union density and bargaining coordination all are significant and have the expected signs. Taxes however, appear significant, but with the opposite sign than theory predicts. In another specification, the one used for later simulations, employment protection turns sign and is significant. Also, bargaining coordination turns sign (becoming positive) and is significant. The tax wedge returns to a significant and theoretically predicted positive value. The coefficient of union density drops by a value of twenty times the original one.

Doubts concerning robustness are also raised about the study by Nickell *et al.* (2005). In their GLS panel data regression with fixed effects that covers 20 OECD countries from the 1960 – 1995 period, they find that both employment protection and taxes do not explain unemployment, while unemployment benefits, benefit duration, union density and coordination are significant with the theoretically predicted effects. Note that these results differ markedly from the ones obtained by the IMF which used the same database with a small 3-year extension. However, this does not restrain the researchers in concluding that "our results indicate (that) broad movements in unemployment across the OECD can be explained by shifts in labour market institutions." (p. 22). In chapter 4, we test the robustness of Nickell *et al.*'s results.

The latest attempt by OECD researchers Bassanini and Duval (2006) to provide evidence for the rigidity hypothesis uses much improved institutional data over a more limited time-span. This empirical analysis forms the basis of chapter 7 of the OECD's 2006 employment outlook, which is intended as a reassessment of the OECD Jobs Study. The table above compares the latest findings with the original ones in 1993. In 1993, all of the included indicators for rigidity showed up with the theoretically predicted sigh. In 2006, only four out of six institutional measures show the correct sign and are significant. Looking at the economic significance, we see that the impact of activating labour market policies is rather limited, as the coefficient is small. Moreover, Howell *et al.* (2007) note that "this analysis, as careful and comprehensive as it is, leaves many key policy-relevant questions unanswered. While the risk of reverse causality is briefly acknowledged, the authors simply note that

'there is no straightforward way to address this issue'. (Bassanini and Duval 2006, p. 11)" (p. 31). This hints to a potential endogeneity problem that may apply to many of the regressions reported in the table above. This problem is aggregated by the Granger-Causality tests that Howell *et al.* (2007) run on the causality of unemployment to the benefit replacement rate. Based on OECD data, they conclude that the "results clearly indicate that the predicted effects run from unemployment to benefits". So we are left with only two variables that back up the rigidity hypothesis in a convincing way: bargaining coordination and taxes. This is hardly the kind of evidence that one would expect to back-up the call for sweeping reform statements.

Apart from the studies mentioned in Table 2.2, it is worth mentioning the studies by Baccaro and Rei (2005, 2007). They perform extensive empirical studies to assess the robustness of the rigidly hypothesis (which they call: the deregulation view). They conduct a panel data analysis (which they call a cross-section time series analysis because of the large time span when compared to the cross section span of the dataset) in which they regress unemployment on a set of institutional variables which are taken from IMF (2003a). They stand out in this literature for their attention to robustness of the results. They test their models in static and dynamic form, use annual and 5-year averaged data, run regressions in levels and first differences and employ various possible FGLS corrections. In total, they run 78 (2005) and 40 (2007) regressions, testing both the direct impact of labour market institutions, the impact of interactions of institutions among themselves and the impact of interactions of institutions with unobservable common shocks. They conclude (2005, p. 43): "Our preferred model is a static fixed effects model in first differences with data averaged over five-year periods. We arrived at it by testing down from our initial specification. It is a parsimonious model, in which only the interest rate appears as macroeconomic control alongside the institutional variables, and there are no interaction terms. This specification gives changes in institutions more than a fair chance to explain changes in unemployment. Yet this model (just like the others we estimate in this paper) provides very little support for the view that one could reduce unemployment simply by getting rid of institutional rigidities." In their 2007 study, they conclude: "Our results suggest that, at least as far as pooled data allow one to tell, the impact of labor market institutions is, for the most part, not robust (...)" p. 563)

2.4.1. Assessment

As already mentioned above, the IMF (2003a), although convinced of the theoretical underpinnings of the call for labour market reforms, notes that "the empirical evidence is somewhat less developed and, in some cases, unsupportive." (p. 129) Considering the studies reviewed above, this seems to be a little understated. Note that the studies that are covered above are widely seen to offer compelling evidence in favour of the rigidity hypothesis in spite of possible doubts about their robustness. Some studies (Scarpetta 1996, Emeskov *et al.* 1998) demonstrate the fragility of results when minor changes are made in the exact years and countries that are taken into account in the empirical analysis. Others (Nickell 1997, Baker *et al.* 2005) show that results depend very much on the exact calculation of indicators for rigidity, where more recent – arguably better – indicators lead to a less favourable result for the rigidity hypothesis. Blanchard and Wolfers (2000) is a demonstration of instability of the parameters with respect to the exact definition of the institutional variables within he same study. Again, the better (time-varying) version of the institutions leads to

results that are less favourable to the rigidity hypothesis. IMF (2003a) is a demonstration of the lack of robustness to the exact inclusion of a certain variable while leaving the model and dataset intact. In chapter 4 of this thesis, we shall report results that raise raise doubts about the robustness of the results in Nickell *et al.* (2005). The most recent OECD effort to back up the rigidity hypothesis also illustrates the difficulty to obtain empirical results that back up the rigidity hypothesis: using arguably far more consistent and accurate data than in previous studies, only bargaining coordination and the tax wedge turn out as factors that reliably raise unemployment.

From the above we conclude that – to paraphrase – our results indicate that broad movements in unemployment across the OECD can not be convincingly explained by shifts in labour market institutions. The evidence offered lacks robustness: results often stand or fall with the exact specification of the model, the countries and years included in the study and with the particular estimator that is employed. This should imply some modesty when it comes to offering policy advice in favour of deregulation of labour markets. Moreover, it puts considerable doubt on the validity and practical relevance of NAIRU theory, although one could also point to other – non theoretical – reasons why the evidence is not robust.

2.4.2. Why is the empirical evidence not robust?

The chain between empirical test and theory is long. When the results of a test do not back up a certain hypothesis, several links in the chain can be responsible for this. Both orthodox and heterodox economists have pointed to the data – both the quantity and quality – as being suspicious. We will summarize their arguments, before proceeding with the main line of this chapter concerning the question: is there something wrong with NAIRU theory?

Bad data, or..?

Howell *et al.* (2007) raise the issue of the poor quality of the data that is used in the cross country studies that regress unemployment on various measures of labour market institutions. They conclude that in spite of admirable OECD efforts to come up with better data, the "unfortunate reality is that the variables on both sides of the equation remain poorly measured." (p. 7). This feature elicits Blanchard and Wolfers (2000, p. C31) to comment on the lack of robustness in their results: "Poor time series for institutions, interacting here with the fact that we are looking at their product with time varying and also imperfectly measured shocks?".

An important part of the study by Howell *et al.* (2007) is entirely devoted to showing inconsistencies in measurements for the same constructs over time, countries or even datasets. They for instance point to the variation in the measurement of unemployment rates for the same countries at the same time across different OECD datasets. Of course, the operationalisation and measurement of the labour market institutions is widely accepted to be notoriously difficult. They conclude that it is a "striking feature of this literature that hardly any attention has been placed on the consistency and quality of the data." (p. 58) They judge the lack of robustness in the results to be "very well an (...) inevitable result of attempts to estimate economic relationships with poorly measured institutions and policies, (...) and small numbers of country observations." (p. 59)

Freeman (2005) puts more focus on the lack of observations: "The data do not scream out loudly and clearly: 'it's labour institutions, stupid', as the new orthodoxy initially claimed, nor do the data say 'that's impossible'. Rather, the data mumble something akin to 'I don't know... don't ask me... maybe... your guess is as good as mine.'" (p. 143). Freeman notes that one of the difficulties of determining how institutions affect outcomes is "the large number of possible configurations of institutions relative to the number of cross country observations." (p. 138) The problem of the limited amount of observations exacerbates the issue of causality that is inherent in any regression of labour market institutions on unemployment. Blanchard (2007) comments: "asking these panel data regressions to tell us conclusively about causal effects of institutions, shocks, and interactions of shocks and institutions on unemployment is beyond what they can deliver. Causality is next to impossible to establish, as many institutional changes are triggered by labor market developments." (p. 415)

Without criticizing the validity of the points raised above, an alternative explanation for the lack of robust evidence may be that there are some problems with the theory that backs the empirical models. As already quoted above, the IMF (2003a) noted: "While there are solid theoretical arguments underpinning the call for such reforms, the empirical evidence is somewhat less developed and, in some cases, unsupportive. (p. 129). We now turn to a discussion of the IMF's (2003a) contention that the theoretical arguments that underpin the call for labour market reforms are solid.

2.5. Appraisal of orthodox NAIRU theory: is it convincing?

In this section, we first critically examine various assumptions that underlie NAIRU theory. Thereafter, we will augment the equations that reflect the orthodox NAIRU assumptions. It will be shown that these augmentations have substantial impact on the qualitative outcomes of the model.

2.5.1. Revisiting assumptions on price setting: do prices really grow proportionally with wages?

As already indicated earlier in this chapter, the assumption on price setting (equation 2.1) states that profit earners protect their share in income by setting prices to grow exactly proportionally with real unit labour costs. Hence profit earners will always strive to maintain their share in National Income, no matter the circumstances. However, there are circumstances where it seems plausible that firms (price setters) do not behave like this.

Several authors (e.g. Rowthorn 1995, 1999; Arestis and Sawyer 2005; Arestis *et al.* 2007) propose that firms are reluctant to raise their prices when there is overcapacity. If they have unutilised machinery and plants, they would rather maintain low prices to outcompete competitors in order to use their idle capacity. In other words: they would allow the profit share to fall.

In terms of the price equation 2.1 we should incorporate a mark-up for prices over real unit labour costs to get the adjusted equation 2.1.a:

$$\hat{p} = \hat{W} - \hat{\lambda} + \hat{m} \qquad \text{equation 2.1.a}$$

Where $\hat{m}$ denotes the growth of the mark-up.

Using the wage equation (equation 2.2) to calculate the expression for the NAIRU, we would obtain:

$$\overline{u} = \frac{\hat{W}_0 + \beta_Z Z + \hat{m}}{\beta_{u,\hat{W}}} \qquad \text{equation 2.8.a1}$$

We see that the NAIRU is a function of the mark-up growth. In the view of Rowthorn, Arestis and Sawer the mark-up is a positive function of capacity utilisation.

Carlin and Soskice (1990) counter this argument by suggesting that long run mark-up growth is zero. They bring forward that firms have an optimal amount of strategic spare capacity (p. 460 – 461), which is the cut-off point for firms to start raising (or diminishing) the profit share. When capacity utilisation is above the optimal (strategic) capacity utilisation, firms will – next to raising the profit share – invest. This brings true capacity utilisation closer to the optimal capacity utilisation. Only when true capacity utilisation equals the desired optimal capacity utilisation, the inflationary (or deflationary) pressures from capacity utilisation seize to exist. This mechanism implies that there is only one combination of unemployment and capacity utilisation consistent with stable inflation, that is: unemployment is at the NAIRU and capacity utilisation at the optimal capacity utilisation. This combination is reached endogenously.

However, this line of reasoning critically depends on the assumption that firms have a fixed notion of their strategic spare capacity. This boils down to assuming that there is a fixed, stable equilibrium output (and thus NAIRU corresponding to the level of equilibrium output!) to which firms can optimise the capital stock.
So we can counter this argument by noting that it entails circular reasoning. To prove the existence of a stable NAIRU, Carlin and Soskice invoke the notion of an exogenous (stable) optimal capacity utilisation. However, this notion predicates on the assumption of a stable NAIRU in the first place. Hence, they assume the very thing they want to prove.
Rather, the notion of the optimal capacity utilisation as an exogenous, stable value is debatable. We can develop a model in which a firm's perception of the optimal capacity utilisation depends on its historical values (as Lavoie 1996 does).

Above, it was mentioned that the growth of the mark-up may depend on capacity utilisation. However, it can also be argued that it depends on price (growth) of other materials and other (natural) resources. It is most likely a positive function of oil prices, the rate of interest and a negative function of the terms of trade. These factors push up non-wage production costs, hence a larger mark-up over wage costs is required to maintain profitability (Hein 2006).
OECD (2006) implicitly recognises the importance of incorporating the mark-up in the price equation when it employs a measure of product market competition in its regressions to explain long-term unemployment. If we note that product market competition increases the price elasticity of demand and that this elasticity is inversely related to the mark-up, we see that product market regulation (by limiting competition) is hypothesised to shift the NAIRU up through increasing firm's mark-up.

Summarising, various authors have proposed factors that influence the NAIRU through their effect on the mark-up in firm's price setting. This casts considerable doubt on the orthodox NAIRU conclusion that the NAIRU is a function of labour market rigidity only.

2.5.2. Revisiting assumptions on wage setting: do wages really grow proportionally with productivity and prices?

The basic assumption behind the wage setting equation (equation 2.2) is that workers defend their living standard (the wage share in National Income) in the face of more or less favourable economic conditions as reflected in the unemployment rate. However, if workers defending their living standard is the rationale behind wage setting, then it seems reasonable that productivity increases relieve the inflationary pressure generated by workers who try to raise (or defend) their living standards. A higher productivity growth implies that workers' living standards can grow without causing inflationary pressures. Rowthorn (1995, 1999) incorporates this idea in the wage setting equation by allowing wages to grow less than one to one over productivity (see equation 2.2.a1):

$$\hat{W} = \hat{W}_0 + \alpha\hat{\lambda} + \hat{p} - \beta_{u,\hat{W}} u + \beta_z' Z \cap \alpha < 1 \qquad \text{equation 2.2.a1}$$

Where α denotes the extent to which productivity growth is reflected in wage growth[10].

Substituting the modified wage equation (equation 2.2.a1) into the original price equation (equation 2.1) yields the following expression for the equilibrium rate of unemployment (Storm and Naastepad 2007a, Rowthorn 1995):

$$\bar{u} = \frac{\hat{W}_0 + \beta_Z Z - (1-\alpha)\hat{\lambda}}{\beta_{u,\hat{W}}} \cap \alpha < 1 \qquad \text{equation 2.8.a2}$$

So we observe that the NAIRU is a negative function of the growth of labour productivity.

Above, the property that wages grow with a fraction of labour productivity was obtained by assuming that productivity growth alleviates inflationary pressure because workers can raise living standards without generating the need for price increases. But this property can be reached by alternative routes. If it is assumed that production is of CES form, this immediately implies that only a fraction of productivity growth is reflected into wage growth. A CES production function of a general form denotes that the elasticity of substitution is constant but different from 1. In this case, the profit share (implied by both price and wage setting) is a negative function of capital intensity[11]. Rowthorn (1999) shows that the orthodox result that the NAIRU is independent from capacity and productivity follows from the assumption of a special

[10] Carter (2007) interprets the coefficient α as a measure of productivity sharing. He finds that in the period 1963 – 1979 $\alpha > 1$, which implies a rising wage share. However, from 1979 – 1996, $\alpha < 1$ which means a declining wage share.

[11] This implies that CES-production is reflected not only by an additional coefficient in the wage setting equation that reflects what ratio of productivity growth is reflected in wage growth, but also by an analogous coefficient in the price setting equation. However, if we would do this, we end up with our alternative expression for equilibrium unemployment (equation 2.8.a2), where α represents the sum of the coefficients in both wage and price equations.

case of CES production: the elasticity of substitution equals exactly one (that is: Cobb-Douglas production). He argues that this is a highly unrealistic assumption.

Another extension of the wage equation can be found if we turn our attention to the effectiveness of the buffer stock of the unemployed. The argument runs that the long-term unemployed are less effective in keeping wage demands down than the short term unemployed (Ball 1999). This happens because people who are unemployed for a longer time, suffer more from skill deterioration and from erosion of the value of their working experience over time. Hence they are less employable than recently unemployed people. Thus the buffer stock of unemployed people is more effective when they have been unemployed for a shorter time.

If we would incorporate this effect in the wage equation, we would modify it as follows:

$$\hat{W} = \hat{W}_0 + \hat{p} - \beta_{u_s,\hat{W}} u_s - \beta_{u_l,\hat{W}} u_l + \beta_z' Z \cap \beta_{u_s,\hat{W}} > \beta_{u_l,\hat{W}} \qquad \text{equation 2.2.a2}$$

Where u_s denotes the short term unemployment rate and u_l the long term unemployment rate.

In orthodox NAIRU theory, it is usually assumed that the long term unemployed do exert some pressure on wage bargaining. Hence they assume: $\beta_{u_l,\hat{W}} > 0$. Employing this assumption is rather harmless for the result of orthodox NAIRU theory. For it does not alter the expression for equilibrium unemployment. It only takes more time before the equilibrium is reached (Layard *et al.* 1991). The slow adaptation of actual unemployment to equilibrium unemployment is referred to as hysteresis. Proponents of the orthodox NAIRU introduced hysteresis to model the slow adaptation of unemployment to the equilibrium following the jump in unemployment caused by the oil crisis. The fact that unemployment remained above the NAIRU for long periods of time, could not be explained by labour market rigidity. Hence they included a factor in the model that could be responsible for delaying this adaptation. However, after the passage of time, finally the equilibrium will be reached.
Lang (2004) argues that such a modelling of the impact of long-term unemployment is not appropriate to model hysteresis. Rather, hysteresis should allow for an effect of the history of unemployment not only on current unemployment but also *on its equilibrium value.* In other words: the effect of the history of unemployment on its current level should not automatically wear out in time. Clearly, the orthodox NAIRU model does not allow for this as one of its core results is an exogenous supply side determined equilibrium.
Can we think of events in the history of unemployment that would influence its long run (equilibrium) value? We can find examples of this if we for instance interpret the "long term unemployed" in the broad sense of people who become unemployed without clear prospects to get another job. Consider for instance people over their 50s who become unemployed. In most OECD countries, the prospects for these people to find a job are rather dim. That would imply that they are permanently lost for the labour market. Other examples we can think of are people with poor education who lack the skills to be re-employed in the labour market. Or people who decide to spend more time on raising their children when they become unemployed. For these groups, it would be more appropriate to model the coefficient $\beta_{u_l,\hat{W}} = 0$. Hence they exert no

downward pressure on wage bargaining. Recognizing this, the expression for the NAIRU would become:

$$\bar{u} = \frac{\hat{W}_0 + \beta_Z Z + \beta_{u_s,\hat{W}} u_l}{\beta_{u_s,\hat{W}}} \qquad \text{equation 2.8.a3}$$

Here, the term u_l is interpreted as the group of unemployed people who do not currently compete for jobs. The interpretation of this term is that there is always a group of people who are – for different reasons – outside the labour market. This can be for reasons of skill-mismatch, preferences, etc. The crucial point is that there is no automatic, natural, mechanism that draws them back into the labour market. The size of this group may vary according to cultural norms, historic experience, age, geographic location or educational level. The size of this stock of people enters in the expression for equilibrium unemployment.

2.5.3. Revisiting assumptions on the feedback from inflation to unemployment: is the real balance effect reliable?

Let us now return to the real balance effect. We have discussed the real balance effect in paragraph 2.3.2. We formulated a reference model of the real balance effect that reflects its critical assumptions (see equation 2.3 and equation 2.4). Now, let us assess the appropriateness of these assumptions. Five arguments will be treated: (1) The real balance effect is tautological; (2) The recursive rationality argument; (3) The real debt effect; and (4) The windfall gains effect and (5) The endogeneity of money argument.

The real balance effect is tautological

A crucial assumption of the real balance effect is that (expected) income is given. However, this assumption can never be the start of a meaningful analysis of the stability of the NAIRU, because it boils down to *assuming* that there is a stable unemployment equilibrium in the first place. Proving something by first assuming it boils down to circular reasoning.

To see this, consider the implication of the assumption that (expected) income is given. This would mean that people have a notion that (expected) income is stable. They would only have this notion if they would indeed experience that there exists a stable average income through time and space. And this can only be the case if there indeed exists a stable equilibrium unemployment level with a corresponding employment level that is needed to generate this income. To summarize: this analysis of stability of the NAIRU starts with the assumption that there is a stable unemployment equilibrium. Hence the argument that the real balance effect ensures a stable NAIRU is tautological.

Using the expressions that reflect the workings of the real balance effect (equation 2.3 and equation 2.4), we can see that the real balance effect indeed is tautological. For if we substitute equation 2.3 into equation 2.4 and solve for the equilibrium rate of unemployment $\bar{u}$ (by setting real wealth to a fixed value $\overline{We}$), we obtain:

$$\bar{u} = (C_0^{'} + \beta_y^{'} \bar{Y})^{-1} \qquad \text{equation 2.8.a3}$$

where $C_0^{'} = \frac{C_0 + \beta_{We} \overline{We}}{\beta_c}$ and $\beta_y^{'} = \frac{\beta_y}{\beta_c}$.

So we see that in fact the system (equation 2.3, equation 2.4 and equation 2.8) is overdetermined. Implicit is a notion of a stable equilibrium value of income ($\overline{Y}$) that corresponds to a stable equilibrium value of unemployment. If people do not have a sense of a stable, exogenously determined equilibrium value of income then the unemployment equilibrium becomes instable as well.

The recursive rationality argument

Another critical assumption of the real balance effect is that it implies that people know, when they are born, what their preferences will look like for the rest of their lives (and also, when they will become dependent and when they die). This assumption is reflected in the stable parameters β_{We} and β_y in equation 3a. These parameters denote that people are able to plan their savings and consumption over their lifetime. This does not seem very realistic, because most people form a lot of their preferences over the course of their lives.

But the real balance effect requires even stronger notions of rationality than just for the current generation. Not only does it require that people are born with a notion of their income and preferences for their whole life, but it also requires that they have this notion for all the future generations as well (Sweeney 1988, p. 43-44). Planning your income and expenditures over your lifetime includes a decision on bequests. To make a rational decision on bequests, the current generation has to know the income and preferences of the next generation. And by recursion of the next and the next, and on so on and so forth. This seems to become absurd.

In terms of the underlying equations of the real balance effect, we can augment them by allowing the parameters to fluctuate according to cultural norms or changing expectations for the prospects of offspring. If we would do this for the part of real wealth that is added to consumption (β_{We}) and denote this instable parameter with $\overline{\beta}_{We}$, then the expression for equilibrium unemployment would depend crucially on this parameter.

The real debt effect

Fisher (1933) proposed the mirror mechanism of the real balance effect. He started by noting that deposits are the financial assets of individuals, but they are the financial liabilities of banks. In general, all loans create (bank)deposits. This implies that, with declining prices, an increase in the real value of the financial assets is largely offset by an increase in the real value of debt. Fisher (1933) called this the real debt effect. The majority of financial assets are mirrored with debts on bank balance sheets. Thus "the fall in wage rates and prices necessary to restore aggregate demand to full employment level would be enormous. Further, falls in the general level of prices would increase the real value of debts and 'would consequently lead to wholesale bankruptcy and a confidence crisis' (Kalecki 1990, p. 343)" (as quoted by Sawyer 2001).

This mechanism would make (accelerating) deflation swamp demand instead of spurring it, thus making the NAIRU unstable.

In terms of our model, we should augment equation 2.3, to get the alternative equation 2.3.a:

$$C = f(\overset{\pm}{\bar{Y}}, \overset{+}{We'/P}) = C_0 + \beta_y \bar{Y} + \beta_{We'} We'/P - \beta_D D/P \qquad \text{equation 2.3.a}$$

where We' denotes the private sector's accumulated financial wealth and D the private sector's accumulated financial debt. Here, $\beta_{We'}$ denotes the fraction of real wealth that is added to consumption, while β_D denotes the fraction of real debt by which consumption is diminished. If we start with unemployment above the NAIRU, unemployment would only return to the NAIRU (i.e. the unemployment equilibrium would only be stable) if consumption rises. Remember that unemployment being above the NAIRU causes P to fall. As a consequence, both real wealth and real debt rise with the same rate. So we see that the stability of the unemployment equilibrium crucially depends on the size of the parameters $\beta_{We'}$ and β_D, for when β_D is very large compared to $\beta_{We'}$, households would on average withdraw from consumption when prices fall due to unemployment being above the NAIRU. This fall in consumption would trigger another rise in unemployment, etc. Hence unemployment would not return to the NAIRU by itself. In other words: the NAIRU is an unstable equilibrium.

Starting with an average reserve ratio of banks of 10%, we would obtain that $D/We' = 0.91$. That would imply that the equilibrium is stable if and only if $\beta_{We'} > 0.91\beta_D$. Fisher (1933) and Kalecki (1990) offered that it is very likely that this is not the case, for people who see the real value of their debt deflated, encounter immediate payment and refinance problems. So they are forced to withdraw strongly from consumption.

Furthermore, firms that have engaged in loan-financed investment suffer profitability and refinance problems. They may go bankrupt. This depresses confidence and triggers a loss of jobs that may exacerbate the instability of the equilibrium.

The windfall gains effect

Keynes (1931) argued that unexpected inflation creates windfall gains for companies: profits rise unexpectedly (Dimand 1991). Thus the return on investment is unexpectedly higher, because they can get a higher price for their products. This may lead to favourable animal spirits and thus an investment growth. If unemployment is below the NAIRU, then prices rise. If, due to this price rise, investment growth is very high, then this causes unemployment to drop even further. Hence the unemployment equilibrium (NAIRU) is not stable.

We can incorporate this effect in our model by adding an investment equation where investment I is a positive function of the price level:

$$I = f(\overset{+}{P}) = I_0 + \beta_{P,I} P \qquad \text{equation 2.9}$$

Where I_0 denotes autonomous investment and $\beta_{P,I}$ denotes the effect of windfall gains on investment.

And we allow the unemployment level to depend on both consumption and investment:

$$u = f(\bar{C}, \bar{I}) = \beta / \varphi_C C + \varphi_I I \qquad \text{equation 2.4.a}$$

Where φ_C and φ_I denote the shares of consumption respectively investment in total demand.

We see that the unemployment equilibrium is stable only if the total decrease (or: increase) in demand caused by a deviation from the unemployment equilibrium through diminished (or: added) consumption offsets the increase (or: decrease) in demand through added (or: diminished) investment[12]. In other words: when prices unexpectedly change, this causes changes in consumption and investment which lead to a change in demand and hence unemployment. For the NAIRU to be stable, the change in unemployment caused by a change in consumption should offset the (opposite) change in unemployment caused by a change in investment.
This condition is highly questionable as it is investment rather than consumption that is volatile (Keynes 1937).

The endogeneity of money argument

The "endogeneity of money" is claimed by some authors (i.e. Arestis and Sawyer 2005, p. 961 and Hein 2006) to invalidate the real balance effect. Lavoie (2006, p. 17) defines the theory of endogenous money as the idea that "the supply of high-powered money (...) ought to be considered as endogenous and demand-determined (by the private sector, R.V.). By contrast, (short term) interest rates (are) exogenous, under control of the central bank (...)[13]." This definition indeed applies to real-world monetary policy in our view. The reason that it invalidates the real balance effect, is that it makes private sector financial wealth (which is denoted by the symbol *We* in equation 2.3) endogenous (and instable). That is: the demand for money at a certain interest rate is determined by the private sector and the government has to accommodate this demand if it aims at targeting an interest rate. Governments accommodate the demand by engaging in deficit spending (fiscal policy), which adds directly to private sector financial wealth (We) and/or by loaning out reserves (monetary policy).
So we can conclude that endogenous money makes private sector financial wealth endogenous which invalidates the real balance effect.

2.5.4. Revisiting assumptions on central bank behaviour: is the central bank's interest rate policy effective?

Before discussing the strength of this stabilizing mechanism, we should first acknowledge that central banks are an institution with the purpose of promoting growth of the economy. Of course, the specific ideas on how to promote growth of the economy differ among central bankers and scholars. That explains why some central

[12] In mathematical terms this would imply that the equilibrium is stable if and only if: $\varphi_C \beta_{We} We / P^2 > \varphi_I \beta_{P,I}$.

[13] The main argument why money is endogenous is that the interest rate is determined in the money market. Hence if central banks target an interest rate, they have to supply the amount of money that the private sector wants to hold at the targeted interest rate.

banks narrow the goal of promoting growth of the economy to the objective of maintaining stable prices.
If the only mechanism by which inflation is stabilizing runs through the central bank, then inflation is not naturally (without interference of the central bank) stabilizing. This would mean that (accelerating) inflation does not automatically cause a contraction of the economy and that may make us wonder why the central bank targets inflation at all. But assume for a moment that it is worthwhile to target inflation. One of the main ways this is done is by targeting the unemployment rate to keep it to a rate close to what the central bank *thinks* the NAIRU is. Note that, without a natural adjustment mechanism the economy would not converge to the NAIRU and it would be very hard to estimate its value. Hence the central bank targets a supposed NAIRU. And if it succeeds, it maintains an artificially imposed unemployment rate in order to keep inflation below a certain level.
In the following, four arguments against an effective central bank interest rate policy will be treated: (1) The target interest rate may be too low to be attainable; (2) The NAIRU is endogenous to the interest rate; (3) The central bank has problems to calculate the target interest rate; (4) The effectiveness of the central banks policy rule entails circular reasoning.

The target interest rate may be too low to be attainable

In severe economic downturns, there may be situations where the natural rate of interest r_0 would have a very low (or even a negative) value. It can be so low, that the accompanying monetary interest rate target would be near zero or even negative. This situation reminds us of Keynes' liquidity trap: in a situation where liquidity preference (the preference to hold wealth in the form of money) is almost absolute, a higher money supply by the central bank will not lower the interest rate as funds are not loaned out anyway. However, one could argue that central banks are always able to set the interest rate at zero, by supplying all the funds that the private sector needs. Or they could even set a negative interest rate, by paying the private sector interest when it borrows funds from the central bank.
Note, however, that central banks target a market interest rate (i.e. Libor, Euribor, etc.). Their instrument to obtain this target, is setting the interest rate at which funds are loaned out at the counter of the central bank (i.e. Fed Funds rate, Refinance Rate). Central banks indeed can set the interest rate at which funds are supplied at their own counter at zero (Japan since the 1990s, US currently) or even negative rates. However, the market interest rate would always be above – or near – zero. For with a negative interest rate, there is no incentive for institutions that hold money to lend it out. Hence one would not see Libor or Euribor fall below zero.
Furthermore, the *long-term* interest rate may be the most relevant for the private sector investment decisions. The response of the long term interest rate to the central bank's short run target may be much weaker than the response of the short term interest rate. The long term interest rate is a function of the risks that the private sector perceives for lending money for the long term and its perception of the development of the central bank interest rate over that period. When the central bank's short-term interest rate is very low, the private sector will most likely expect it to go up in due course. Furthermore, the risk and liquidity premium of long-term lending are higher than that of short-term lending. Hence the relevant long-term interest rate has a positive lower bound that is at best near zero, while the natural rate of interest may

imply that a negative interest rate is needed tot restore full employment (see also Arestis and Sawyer 2004).

The NAIRU is endogenous to the interest rate

Recall that in the NAIRU model, inflation arises out of a conflict over the distribution of income between wage earners and profit earners. If we want to assess the effect of a rise in interest rates on the NAIRU, we should extend the model and add a rentier class (interest earning class). If we do this, a rise in the interest rate would imply that rentiers claim a larger share of total output. NAIRU theory would hold that both wage earners and profit earners would not accept this, with inflation as the consequence. To quell inflation, more unemployment is needed. Hence the NAIRU rises[14].

The central bank has problems to calculate the target interest rate and the NAIRU

Taylor's rule for interest rate setting by central banks looks deceivingly simple. However, neat symbols mask a fuzzy world. This is especially true with respect to the calculation of the natural rate of interest (r_0). The natural rate of interest cannot be observed and information on its value is not readily available. Moreover, it is a moving target. Hence mistakes in the central bank's assessment of its value are likely to lead to policy failures (Arestis and Sawyer, 2004, p. 451). But there is another unobservable, difficult to measure, variable in the formula: the NAIRU. This may be a reason why estimates of the NAIRU are frequently revised years later (Galbraith 1996). Unfortunately, an interest rate policy cannot be set retroactively.

The central banks' policy rule entails circular reasoning

The interest policy rule is built on the assumption that the NAIRU is the equilibrium value of unemployment. At the same time, it is meant to stabilize unemployment at the NAIRU. Thus this stabilizing mechanism assumes the very thing it is supposed to ensure. This raises doubts about whether the interest rate policy rule is based on circular reasoning.

To summarize, our evaluation of the central bank's interest rate policy points out that there are problems with it. First, it may not be possible to reverse an economic downturn by monetary policy alone. Second, the NAIRU is endogenous to the interest rate, where an interest rate aimed to bring unemployment up to the NAIRU brings up the NAIRU itself. Third, empirical determination of the concepts in the policy rule is difficult. Finally, the policy rule builds on circular reasoning. The last two problems imply that the central bank cannot, practically or in principle, bring unemployment to the real "NAIRU", but guides unemployment to the level it thinks the NAIRU is.

2.5.5. *Summary and conclusions*

The conclusions are set up such that they can be compared to the conclusions of the orthodox NAIRU theory above.

[14] See Hein (2006) for a cost-based reasoning of why an interest-rate rise pushes up the NAIRU.

The NAIRU is not an attracter of the buffer stock of unemployed people

Above, we have seen that the NAIRU is not a stable equilibrium. Neither the real balance effect nor the central banks interest rate policy is a reliable mechanism that leads to (automatic) adjustment of unemployment to the NAIRU. This changes our interpretation of the NAIRU from the long-run equilibrium rate of unemployment to an inflation barrier: the NAIRU is that buffer stock of unemployment which is consistent with stable inflation. However – as will be discussed below - the focus on the labour market that is embedded in the name NAIRU may be deceiving, for the rate of NAIRU unemployment depends on the effectiveness and size of other buffer stocks. Furthermore, it is dependent on demand, productivity and various other factors not mentioned by orthodox NAIRU theory.

The NAIRU is endogenous to the size and effectiveness of other buffer stocks

Above we concluded that the orthodox NAIRU can be interpreted as the size of the buffer stock of unemployed people that is needed to keep inflation stable (i.e. to prevent too much pressure on wages). However, if we follow this interpretation we can focus on other buffer stocks that have an effect on prices and thus inflation. And we should also look at their effectiveness in preventing price pressure: as discussed above, the effectiveness of the buffer stock of unemployed people in keeping wage demands down depends – among other things – on its age composition, education levels, geographic distribution, cultural norms, etc.

We have already argued that the buffer stock of excess capital may be important. Concerning its effectiveness, its age is of primary importance: if capacity has been idle for a long time, firms may stop maintaining it (or even scrap it), or the embodied technology may become obsolete.

A third buffer stock that is often recognised is the buffer stock of competing end products. The OECD (2006) recognises this when it estimates the effects of product market regulation and openness on the unemployment rate. To incorporate this feature in the NAIRU model, we can endogenise the parameters that reflect the mark-up or wage pressure of the unemployed in the NAIRU model: they are a function of the size and effectiveness of the buffer stocks.

The NAIRU depends on various other factors like demand, the history of unemployment and productivity

It turns out that the NAIRU itself may be very well attracted by the unemployment level instead of being an attracter for it. Galbraith (1996) argues that this indeed is the case. Theoretically, we can offer a number of channels that would achieve this behaviour. First, as already discussed above, in a number of circumstances the unemployed do not put downward pressure on wage bargaining. But one can think of other channels; for example if high unemployment results in a fall in demand and expectations, this may lead to capital scrapping which pushes up the NAIRU.

To formalise this argument, we would get a price equation where the mark-up is allowed to grow, like equation 2.1.a. We can capture the essence of the argument that the mark-up is a positive function of capacity utilisation by allowing the mark-up to depend negatively on capacity (K):

$$\hat{m} = f(\bar{K}) = \hat{m}_0 + \hat{m}_K(\bar{K}) \qquad \text{equation 2.10}$$

where $\hat{m}_0$ denotes autonomous mark-up growth.

Capacity in itself can be modelled as a positive function of demand: $K = K(\overset{+}{Y})$, through accelerator and profitability effects.
Using the equations above, we can derive the following expression for the NAIRU:

$$\bar{u} = \frac{b + b_{lmi} LMI + \hat{m}_0 + \hat{m}_K(K(\overset{+}{Y}))}{b_u} \qquad \text{equation 2.8.a4}$$

We see that the NAIRU is a negative function of demand and hence unemployment (see also Arestis and Sawyer 2004, p. 965).

Another channel by which the NAIRU is a negative function of unemployment, is if people who become unemployed are forced to accept lower productivity jobs than they initially had. This leads to a fall in productivity which also pushes up the NAIRU (through equation 2.8.a2). Storm and Naastepad (2007a) employ the Verdoorn (1949) effect (see McCombie *et al.* 2002 for a recent assessment of this effect) to argue that total demand (which is inversely related to unemployment) has a positive effect on labour productivity. As low unemployment causes a high demand, this is another reason why the NAIRU follows unemployment.

From the discussion above, we conclude that the NAIRU is endogenous to the history of demand, the history of unemployment and productivity. Hence it is not a supply side equilibrium, but can better be perceived as an inflation barrier that shifts under the influence of many factors among which labour market regulation is just one.

Labour market rigidity has an ambiguous impact on the NAIRU

The orthodox NAIRU hypothesis that labour market rigidity pushes up the NAIRU can be objected to on theoretical grounds. An example can be found in the recent work by Storm and Naastepad (2007a, 2008). They develop a model in which labour market rigidity has an ambiguous impact on the NAIRU. They do this by endogenizing labour productivity growth as a positive function of labour market rigidity. Remember that a high labour productivity growth can bring the NAIRU down (see above).
Their line of reasoning is that labour market rigidity both contributes to and is a symbol of trust between and sharing of power between managers and employees. Most labour productivity improvements are crucially dependent on the contribution of employees. They can only be expected to contribute to the extent that they have a stake and a say in productivity growth which requires trust and a sharing of power (more on this in chapter 3).
But another mechanism by which labour market rigidity can bring down the NAIRU is by its effect on total demand. If the economy is wage-led and more rigid labour markets push up the wage share, then the Verdoorn effect will imply that more rigid labour markets push up productivity growth through their effect on demand growth. Furthermore, the increase in demand may be favourable for investment which pushes the NAIRU down.

2.6. Conclusions

To conclude this chapter, we have seen that the diagnosis that labour market institutions cause unemployment was advanced by the OECD (1994b) mainly out of a theoretical foundation. At the time the OECD published its report, the data needed for a sound empirical test of the hypothesis that labour market institutions are responsible for unemployment simply was not yet available. Only after the OECD publication, gradually more data was gathered. We conclude that the OECD did not build its policy recommendations on strong empirical analyses. They were prominently based on theory.

The theoretical foundation of their policy advice is orthodox NAIRU theory. This theory predicts that unemployment revolves around the NAIRU. The NAIRU is the only sustainable level of unemployment because it is consistent with stable inflation. A higher rate of inflation is supposed to drag down demand, a lower rate is supposed to boost demand. The unemployment rate settles around the NAIRU. Furthermore, it is predicted that the NAIRU itself is a function of labour market institutions. The idea behind this is that the unemployed function as a buffer stock to keep wage demands in check. The more regulated the labour market is, the bigger the buffer stock must be in order to keep down wage demands. This implies a trade-off between unemployment (the size of the buffer stock) and rigidity in the labour market, the latter having a negative impact on the effectiveness of the buffer stock in keeping wage demands down. Hence the NAIRU is a positive function of the rigidity of the labour market.

Although the mechanisms sketched above may seem plausible, empirical studies that back the NAIRU are found not to be robust (see also chapter 4 below). Traditionally, the literature has advanced two explanations for this: either the quality or the quantity of the data is insufficient. In this chapter, a third explanation is advanced: orthodox NAIRU theory is flawed.

We have seen that there are severe problems with orthodox NAIRU theory. First of all, the feedback mechanism from inflation to unemployment is problematic. We have argued above that the real balance effect is not realistic. That implies that the central bank guides the unemployment rate to whatever value it thinks the NAIRU is, if it is able to guide unemployment at all.

Furthermore it was argued that the NAIRU is not a fixed value but that it depends on the effectiveness of buffer stocks, the size of buffer stocks, labour productivity growth and even demand and thus unemployment itself. The NAIRU is interpreted as an inflation barrier, not as an attracter for the unemployment rate. Moreover, the NAIRU depends on the history of unemployment, demand, productivity and business expectations. rigid labour markets have an ambiguous effect on the NAIRU.

3. Are rigid labour market institutions really detrimental for labour productivity growth?

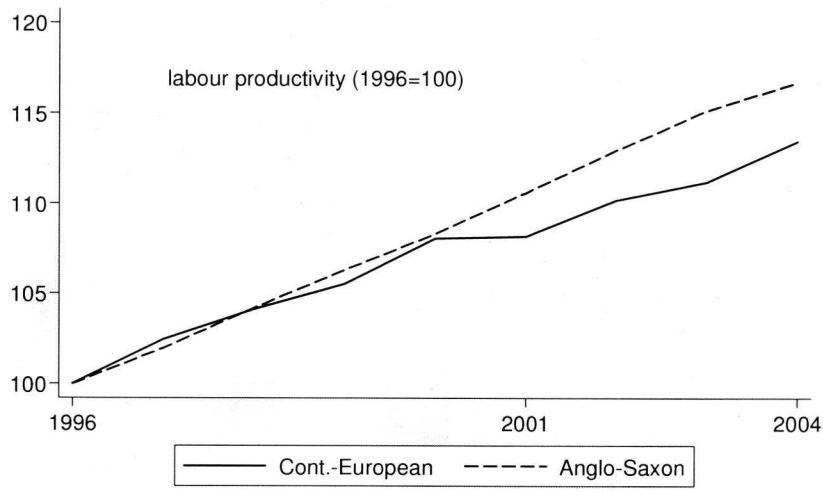
3.1. Introduction

An important observation to explain for most neoclassical economists, besides high unemployment, is the sluggish growth of European labour productivity when compared to US labour productivity (i.e. Nicoletti and Scarpetta 2003; OECD 2003b; OECD 2007a). To be more specific, they focus their explanatory analysis on the period since the ICT-revolution, starting in the late 1980s/beginning of the 1990s.

OECD/IMF economists Nicoletti and Scarpetta (2003) state this most explicitly:
"One of the most striking economic facts in the OECD area is the considerable dispersion of growth rates observed in the past decade, when some countries (most notable the United States) have pulled ahead in terms of output and productivity growth, while others (e.g. large Continental European economies) have lagged behind." (p. 5)

The graph below is an illustration of the fact they attempt to explain. In paragraph 3.5, when we assess the empirical validity of this observation, we will return to this observation and note that, if we extend the period of observation further backwards, it is not Continental Europe, but rather the Anglo-Saxon countries that are lagging behind.

Figure 3.1. Development of labour productivity: Anglo-Saxon versus Continental-European countries (1996-2004); 1996=100



Anglo-Saxon countries: Australia, Canada, New Zealand, UK and USA;
Cont.-European countries: Austria, Belgium, Denmark, Finland, France, Germany, Italy, Netherlands, Portugal, Spain, Sweden;
Source: Database of the Groningen Growth and Development Centre (http://www.ggdc.net/).

The graph clearly depicts the take-off of Anglo-Saxon productivity growth. If we would single out the US-line, we would see that it is even steeper when compared to the Continental European productivity growth. Since the mid-1990s, Anglo-Saxon productivity has indeed run ahead of productivity growth in the Continental European countries. Turning to the explanation of these facts, it has been hypothesised that labour market institutions distort the free market process. Therefore, they are detrimental to innovation and productivity. The following quotes illustrate this.

Cohen *et al.* (2004) state: "The basic hypothesis relating policy and regulations to incentives for innovation and adoption is non-controversial, that is, policy barriers to resources being allocated to their highest valued use may have an adverse impact on economic performance in general, and on productivity growth in particular" (p. 77). Another example is Siebert (1997), who notes: "However, starting from a simple notion of an equilibrium in a classically clearing labor market, institutional arrangements can influence the clearing function of the labor market in basically three ways: by weakening the demand for labor (...); by distorting the labor supply; and by impairing the equilibrating function of the market mechanism" (p. 43). Bassanini and Ernst (2002b) put it like this: "Institutions that make post-innovation employment adjustment more difficult or costly are likely to reduce innovation rents accruing to firms and hence innovative effort."

These quotes illustrate the basic framework in which the effect of labour market institutions on productivity growth is analysed by these authors. Clearly, these orthodox economists claim that the most flexible countries are the most innovative and reach the greatest productivity increases. In the following, this orthodox believe will be questioned.

For clarity reasons, we first define a few terms. When productivity growth is analysed, different channels that lead to greater productivity can be distinguished. To start with, in orthodox theory, we can disentangle the effects of greater capital intensity from innovation. This distinction goes back to Solow (1957), who distinguished the impact of capital deepening from the impact of total factor productivity (TFP), where the former is associated with a move along the production function and the latter with a shift of the production function. Apart from this, we can distinguish worker motivation factors, proxied by the efficiency of a given input of worker effort in terms of output. The efficiency wages literature (the classic reference is Shapiro and Stiglitz 1984) is a well-known example that puts focus on this channel of productivity growth.

In this chapter, we will not explicitly disentangle these channels that lead to enhanced productivity growth. We will perceive them in a holistic way for 3 reasons:
(1) The distinction between capital deepening and TFP growth rests on the assumption of a production function. However, the use of a production function at the macro-economic level is theoretically problematic as it requires aggregation of micro production functions. These micro production functions would have to entail very specific properties for this to be feasible. These properties are not realistic (see Felipe and Fisher 2003[15]).
(2) The distinction between total factor productivity and capital intensity is theoretically problematic. This is because technological innovations are often capital embodied, making the distinction meaningless. Rather, technological innovation and capital intensity are complementary. This critique on TFP as an independent measure of innovation has been originally offered by Kaldor (1957).
(3) Where the orthodox efficiency wages literature emphasises individual worker efficiency, we will follow Buchele and Christiansen (1999) in emphasizing work as a group effort. Furthermore, worker effort and innovation are not independent but more likely to be strongly interdependent. For a motivated worker may not only work harder but he may also work smarter, i.e. he may not only work more efficiently within the existing production process, but may also contribute to innovations that make the production process itself more efficient (See also Lorenz 1992).

Finally a word about labour markets: rigid labour markets are defined as markets in which management in one or the other way shares power with labour. This means that, for example, hiring and firing possibilities may be restricted, due to for instance labour market regulation, or there may be active union and employer associations, or there is employee participation in decision making, etc.
The emphasis of the chapter is not on the unique, individual impact of separate labour market institutions, but on their joint impact in the form of rigid labour markets. This choice follows the distinction by Hall and Soskice (2001) who distinguish regulated market economies with rigid labour markets from liberal market economies.
We will occasionally, in case it is of particular interest, point out the effect of individual labour market institutions on labour productivity. However, we should also recognize that, from a practical point of view, there is a high degree of institutional interdependency within countries. In other words, countries typically have either more

[15] Here, we list theoretical reasons why we refrain from employing these analytical channels to analyze the impact of labour market institutions on labour productivity. However, from an empirical point of view, the distinction is also problematic. (See Felipe and McCombie 2003.)

regulated or more liberalized labour markets across a range of indicators. The empirical emphasis by other authors has been on one specific type of institution, namely firing restrictions. These can be used as a proxy for the overall rigidity of the labour market.
Finally, in this chapter we will not dwell on the effect of wages on productivity, the induced innovation hypothesis (see for instance Funk 2002, Hicks 1932). This is the subject of chapters 5 and 6 of the thesis.

The setup of this chapter is as follows: the next paragraph deals with neoclassical arguments against and in favour of rigid labour markets. Then it turns to a perspective that tends to be neglected by neoclassical theory: labour-management co-operation. In paragraph 3.3, the effect of rigid labour markets on productivity is analysed from this perspective. Paragraph 3.4 concludes the theoretical analysis with the hypothesis that rigid labour markets are favourable for labour productivity. In paragraph 3.5 a number of empirical studies that test this hypothesis are reviewed. Paragraph 3.6 concludes.

3.2. Neoclassical perspectives on labour productivity

The neoclassical perspective offers arguments against rigid labour markets, as well as arguments that support rigid labour markets. The basic neoclassical framework that starts from a perfectly clearing labour market offers arguments against rigid labour markets. This is because any form of rigidity hampers the competitive process in generating the most productive outcomes. Rigidity causes the market to fail. This is treated in section 3.2.1. However, there are also neoclassical arguments that hypothesise positive effects of rigidity on productivity. These arguments typically start with some inherent market failure that is solved by a rigid labour market institution, i.e. by introducing another rigidity. We will turn to these arguments in paragraph 3.2.2.

3.2.1. Neoclassical arguments against rigid labour markets

The neoclassical perspective offers a range of arguments against rigid labour markets: rigid labour markets are perceived to be detrimental to the enhancement of labour productivity. These arguments are grounded in general equilibrium assumptions. Especially important are the assumptions that all firms are on the production possibility frontier, that every firm and worker has complete information about technologies and that technology is given exogenously (i.e. neoclassical theory disconcerns itself with the question of how innovations arise). Within this theoretical framework, it is obvious that labour market institutions can only restrict the otherwise perfect market. Hence they are detrimental to the efficiency enhancing process of free competition and as a corollary hamper innovation.

We will now review a number of arguments against rigid labour markets that are grounded in the orthodox theory of the perfect labour market. In the literature, the following can be found[16]:

[16] This review draws from OECD 2007a.

Difficult and expensive firing of redundant personnel frustrates labour-saving process innovations (Bassanini and Ernst 2002b).

Labour saving process innovations can make labour redundant. Of course, for firms, the benefits from a given labour saving process innovation can only be reaped after firms lay-off the redundant labour. This is more costly when institutions like employment protection legislation are in place[17].

With easier firing, shifting labour from old and declining industries to innovative activities is easier (Bassanini and Ernst 2002b; Saint-Paul 2002; Nickell and Layard 1999, p. 3064).

When some innovative industries are growing fast, they typically need new staff. Especially in periods that the economy runs at (near) full capacity, this may be difficult and slow down the progress of these new innovative industries. Easier firing in old and declining industries makes more staff available for the innovative industries. Moreover, easier firing may enhance the inflow of "fresh blood" (i.e. of people with novel ideas and networks) in the growing innovative industries.

The (latent) threat of easy firing reduces shirking.

This is the core argument of the efficiency wages literature (see Shapiro and Stiglitz 1984): people are assumed to be motivated to work for an external (pecuniary) incentive. Hence they will work harder (more productive[18]) when there is a greater likelihood and cost of being fired in the case that their shirking is discovered. The likelihood of being fired is higher when firing restrictions are limited. And, with given wages, the relative damage to workers of being fired is higher when unemployment benefits are low and of a short duration. Hence, workers are more productive when the labour market is less rigid.

Factor market regulation and rigid employment contracts may withhold firms to experiment with new business processes.

This happens because the downside risk of experimentation may become overly large, due to increased costs of having to lay-off people in case of failure. Hence, an economy with a rigid labour market would exhibit less new business experiments and thus less productivity growth (Cohen *et al.* 2004, p. 79).

There is a danger of hold-up if employees have a strong bargaining position at the decentralised level (Malcolmson 1997; Nickell and Layard 1999, p. 3067-3068).

Hold-up is a risk if contracts are not made-up in a time-consistent manner. For instance, if a firm generates a high productivity gain, then the labour union may bargain for a high pay-rise, appropriating (part of) the rents of this productivity gain. This takes away part of the incentive for firms to opt for highly risky and uncertain

[17] Staying within neoclassical theory, we could also reverse this argument. Following the induced innovation reasoning, difficult and expensive firing may spur firms to invest in labour augmenting technological change. Therefore, within neoclassical theory, firing restrictions can boost labour productivity. We will come back to this argument below.

[18] The assumption underlying the efficiency wages literature that people who work harder - i.e. put in more effort - also work more productively, is questionable (see Buchele and Christiansen, 1999).

innovation projects with high potential benefits. Hence strong, decentralised unions that bargain at the level of the individual firm are detrimental to productivity growth while centralised unions that bargain at the level of the sector are not.
However, Haucap and Wey (2004) argue that the relationship between the degree of centralization of wage bargaining and firm's investment incentives is characterised by a non-monotone (U-shaped) relationship. In a centralised bargaining system, where the union sets a uniform wage rate for all firms in the sector, investment incentives are highest. In the coordinated case, where one sector-wide union sets wages independently for all firms, they are lowest and in the decentralised case, where wages are determined independently at the firm level, investment incentives are intermediate. This result arises because in the coordinated case, the monopoly union can exploit its hold-up potential fully by setting discriminating wages for firms that differ in the productivity of their employed labour. In contrast, centralization and decentralization both constrain the unions' hold-up potential. In the former case this is because it sets only one wage for the whole sector. In the latter case this is through competition between firm level unions.
Clearly, following the reasoning above and applying the Rehn-Meidner argument (see LO 1953), one could argue within neoclassical theory that centralised bargaining actually spurs productivity, because the equality of wages drives inefficient firms off the market. This expedites structural change and fosters productivity growth (Agell 1999).

Unionised labour markets lead to wage compression over the skill-dimension (Freeman and Schettkat 2001). This decreases incentives for individual workers to invest in skill-formation (OECD 2007a).

Insofar as unionised labour markets lead to a more egalitarian society, the wage distribution is compressed over the skill-dimension. In other words: the ratio between earnings of a high skilled person and earnings of a low skilled person is smaller in unionised labour markets. This would decrease the incentives for workers to invest in skill-formation that would enhance their productivity. However, from the perspective of firms there is an incentive to invest in the skill formation of their (highly qualified) employees, as they benefit more than proportional from the productivity increase that is associated with skill formation.

Autor et al. (2007) claim that firing restrictions can only affect productivity to the extent that they have an employment reducing effect[19]*. They provide arguments why firing restrictions are detrimental to labour productivity as well as why they may be beneficial. Here, we treat the argument that explains why they may be detrimental. Below, we will turn to the arguments why they may be beneficial.*

The argument explaining why firing restrictions are detrimental runs as follows: suppose we have a labour market without firing restrictions and an economy running on the long run growth path with the corresponding productivity. As we are on the long run growth path, the inflow of workers equals the outflow of workers from the firm. The outflow of workers emanates from the lay-off of people whose productivity is below a certain threshold. Suppose now that we introduce firing restrictions in the

[19] Which, according to the authors, would not be the case if bargaining is without transactions cost. In this case, there is no employment-effect.

form of an additional cost for the firm of firing an employee. Then the lower bound of individual labour productivity before people are fired would decline, because the cost of firing rises. Hence the overall productivity would decline[20].

We can observe that the bottom line of the above arguments is that the free-market system is the most conducive to productivity growth. This is because in this setting the incentives are aligned with efficiency gains: both firms and employees are supposed to reap benefits in a strict relationship with their contribution to the productivity gains. There are no "false" incentives and there are no possibilities for rent seeking. The forces of competition drive productivity growth. All that labour market institutions can do is distorting the free market process, causing the market to fail.

However, this is not the end of the neoclassical story on the effect of labour market institutions on productivity gains. In the following, we will see that within neoclassical theory, there is also room for labour market institutions to spur labour productivity.

3.2.2. Neoclassical arguments in favour of rigid labour markets

Neoclassical arguments in favour of rigid labour markets generally start with imposing some kind of (cause for) market failure that is inherent in the market or in the characteristics of productivity enhancing innovations. Then the labour market institutions can come in to solve this market failure. The imposition of a (cause for) market failure usually is a realistic feature of the process of creating innovations and turning innovations into marketable products. For instance, Romer (1990) extended Solow 's (1957) innovation theory by realistically assuming that knowledge is only partly appropriable, hence that it partly leaks away. Then, labour market institutions can come in to contain this leak. In other words, one "deficiency" of the market mechanism is repaired by introducing another "deficiency". Let us list a number of these arguments from the literature:

Rigid labour markets may limit the leakage of knowledge to competitors, thereby limiting the extent to which there is under-investment in knowledge (Kleinknecht et al. 2006).

Greater chances that trade secrets and technological knowledge leak to competitors create larger positive externalities leading to stronger under-investment in knowledge (see also Romer 1990). When tenureships are longer and pay differences between firms within the same sector are smaller, there is less motivation for staff to move to competitors, taking with them their (embodied) knowledge. In rigid labour markets, tenureships are generally longer and pay differences are smaller. Moreover, a longer stay in the same firm will create more loyalty and commitment.

[20] One may rebut this argument by noting that the productivity barrier to hire a new employee will rise because of the extra risk that firms incur when they hire people. Hence the effect on productivity would be ambiguous.

In a related argument, Bassanini and Ernst (2002b) argue that institutionalised labour markets install norms against poaching, which limit the leakage of knowledge to competitors.

Strong employer associations may function as a limit on poaching activities among competitors, because the employers meet regularly and share a common interest next to being competitors. This prevents a part of the leakage of knowledge. Hence, positive externalities related to training or R&D activities, will tend to be smaller.

In flexible labour markets, where job durations are shorter, there is less investment, both by firms and by employees, in manpower training as pay-back periods are shorter. (Bassanini and Ernst 2002b; Acemoglu and Pischke 1999a; Acemoglu and Pischke 1999b)

The market failure leading to too little investment in training can be partly repaired by introducing more rigid labour markets that lead to longer job durations. This prolongs the payback time for training expenditures.

Union-induced wage compression over the skill-dimension makes it more profitable for firms to invest in firm specific training.

This related argument by Agell (1999) starts with assuming that firms invest too little in firm specific training of their personnel. Wage compression over the skill dimension means that peoples' wages rise less then proportional with increased productivity from extra skills. The benefits for the firm of these investments are larger if there is union-induced wage compression over the skill-dimension, because the firm can appropriate a large part of the productivity increase that arises from the training. Hence firms have more incentives to invest in skill-formation of their employees.

In a free labour market, personnel have no incentives to invest in firm-specific knowledge. Unionised bargaining enables them to reap some of the benefits. This leads to a productivity rise (Bassanini and Ernst 2002b; Auer et al. 2005).

In a free labour market, labour has no incentive to invest in learning firm-specific skills, because these are not transferable to other firms. Hence they are not in a position to get any benefits from this, because a competitor firm would not reward them for the skills. Unionised bargaining allows labour to pose a credible and considerable threat (for instance a strike) in case the firm does not reward them for their firm specific skills. If we again assume that firms under-invest in training of personnel in firm specific skills, then unionised bargaining would create a productivity enhancing incentive for workers to do this themselves.

Without powerful employer associations, unions cannot make credible commitments (Soskice 1997). This leaves both parties vulnerable for hold-up.

Above, we spoke of the danger of hold-up when powerful unions bargain at the firm level. Soskice (1997) argues that this problem is mitigated by powerful employer associations. The argument is that the hold-up problem arises because contracts are not time-consistent. For a contract to be time-consistent, it is necessary that both parties make credible commitments. This requires both parties to be trustworthy. A powerful employer association keeps the union in check (i.e. presses it to honour its

commitments) and is a more trustworthy partner for the union to keep its own commitments. Hence this balance of power mitigates the hold-up problem and is conducive to labour productivity.

Powerful unions with centralised wage bargaining can serve as a signalling device for credible commitments (Hogan 2001).

From neoclassical transaction cost theory, we know of the importance of signalling. A signal communicates a certain characteristic from one party to another. Powerful unions with centralised wage bargaining may serve to signal that the firm, sector or country has the institutions which allow for credible commitments. This attracts both workers and firms that aim at achieving productivity gains, for which potential hold-up would otherwise be a disincentive.

Shared training costs over the sector (Bassanini and Ernst 2002b).

Many training facilities exhibit increasing returns. Thus, sharing costs for training over the sector reduces the cost per trained employee. Institutionalised labour markets, with strong employer associations and/or unions, allow for such a sharing of costs across firms.

Acemoglu and Shimer (2000) argue that a good unemployment insurance stimulates people to choose for more productive jobs, as they can take more time for job search.

They start with the assumption that the likelihood of a match between a worker and a job is a declining function of productivity. Then higher unemployment benefits would stimulate people to aim for higher productivity jobs as the cost of no match - continued duration of unemployment and receiving unemployment benefits - are lower when compared to a situation with lower unemployment benefits. This leads to better, more productive matches between jobs and workers.

Closely related to the previous argument, Acemoglu and Shimer (1999) argue that in a society with higher unemployment benefits, firms will adapt to the increased demand for higher productivity jobs.

Related to their 2000 article, Acemoglu and Shimer (1999) argue that firms will adapt the type of jobs they offer to the increased demand for higher productivity jobs, because an unfulfilled vacancy brings opportunity and search costs.

Unionised bargaining may solve free rider problems (Agell 1999).

This argument aims at potential free rider problems, like the demand for light, heating and/or safety on the work floor. From the perspective of an individual worker who would swap a part of his wage for a better heat system, there is a free rider problem because he is not the only worker who would benefit from this, while the other workers do not have to trade salary for it. In other words, there are positive externalities from heating which lead to a free rider problem. The market would tend to undersupply heating on the work floor. Unionised bargaining may mitigate these problems. Light and heating help to raise worker productivity.

In a related argument, Agell (1999) and Freeman (2005) argue that unionization of the labour market may make bargaining in general more efficient. In that case unionization would reduce transaction costs that form a barrier to reaching the efficient solution.

Coase's theorem (Coase 1960) reads that, regardless of the distribution of property rights, in the absence of transaction costs, bargaining ensures that the allocatively efficient solution is reached. To the extent that unionised bargaining reduces transaction costs when compared to bargaining at the individual level, unionised bargaining leads to a solution that is closer to the efficient solution.

If the Coase theorem applies, then firing restrictions would have no impact on employment levels in the neoclassical model (Autor et al. 2007, p. F195); neither do they have an effect in the search-model framework. (p. F196). Hence neither would there be an effect on labour productivity.

Imposing firing restrictions can be regarded as a change in the distribution of property rights (of the costs/benefits of firing/being fired). If the Coase theorem would apply (i.e. if there are no transaction costs in bargaining), then this shift in the distribution of property rights would not affect the outcome in the labour market. Hence there would be no effect on unemployment and neither on labour productivity.

If the Coase theorem does not apply, then there are positive effects of employment protection legislation on labour productivity due to a further deepening of capital and a better recruitement function at the firm level. (Autor et al. 2007)

In practice, the Coase theorem is not applicable to the case of installing employment protection. This is because firing restrictions cause transaction costs to both employer and employee in the case of lay-off. Think for instance of lawyer costs to both the firm and employee.

The existence of positive transaction costs implies that firms have an extra incentive not to fire people when they become unprofitable for the firm. For when they would fire the employee, they would incur extra costs. Alternatively, they may invest this money to increase the productivity of the worker. Thus production will become more capital intensive.

Next to this productivity enhancing mechanism, firing restrictions make it profitable for firms to incur more costs during the recruitment process to reduce the probability of having to fire people. This leads to a better match between employee and firm, which is beneficial for overall productivity.

Furthermore, following the induced innovation reasoning, we could also argue that difficult and expensive firing may spur firms to invest in labour augmenting technological change. Therefore, within neoclassical theory, firing restrictions can boost labour productivity.

From these arguments, we see that within neoclassical theory, there is an array of arguments in favour of rigid labour markets. Generally, these arguments impose some obstacle for the market to generate an efficient outcome. For instance, they impose transaction costs or public good characteristics of knowledge, skills or working conditions that favour a higher productivity. Then labour market institutions can help to solve the market imperfection.

3.2.3. What neoclassical theory neglects

In the following, we will go beyond an important limitation that is, often implicitly, imposed by neoclassical theory. This is that it considers the creation of production and productivity enhancing innovations as a black box.

In doing this, it also considers the labour market as similar to other factor markets, or any other market indeed. This generalization denies the essence of what makes the labour market indeed the market for labour. The essence of a labour contract involves a subordination relationship where the worker sells a number of hours of labour to the firm (or: the management that represents the firm), where the firm can determine – up to a certain point – the tasks and activities of the worker during those hours. Hence this necessarily entails a power relationship, with management exercising power over labour.

A neoclassical theory that moves into the direction of incorporating a power relationship and incomplete contracts in the labour process, can be argued to be principal-agent theory (with its corollary: the theory of efficiency wages). Principal-agent theory assumes that there is a principal that hires an agent to perform a certain task. However, the interest of the principal may not be the same as the interest of the agent. Furthermore, the relationship between principal and agent is characterised by asymmetric information. Hence the principal has to design smart incentives to make the agent behave in his interest.

Without denying that principal-agent theory may be applicable to the employer – worker relationship – especially concerning the power relationship - we would argue that neoclassical principal-agent theory does not capture the essence of an insubordination relationship with *incomplete contracts*. That is, incomplete contracts is a broader concept than asymmetric information: it does not just imply that a subset of all relevant information is included in setting up the contract and monitoring it (as with neoclassical principal-agent theory), but it implies that there is no set of "all information". In other words: the possibilities of a worker are endless and tasks that the employer may want him to perform are subject to an uncertain future. Moreover, workers (and managers) learn and adapt their behaviour, thus changing the information set. Neoclassical theory, on the other hand, supposes the future is known up to the certainty of a probability distribution. Hence the neoclassical principal indeed draws his information subset out of the true, total set of information. If the principle invests in more monitoring costs, he can draw a larger part of the "true" information set. This does not apply to the reality of a labour relationship that is characterized by incomplete contracts.

Buchele and Christiansen (1999) emphasize a practical implication of this difference in perspective. From a principal-agent (and efficiency wages) theory perspective, there is a firm level trade-off between supervision costs and wages paid. Supervisors monitor effort. Workers who are caught shirking (not putting in enough effort) are laid-off and thus loose their wage. However, from the perspective of incomplete contracts, this trade-off is problematic. The reason is that effort can be wasted. Wasting effort is a way of changing the information set.

Furthermore, in contrast to a machine, the tasks that a worker can hypothetically perform are endless. This is why labour typically has the role of performing highly fluctuating and flexible tasks, whereas machines are used for standardised tasks. The implication is that labour contracts are incomplete: it is difficult to specify ex ante all the tasks that a worker should perform. Hence the labour-management relationship is characterised by an incomplete contract where management exercises power over

labour. Neoclassical labour theory can be argued to deny this, when they perceive the labour market like any other market (see Kaufman 2007), but the least we can say is that it ignores this important characteristic of the labour market. If we were to focus on this characteristic, new questions would arise, such as: how should management deal with its power over labour to enhance productivity? Or: what are the implications of the incompleteness of contracts for the organisation of the production process? Neoclassical theory is empty on these aspects, for it considers the production process, including technological change in the production process, as a black box. Its main concern is the optimal allocation of scarce means in order to maximize utility, taking technology and productivity as given. In neoclassical theory, there are inputs (capital and labour) and then there are outputs (products). What happens in the conversion is somehow neglected by neoclassical theory. Therefore, it neglects the potential impact of labour market institutions on this conversion process. The next paragraph focuses on this.

3.3. The perspective of labour-management co-operation

Buchele and Christiansen (1999) note that production and productivity depend critically on a joint contribution by labour and management. They term this labour-management co-operation. If we focus on the creation of innovations and production, and on the implementation of innovations in the production process, then we can start with the position that both employees and employers (or: managers) contribute to these processes. That implies that effective production and/or successful innovations are dependent on a joint contribution of both parties. Hence they require a base of trust between them. Many of the arguments listed below hinge on this notion of trust.
Furthermore, we can say that employers and employees should have both a stake and a say in the realization of productivity growth. Without a stake, they lack a clear motive or incentive to contribute to this. Without a say, there is no possibility for them to contribute (see Buchele and Christiansen 1999). This requires a sharing of power between managers and their employees. In what follows, we give arguments based on these ideas.

There is more need for monitoring and control in deregulated labour markets. This hampers productivity growth.

The lack of labour unions and employment protection in deregulated labour markets can be regarded as a sign of distrust between labour and management. The lack of these institutions implies that labour has to be motivated with the stick (threat of firing/reduction of pay). Hence there is low trust between labour and management, which in itself is frustrating the collaboration process needed to generate productivity gains. Furthermore, the distrust generates the need of – and is reflected in – more intensive monitoring and control by management. Empirical research shows that Anglo-Saxon countries have substantially larger management bureaucracies which are frustrating for creative people (Naastepad and Storm 2006; Gordon 1996).

Many productivity enhancing innovations crucially depend on the accumulation of tacit knowledge, which requires a certain rigidity in the labour market. (Dekker and Kleinknecht 2008)

Many, even radical, productivity enhancing innovations do not make it to maturity without many small, incremental innovations. For these incremental innovations, the continuous accumulation of (tacit) knowledge is essential. Tacit knowledge is based on personal experience in working with new production processes and systems. It is ill-documented, idiosyncratic and difficult to transfer (Polanyi 1966). As tacit knowledge is "embodied" in persons, the accumulation of tacit knowledge is favoured by longer-lasting employment relations. A certain rigidity in the labour market may therefore be conducive to knowledge accumulation. This argument gains weight in those sectors that exhibit a Schumpeter II 'routinized' innovation regime (Schumpeter 1942). A Schumpeter II innovation regime relies heavily on cumulative learning which is favoured by a longer average job duration.

Higher labour turnover will reduce loyalty and commitment of workers. This inhibits productivity growth (Kleinknecht and Dekker, 2008).

More flexible labour markets typically exhibit a higher labour turnover. This is detrimental for the loyalty and commitment of workers to their firm. Hence they will leak knowledge more easily and will also change jobs by their own initiative more easily, taking with them their (tacit) knowledge and production secrets. Hence this is a less favourable climate for firms to invest in productivity growth.

Workers threatened by easy firing may not reveal productivity enhancing knowledge, for this may cost them their job. (Buchele and Christiansen 1999; Kleinknecht et al. 2006; Auer et al. 2005)

People on the shop floor possess much of the (tacit) knowledge required for process innovations. People threatened by easy firing have incentives *not* to reveal knowledge relevant for the realisation of labour-saving process innovations. Hence employment protection legislation is beneficial for productivity gains.

Substantive employee participation is beneficial for productivity growth, because many productivity improvements depend crucially on employee cooperation (Nickell and Layard 1999, Buchele and Christiansen 1999; Auer et al. 2005).

Hence labour markets with works councils that have real decision making power can be conducive to productivity gains.

Nickell and Layard relate the three arguments above to each other when they write the following in their handbook on labour economics (1999). "There is a great deal of evidence that, in many sectors, substantive employee participation, where employees have some degree of autonomy in decision taking, is associated with high productivity growth. (...) Employment security is important for two reasons. First, productivity improvements often depend crucially on the co-operation of workers, or even directly upon their ideas and suggestions. These will be withheld if individuals feel their jobs are at risk as a consequence. Second, substantive participation requires more training, and this is only worth providing if the employment relation is longterm. So there is no

reason to be surprised that employment protection shows up with a positive coefficient in our simple productivity regressions (table 17)."

Norms of fairness are important for motivating people to contribute to productivity growth. In more rigid labour markets, the benefits of productivity gains are distributed in a more predictable and more egalitarian way. Hence this gives people a stake in contributing to realising productivity gains. (Buchele and Christiansen 1999; Agell 1999; Freeman 2005)

This argument gains force when we realise that production and work in most modern organisations is a group effort. Hence participation, productivity sharing, and norms of fairness (Buchele and Christiansen 1999) become more important. Freeman (2005; p. 9) notes: "Firms with employee participation, profit-sharing, or employee ownership seem to do a bit better than other firms. (...) Fairness and trust appear frequently in business decisions and depend critically on the context and framing of issues." (p. 12)

Panic (2006) extends these norms of fairness from the level of the firm to the societal level. He argues that, especially in times of rapid technological change like the ICT revolution, labour market institutions are needed to meet with norms of fairness.

He argues that the more dynamic an economy is the higher frictional unemployment is. For the unemployed to accept this, a substantial level of unemployment benefits is needed. Next, economic activity tends to be a highly collective effort. For a collective effort to succeed durably, a certain level of solidarity is needed. This solidarity is provided by labour market institutions which cushion the impact of lay-offs. Finally, he argues that cooperative unions are needed to make structural changes acceptable.

3.4. Conclusions from the theoretical discussion

Neoclassical theory provides arguments for and against rigid labour markets when considering their effect on productivity gains. Most of the arguments against rigid labour markets point to the idea that these institutions hamper the workings of the competitive labour market and thereby impair productivity gains. Saint-Paul (2002) adds force to this line of reasoning when he argues that the demand for new, innovative goods, is more volatile than the demand for old goods. So there is even more flexibility required to produce these new goods – which, is the underlying assumption, are often produced by newer and more efficient production processes than the old ones. He argues that countries with flexible labour markets will specialise in such volatile goods. An example is the US specializing in ICT.

Nickell and Layard (1999), provide a counter-argument, however, when they state that it should be recognised that firms can reduce employment by 10% per year (or even more) simply by relying on workers leaving voluntarily (p. 3064). Note that labour market institutions, in neoclassical theory, most notably have an impact when workers leave the firm *in*voluntarily. Voluntary leaves are most often work-to-work transitions, which take place regardless of the institutions. Hence we can conclude that the impact of labour market institutions on productivity within the neoclassical framework is hard to predict.

Therefore, we move beyond neoclassical theory and focus on labour-management co-operation. Turning to the relative importance of these two perspectives on productivity growth (i.e. comparing the importance of the neoclassical labour market perspective with the labour-management co-operation perspective), we acknowledge that the neoclassical perspective focuses on the allocation of labour to firms: The labour market is the meeting place of workers and firms where transactions take place. After this transaction has taken place, the worker has to engage in a production process. The productivity of the process crucially depends on how (with how much effort and how smart) this is done. We can set up the same line of reasoning for improvements in the production processes in terms of efficiency (productivity gains): these crucially depend on the cooperation of the worker. Thus if we want to say anything about labour productivity, the natural place to start looking seems to be in the production process. As most modern production processes are a joint co-operation between labour and management, this seems the most fruitful perspective.

Schumpeter (1942) also provides us with a statement on the relative importance of both perspectives. He argued "for a sharp distinction between the organisation of firms and markets most conducive to solving the static problem of resource allocation and those organisational forms most conducive to rapid technological progress."
Above, we have already seen that neoclassical theory really is static in the sense that it is not concerned with the dynamics of production, nor with the dynamics of the creation and implementation of productivity enhancing innovations. Schumpeter argues that we need a different theory to analyse the factors that have an impact on technological progress.

Boyer (2006) makes a similar statement, when he argues that the flexible labour view is based on an old labour market theory that is static and considers the production process as given. Also he argues that we need a more realistic theory based on asymmetric information within the production process and the specificities of the capital/labour nexus. Hence a relevant theory of productivity growth should take the management-labour cooperation perspective as one of its core elements.

Clearly, the reasoning above heavily draws from the perspective of management-labour cooperation. This perspective, in which sharing of power between management and employees is central, offers a range of arguments in favour of rigid labour markets, which motivates the hypothesis that rigid labour markets might actually be favourable for productivity growth. The fact that neoclassical theory provides arguments against as well as in favour of rigid labour markets, invites a look at the literature on empirical tests of this hypothesis.

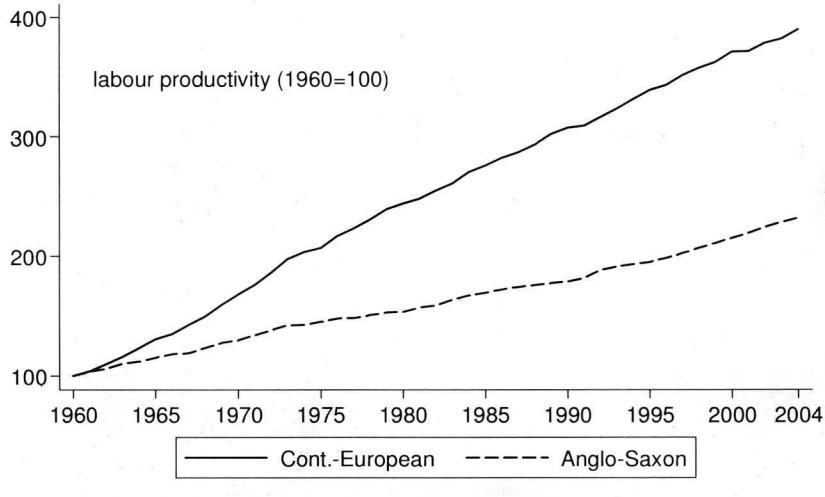
3.5. Empirical evidence in the literature

Before going into details, it must be noted that many of the studies focus on the impact of firing restrictions on productivity. Different explanations can be found for this and these depend on the theoretical approach that underlies the empirical study. First, in orthodox theory, employment protection legislation should have the most profoundly negative impact on productivity; whereas the impact of unions and/or unemployment benefits is less clear cut. Heterodox economists may use this focus because in their conceptualisation firing restrictions are a measure for labour-management cooperation. Most usually, firing restrictions are measured by the

OECD's index for the strictness of employment protection legislation (EPL). In line with heterodox reasoning, EPL indeed is found to be highly correlated with a number of other indicators for rigidity of the labour market (Storm and Naastepad 2007a).

Let us now return to the empirical observation that is the central "fact" to explain in neoclassical analysis. Figure 3.1 above already illustrated this observation: in the last decade, Anglo-Saxon productivity growth has run ahead of growth in Continental Europe. However, if the observation period is extended backwards, we can see that things change. In fact, starting from the 1960s we see that Anglo-Saxon productivity growth has been lagging behind Continental European productivity growth (see Figure 3.2). Only in the most recent period (approximately after 1995), Anglo-Saxon countries have done better (as was visible from Figure 3.1).

Figure 3.2. Development of labour productivity: Anglo-Saxon versus Continental-European countries (1960 - 2004); 1960 = 100



Anglo-Saxon countries: Australia, Canada, New Zealand, UK and USA;
Cont.-European countries: Austria, Belgium, Denmark, Finland, France, Germany, Italy, Netherlands, Portugal, Spain, Sweden;
Source: Database of the Groningen Growth and Development Centre (http://www.ggdc.net/).

This observation questions the belief of neoclassical analysis that liberal markets are most conducive to productivity growth[21]. In the following, this belief will be confronted with a review of available empirical studies that test the relationship between the

[21] Orthodox economists would argue that, until the 1980s, Continental European productivity grew faster than US productivity because of Europe's' "catching up" with the technologically advanced US, while since the mid-1990s, the US have been the first to benefit from the ICT revolution. This analysis, however, does not diminish the fact that Europe indeed was able to "catch up" with the US, in spite of its rigid labour markets. Furthermore, other flexible Anglo-Saxon countries do not show the same productivity increase as the US since the 1990s. In fact, in the period 1996 - 2004, the average of the Anglo Saxon countries in the period is biased upwards due to the performance of EU-subsidized Ireland (3.6%). The remaining Anglo-Saxon countries had a productivity growth that resembles the Continental European average of 1.4%: Australia reached 1.6%, Canada 1.5%, New Zealand 1.2% and the UK 1.9%. These rates are comparable to for instance Germany (1.7%) and France (2.1%). Data: GGDC.

rigidity of the labour market and productivity growth. Table 3.1 summarizes empirical studies. It is partly based on the survey by Storm and Naastepad (2007b). This is extended by work treated in Deelen *et al.* (2006) and by other sources compiled by the author. Before turning to the overview, we should note that Storm and Naastepad (2007b) conclude on the basis of their overview that in general the effect of firing restrictions (generally proxied by OECD's index for employment protection legislation, EPL) on productivity is positive, while Deelen *et al.* (2006) conclude that "the impact of EPL on productivity is mixed in empirical work." (p. 10)

The following table provides an overview of a number of studies that empirically assess the effect of firing restrictions on productivity. A couple of characteristics of the studies are singled out. This will allow us to group the studies according to certain characteristics and discuss the implications.

Table 3.1. Overview of the effect of firing restrictions on productivity, selected empirical studies

Study	Found effect (EPL + 1 unit)	Observation level	Panel/Cross section estimation	Proxy for firing restrictions	Dep. Var.	Hypoth.	Group
Nickell and Layard 1999	0.09	Country	Cross section	EPL	lp; TFP	No hypoth.	1
Buchele and Christiansen 1999	0.45	Country	Cross section	Rts-Co[(a)]	lp	+	1
OECD 2003b	-0.002	Industry/ Firm	Panel, fe	EPL	TFP	-	2
Michie and Sheehan 2003	+	Industry/ Firm	Panel, fe	External turnover	lp	+	3
Scarpetta and Tressel 2004[(c)]	NS.	Industry/ Firm	Panel, fe	EPL	TFP	-	2
Cohen *et al.* 2004	NS.	Industry/ Firm	Panel, fe	EPL	TFP	-	2
Naastepad and Storm 2006	0.25	Country	Cross section	EPL	lp	+	1
Storm and Naastepad 2007c	0.2	Country	Cross section	EPL	lp	+	1
Autor *et al.* 2007	+ (lp); - (TFP)	Industry/ Firm	Panel [(d)]	Strictness of wrongful discharge protection[(e)]	lp; TFP	-,+	2,3
OECD 2007a[(f)]	-0.02 (lp); -0.04 (TFP)	Industry/ Firm	Panel, fe	EPL	lp; TFP	-	2,3
Dew-Becker and Gordon 2007[(g)]	1.82	Country	Panel, fe	EPL	TFP	No hypoth.	
Pieroni and Pompei 2008	+	Industry/ Firm	Panel, fe	External turnover	lp	+	3
Lucidi and Kleinknecht 2009	+	Industry/ Firm	Cross section	External turnover, share of employees with fixed term contract	lp	+	3

Notes:
(a) A 2-dimensional index of worker rights and labour-management co-operation, based on a factor analysis of several sub indices such as earnings dispersion, ratio of supervisory personnel and the level of collective bargaining. The first dimension of this index has a correlation of over 90% with the OECD's EPL index (Storm and Naastepad 2007a).
(b) Panel data estimator with panel specific fixed effects.
(c) The RESET test in Scarpetta and Tressel (2004) shows problems arising from omitted variables.
(d) Panel data estimator without panel specific fixed effects.
(e) Three indicators for common-law exceptions to the employment-at-will doctrine: the implied covenant of good faith and fair dealing, the tort of wrongful discharge in violation of public policy, the implied-in-fact contract not to terminate without good cause.
(f) This study stands out for its specific choice of industries. OECD has selected the industries it includes in the study on the basis of a high lay-off rate (the so called "policy-binding industries", see box 2.2, page 68). This introduces a bias in the estimation in favour of obtaining a negative coefficient, because firms that rely to a high degree on numerical flexibility are over-represented in the sample.
(g) This study uses differences of the variables instead of growth rates.
NS means not significant at the 5% level.

3.5.1. Three groups of studies

The studies summarized above can be structured into three groups based on the characteristics listed in the table.

Group 1 consists of studies that use labour productivity as the dependent variable, exploit a cross section of country data and use OECD's measure of EPL strictness as the independent variable in a setting with different controls. Typically, the hypothesised effect of strictness of EPL on productivity is positive. This hypothesis is consistent with the choice for labour productivity as the dependent variable. In paragraph 3.1 we already noted that the alternative proxy for productivity, namely: TFP, is a concept that relies on a neoclassical production function and neoclassical market clearing. This implies that a choice for TFP as the dependent variable displays that authors' adoption of orthodox theory, whereas the choice of labour productivity (lp) as the dependent variable displays the authors' adoption of heterodox theory. Heterodox theory, as stated above, allows for much more mechanisms that would lead to a positive effect of employment protection legislation on productivity. So we can observe that, within group 1 studies, the empirical set-up and theoretical choices are indeed consistent with the hypothesis.
Group 2 consists of studies that use total factor productivity (or: the closely linked multi factor productivity) as the dependent variable, exploit a panel data set of industry- or firm-based data and use OECD's measure of EPL strictness as the dependent variable in a setting with different controls and fixed effects. Here, the hypothesised effect of EPL strictness on productivity is negative. Using a measure of TFP as a proxy for productivity shows the author's use of orthodox theory, which indeed fits well within their hypothesis of a negative effect of EPL on productivity.
Group 3 consists of studies that use labour productivity as a proxy for productivity, but exploit an industry- or firm-based panel data set (except for Lucidi and Kleinknecht (2009), who use a cross section data set). They do not use OECD's EPL indicator as the independent variable, but proxy firing restrictions with a measure of external flexibility (such as share of temporary contracts or numerical flexibility). Again, the hypothesised effect of employment protection legislation on productivity (a positive effect) fits with the choice of the dependent variable. The use of labour productivity shows that the study falls within the heterodox paradigm, which allows for more mechanisms that cause a favourable effect of employment protection.
Autor *et al.* (2007) and OECD (2007a) can be assigned to two groups. The regression with labour productivity as the dependent variable would fall within group 3. The regression with TFP as the dependent falls within group 2, with the remark that Autor *et al.* (2007) use a different proxy for firing restrictions than OECD's EPL measure.
Apart from these three groups, the study of Dew-Becker and Gordon stands out.
Dew-Becker and Gordon (2007) combine the use of total factor productivity as the dependent variable with a country-based data set in panel format. They use OECD's EPL indicator as the independent regressor.

3.5.2. Econometric choices and problems

Comparing the econometric properties of the different approaches, group 1 clearly suffers from the limited number of observations. This forces the authors to be sparse in their modelling, which leads to the lack of fixed effects and other possible controls in their regression.

Group 2 and 3 avoid these problems, by exploiting the large industry-based OECD's STAN dataset or other large industry- or even firm-based datasets. This allows them to exploit the panel nature of the dataset by including sector and country dummies and other control variables in their regressions. Most studies employ a panel specific fixed effects estimator which has the advantage that it is consistent even if the unobserved panel specific effects are correlated with the other regressors.
Group 2 is characterised by the use of the growth of TFP as the dependent variable. However, this introduces a 'bias-by-construction' problem in the regression. If we assume that a decline in the degree of employment protection leads to a rise in capital's share in National Income (which is supported by empirical work, see for instance Nunziata 2005), then we end up with a positive correlation between TFP growth and EPL by construction. This happens because of the way TFP growth is usually calculated as: $TFP_g = \lambda_g - \hat{\beta}(\frac{k}{l})_g$ where λ_g denotes labour productivity growth and $(\frac{k}{l})_g$ denotes the growth of the capital intensity in production. This TFP growth calculation as the Solow residual can be theoretically derived starting from perfectly clearing neoclassical factor markets, profit maximizing firms and a Cobb-Douglas production function with constant returns to scale: $Q = al^{\alpha}k^{\beta} \cap \alpha + \beta = 1$ where Q denotes total output and a is interpreted as TFP. It can then be shown that β can be estimated by capital's share in National Income ($\hat{\beta}$).
Thus if the share of capital rises because capital's partial efficiency (β) rises – as can be derived from neoclassical theory - then TFP falls, ceteris paribus. If in reality the assumptions of neoclassical theory would apply, there would be no bias by construction. Of course, in reality, factor markets are not perfect and this certainly is a peculiar assumption if we want to asses the effect of labour market regulation on productivity. Thus, letting capital's share fall because of a rise in EPL (i.e. a strengthening of labour's bargaining position), then the calculated TFP_g rises because EPL rises. So if the TFP_g calculation is based on a frictionless factor market (as it is) but in reality income shares are subject to bargaining, capitals partial efficiency β is likely to be underestimated (hence TFP_g overestimated) and a positive bias is introduced[22].

3.5.3. Theoretical choices and problems

Group 1 and 3 use labour productivity as the dependent variable. This choice would be rejected in favour of using TFP from a neoclassical point of view, the argument being that no difference can be made in labour productivity growth arising from capital deepening or from "true" innovation. However, as mentioned in the theoretical section, heterodox economists would reply that much innovation is in fact capital embodied, making the distinction between TFP and capital deepening useless.
Another problem with group 2's choice of TFP as the dependent variable, is that it introduces aggregation problems. Felipe and Fisher (2003) point out the specific characteristics disaggregated production functions must have, would an aggregation to

[22] Note that we could also argue that a negative bias is introduced, because unions may be willing to give up higher wage claims in exchange for employment protection.

the national or firm level be meaningful. And the fact that estimating a Cobb-Douglas function gives a good fit, is likely to arise because of the statistical and mathematical commonalities between the Cobb-Douglas production function with constant returns to scale ($Q = al^{\alpha}k^{\beta} \cap \alpha + \beta = 1$) and the accounting identity ($Q = wl + rk$, where w and r denote the real remuneration for labour and capital respectively). The following demonstrates the commonalities between TFP calculation from a Cobb-Douglas function and the accounting identity. The accounting identity reads: $Q = wl + rk$. This can be written in growth rates: $\hat{Q} = \phi(\hat{w} + \hat{l}) + (1-\phi)(\hat{r} + \hat{k})$ where ϕ denotes the share of labour in National Income. This implies that rewriting the accounting identity into growth rates and expressing it in terms of labour productivity yields: $\hat{\lambda} = \hat{Q} - \hat{l} = \phi\hat{w} + (1-\phi)\hat{r} + (1-\phi)(\hat{k} - \hat{l})$. Note that $(\hat{k} - \hat{l})$ is the growth of capital intensity. If we would rewrite the Cobb-Douglas production function in terms of the growth rates of labour productivity, TFP and capital intensity, we would obtain: $\hat{\lambda} = \hat{a} + \beta(\hat{k} - \hat{l})$ where $\hat{a}$ is usually interpreted as TFP growth. Note the similarities between the two expressions. Running a regression of labour productivity on capital intensity and a constant is bound to yield a high r^2. Not because Cobb Douglas is such a good description of production, but because the specification is a minor restriction ($\phi\hat{w} + (1-\phi)\hat{r}$ are estimated in one coefficient $\hat{a}$) of the accounting identity. Hence we estimate the weighted average of the growth of real wages and prices for capital as TFP growth. So we see that, when estimating the coefficients of a Cobb-Douglas function, one comes close to estimating the accounting identity (see Felipe and McCombie 2003). The latter would have a 100% fit by definition. Hence from a theoretical point of view, the use of a measure of TFP is highly problematic, notwithstanding the good fit of its estimations.

Next, several studies in group 2 find that EPL interacted with a medium level of bargaining coordination (at the sector level) has a significantly negative effect on productivity (OECD 2003b, Scarpetta and Tressel 2004 and Cohen *et al.* 2004), while EPL interacted with low (at the firm level) or high (at the national level) bargaining coordination picks up an insignificant effect. Although the authors interpret this finding as evidence for a negative effect of EPL on productivity, it seems more reasonable to interpret this finding as evidence for a negative effect of medium bargaining coordination on productivity. This would be consistent with the argument by Haucap and Wey (2004), that a wage bargaining regime where one union at the sector level sets individual wages for firms is detrimental for productivity. That is, they argue that the potential hold-up problem, when compared to a situation of completely decentralised wage bargaining or completely centralised wage bargaining is most severe in the case of medium bargaining coordination. This is because in the decentralised case, the union's bargaining position is constrained by competition, while in the centralised case it is constrained by the uniformity rule. In the intermediate case, the union can optimally exploit its hold-up potential by setting discriminating wages over the firms in the sector.

Furthermore, group 1's use of cross-section data may be criticised by group 2 and 3 for econometric reasons (as explained above); this choice follows from their interpretation of EPL as an indicator for the institutional state of the labour market. Thus they would theorise that employment protection is not an indicator which has an individual, direct and isolated impact on labour productivity, but which is an indicator for an institutional setting of trust and loyalty which only changes over a time-scale of decades. Hence it would indeed be useless to disaggregate ten-year averages into

yearly data as is done by the authors of group 2 and 3. This argument is a specific version of the argument offered by Freeman (2005). He discusses why there is no commonly agreed upon conclusion concerning the empirical effect of labour market institutions on unemployment. He states that we cannot solve this problem by increasing the amount of observations by taking for instance yearly instead of 5-yearly observations, the reason being that the relevant time-scale over which these institutions change is too long for yearly observations to add any true meaning. Instead, using yearly observations would only artificially increase the fit of the model, which is reflected in the problems of autocorrelation that plague most of these models. Curiously, in neither of the group 2 regressions, any test for autocorrelation is reported. However, we can learn from other panel data regressions with an extensive time-series dimension, that they typically do exhibit autocorrelation, see for instance Nickell *et al.* 2005. See Baccaro and Rei 2007 for the instability of such results.

3.5.4. Conclusions from the empirical analyses

The analyses above point out that most regression–frameworks fit with the hypothesised effect of labour market institutions on labour productivity. Furthermore, several problems with all methods were singled out. Hence if we want to draw conclusions on the empirically measured effect of the rigidity of labour markets on labour productivity, we need to be careful.

Another thing we have seen is that there are severe problems with empirical approaches that rely on a measure of TFP as a proxy for productivity. Not only do they ignore capital embodied technological change, but they also run into problems with the interpretation of a macroeconomic production function and a bias by construction problem. The use of labour productivity as a proxy for productivity does not need to disentangle productivity increases in a contribution from adding more capital to an existing work force and a contribution from the use of new technology. However, this may not be a problem at all. As Kaldor notes: "the use of more capital per worker ... inevitably entails the introduction of superior techniques which require "inventiveness" of some kind ... On the other hand, most, though not all, technical innovations require the use of more capital per man ... It follows that any sharp or clear-cut distinction between the movement along a "production function" with a given state of knowledge and a shift in the "production function" caused by a change in the state of knowledge is arbitrary and artificial" (1957, pp. 595-596).

If we would simply add up all the measured negative and positive effects of EPL on productivity (including the findings of group 2), we see that the weight of the evidence favours a positive or insignificant effect. This conclusion gains force when we acknowledge that, even in a regression framework that fits within a paradigm that tends to hypothesize a negative impact of labour market institutions on productivity (group 2), no negative effects are measured. Hence we conclude that the balance of the empirical evidence points towards a positive (or at least to a non-negative) effect of rigid labour markets on productivity.

The (still) limited amount of studies that measure this effect unfortunately does not allow for a more thorough examination in the form of a meta analysis. When more studies are published, it would be interesting to test them on the existence of publication bias, especially given the paradigm driven choices for the empirical approach and hypothesis, and the corresponding outcomes.

3.6. Conclusions and policy implications

Neoclassical economists who paint rigid labour markets in their benchmark picture of a perfectly competitive labour market, tend to conclude that labour market institutions hamper the workings of the market, causing the market to fail. However, there are also a number of neoclassical arguments in favour of rigid labour markets. These typically start with assuming some kind of market failure. Then rigid labour markets may help mitigating this market failure. In other words, one market imperfection is dealt with by introducing another imperfection.

More importantly, we have seen that neoclassical labour market theory tends to ignore an important property of the labour market: a labour relationship entails power of management over labour and is necessarily characterised by incomplete contracts. Acknowledging this opens up the perspective of labour-management co-operation. The central claim of this perspective is that it is beneficial for management to share power with its employees; i.e. to give them a say over and a share in productivity advances. This perspective points to favourable properties of rigid labour markets as a way to share power between management and workers. Based on this theoretical perspective we hypothesised that rigid labour markets would be favourable for productivity.

Turning to the empirical analysis, we have seen that the observation that labour productivity in Anglo-Saxon countries has run ahead of productivity in Continental-European countries is valid only for the period after 1995; during the decades before, the opposite holds. (Comparing Figure 3.1 and Figure 3.2). A review of empirical studies that assess the impact of rigid labour markets on productivity reveals that the evidence is mixed, albeit overall supportive of our hypothesis that rigid labour markets are at least not unfavourable for productivity. Furthermore, we detected a relationship between the empirical set-up of studies, the hypothesised effect and the findings of the study. Given the problems in constructing a measure of TFP and interpreting it as a proxy for productivity growth, we focussed more on the outcomes of studies that used labour productivity as the dependent variable. However, even if we include all studies in our analysis, the weight of the evidence seems to support the hypothesis that rigid labour markets are conducive to productivity.

In conclusion, the OECD's and IMF's call for liberal labour markets that supposedly support labour productivity is poorly grounded in empirical evidence; and there is no overwhelming theoretical support for it. On the contrary, even neoclassical orthodoxy does not give a clear-cut theoretical prediction about the impact of rigidity in the labour market on labour productivity, while the empirical evidence strongly indicates a positive one.

4. Explaining unemployment in the OECD from the 1960s to the 1990s. A robustness contest: NAIRU vs. Keynes[23]

4.1. Introduction

The view that rigid labour market institutions are responsible for high unemployment is popular among policy makers. An example is the following statement in the editorial to the OECD employment outlook 2006: "It is now vital for the lagging countries to take heart and implement the necessary reforms. The costs of inaction are too high in terms of continued unsatisfactory labour market performance. The successes achieved by some OECD countries show what can be done if there is sufficient political will to reform" (OECD 2006b, editorial). The IMF 2003a; OECD 1999b; 2003a and the EU, in its Lisbon agenda, propagate quite similar views.

Among scholarly studies that support this view empirically, the work of Nickell and various co-authors (to be traced back to Nickell 1997) has inspired various others to pursue this line of research (e.g. Belot and van Ours 2001; 2004; Blanchard and Wolfers 2000). The basic approach stems from the NAIRU hypothesis: labour market institutions such as employment protection legislation, the amount and duration of benefits, union density and the total employment tax rate, are all expected to raise unemployment rates. Nickell *et al.* (2005) is the latest contribution in this line of research. It is also the most outspoken, concluding: "broad movements in unemployment across the OECD can be explained by shifts in labour market conditions" (p.22).

In this chapter, we question the robustness of their empirical approach. In contrast to others who question the robustness of the labour market rigidity view of unemployment (e.g. Baker *et al.* 2005; Howell *et al.* 2007 and Baccaro and Rei 2005; 2007), we do not alter the original model's specification, the time span nor the exact indicators of labour market institutions used. Our study thus has the advantage that it cannot be criticised for tampering with the (theoretical) foundations of the model or for arbitrariness in selecting time span or (indicators for) labour market institutions.

Following our robustness check, we define an alternative, Keynesian-inspired and demand-driven model that explains unemployment. This is estimated and submitted to a battery of robustness tests inspired by Baccaro and Rei (2005). These tests include, among others, a country-wise leave-one-out approach, a step-wise removal of control variables, static and dynamic estimations, estimation by ordinary and feasible generalised least squares, and estimation in the original annual data and 5-year averaged data.

It is interesting to compare the results of our robustness tests to the results of Stockhammer (2004a), who also compares a NAIRU with a Keynesian model. Our findings are consistent with those in his study, the Keynesian model out-performing the NAIRU model. Stockhammer arrives at this conclusion after comparing the results of a seemingly unrelated regression model which explains employment growth by means of capital accumulation (the Keynesian model) and unemployment by means of labour market institutions (the NAIRU model). Our approach differs from Stockhammer's analysis that the performance of both models is compared when explaining the same variable. Furthermore, our approach emphasises the robustness of panel data estimators for the two models.

[23] A version of this chapter has been submitted for publication to the *International Review of Applied Economics*.

This chapter is organised as follows. The next section deals with theoretical and empirical issues surrounding the Keynesian model that is tested in this chapter. Section three compares the robustness of the NAIRU model to the Keynesian model. Three robustness checks on the work by Nickell *et al.* (2005) are applied. Subsequently, we examine the performance of the Keynesian model by employing, among others, the generic panel data robustness checks inspired by Baccaro and Rei (2005). The final sections present our discussion and conclusions.

4.2. A Keynesian explanation of unemployment

The Keynesian model used in this chapter is investment-driven. It is based on the expenditure-income-expenditure link. It thus emphasises the centrality of demand, in contrast to the NAIRU model. The model assumes that savings are a fixed fraction of income (as in Keynes 1937). We take investment as the exogenous variable. Note that, although we present a discussion on how this Keynesian model relates to other models that can be designated as Keynesian, this chapter has not the ambition of building a new Keynesian model. We rather focus on the robustness of panel data estimators of regressions of such a model.

Although this chapter contrasts the empirical robustness of a NAIRU model with a Keynesian model, some have argued that the NAIRU model itself has a Keynesian flavour (see Sawyer 2002; Stockhammer 2008). The NAIRU model can be argued to be Keynesian in the sense that it employs a notion of 'conflict inflation'. That is: the NAIRU model can be derived from a wage bargaining model where inflation arises out of a conflicting claim on output. Furthermore, it allows for involuntary unemployment. However, its corollary of a supply side determined equilibrium level of unemployment turns the Keynesian message upside down. Authors like Sawyer (2002) and Arestis (together with Sawyer, 2005), augment the NAIRU model by including a measure of capital stock in the price equation. The idea is that – with given output – a larger capital stock diminishes the ability of firms to raise prices. The model is Keynesian in that – if we employ the accelerator component in firm's investment decisions – the capital stock is a function of demand. Hence the NAIRU is a function of demand.

As the focus of this chapter is to contrast a Keynesian model with the NAIRU model, our Keynesian model entails a more direct link between investment-demand and unemployment. Furthermore, one could argue that the essence of the augmented NAIRU model is not Keynesian at all, at least not as an explanation for unemployment. After all, it perceives the NAIRU as a strong attracter for unemployment[24]. This resembles the neoclassical labour market, in that it employs a downward sloping labour demand curve (Blanchard 2007).

Stockhammer (2004a) contrasts the NAIRU model with a Keynesian model. His Keynesian specification focuses on the capital shortage explanation of unemployment. He uses a Keynesian-Robinsonian growth model that assumes that both investment and savings are a function of profitability. Real output growth is constrained by the implicit assumption that the economy operates at full capital utilisation (see also Stockhammer 2004b, p. 35). Hence a growth in demand for output results in rising prices in the short run and - through the effects on the income distribution and the

[24] Arestis and Sawyer (2004) argue that the mainstream's reliance on monetary policy as the equilibrating mechanism is unfounded. The same authors (2005) explicitly interpret the NAIRU model as an explanation for inflation rather than for unemployment.

profit rate – in investment growth in the long run. The rise in profitability generates the savings needed to sustain investment.

In Stockhammer's model, unemployment is generated by a lack of capital. Employment growth is constrained by accumulation. When the accumulation-constrained employment growth is smaller than the growth of labour supply, unemployment rises.

The model offered in this chapter has the same spirit as Stockhammer's (2004a) model in the sense that savings adjust passively to investment (a core feature of Keyensian models). Where Stockhammer's model, however, sees savings as forced by a distributional change towards profits, in our model savings are generated by the increase in total (real) income.

Our model further differs from Stockhammer's in that we do not assume that the economy is running at full capacity. The model also differs from Stockhammer's model (2004a) in the sense that it does not focus on the capital shortage explanation of unemployment, but rather on the shortage of aggregate demand as an explanation of unemployment. The effect of investment on unemployment runs not through the build-up of capacity, but through fostering demand. In doing that, the Keynesian model in this chapter is in the spirit of the unemployment analysis of Davidson (1998), where he argues that a lack of demand is the key factor causing unemployment. The model is in the spirit of Keynes (1937), when he writes: "The theory can be summed up by saying that, given the psychology of the public, the level of output and employment as a whole depends on the amount of investment." (p. 221)

The Keynesian model that is used in this chapter takes investment as the exogenous variable:

$$I = \bar{I} \qquad \text{equation 4.1}$$

Where the symbol I denotes investment.

$$S = sY \qquad \text{equation 4.2}$$

Savings (S) is a fixed fraction s of income Y.

This yields the following savings-investment equilibrium. The adjusting variable in generating equilibrium is the level of output:

$$Y = \bar{I} / s \qquad \text{equation 4.3}$$

The inverse of the parameter s is the Keynesian investment multiplier.

We then use the definition of unemployment for calculation of the unemployment rate (u) that belongs to the investment/savings equilibrium:

$$u = 1 - \frac{\lambda^{-1} Y}{l_s} = 1 - \frac{\lambda^{-1} \bar{I}}{s l_s} \qquad \text{equation 4.4}$$

Where λ denotes labour productivity and l_s labour supply.

In contrast to the NAIRU model, full employment is no automatism in the Keynesian model. On the contrary, it would be a coincidence when investment supports the level of demand needed to sustain full employment (also see: Sen 1963).

Econometric issues

Before turning to estimation of the model above, several econometric issues have to be dealt with:

- Reliable and exogenous indicators of labour supply in the period under investigation are not available[25]. Therefore, we omit it from the empirical specification. However, assumptions of a constant growth rate or a country-specific trend in labour supply are both accounted for in one or more of the model's estimated equations.
- Unemployment is bounded by definition between 0 and 1. This has the implication that investment, labour productivity and labour supply are cointegrated in the long run, each of them being integrated of order 1. As we refrain from using an indicator for labour supply, we would end up regressing two non-cointegrated I(1) variables on an I(0) variable. As this is meaningless, the values of all variables are first differenced. Although this procedure solves a problem in the order of integration of the model, it has the draw back that the regression picks up short run effects. To test whether short-run effects drive the regression results, table 4 shows the results of a model where 5-year average values of the data are used.
- Our aim is to explain the effect of differences in investment on differences in unemployment. However, a given difference in investment is likely to have less effect on unemployment in a large country than in a small one. As a linear regression model is used, an attempt should be made to control for this size-associated non-linearity in the effect of our variables. Differences in investment are divided by the level of investment. So the difference in unemployment is regressed onto the growth rate of investment. Growth rates are used for other control variables as well (except for the interest rate), for the reason mentioned above. Using growth rates as explanatory variables has the additional advantage that they allow for a straightforward interpretation in terms of (differences) in the unemployment rate.
- Other demand factors (besides investment) need to be controlled for, like (the growth of) exports and government expenditure. We use the growth of exports (rather than the growth of net exports) because imports fluctuate strongly with fluctuations in domestic income and may thus be endogenous to the unemployment rate[26]. With regard to government demand, the growth of government expenditure is used rather than (growth of) government deficits. Inclusion of the latter would introduce an endogeneity problem in that the deficit varies positively with unemployment, unemployment causing the variations. Using the growth of government expenditure does not fully solve this problem because, as unemployment benefits are likely to rise with the unemployment rate. However, the expected effect of government expenditure on unemployment is negative. The reversed causation then does not result in overestimation of the coefficient, thus mitigating the endogeneity problem.
- The real interest rate is included in the regression. As it may have a (positive) effect on the savings ratio (s in equation 4.4), its expected effect on unemploy-

[25] Both Eurostat's Ameco database and OECD's economic outlook database contain indicators for the total labour force. However, these indicators are constructed from the same surveys from which the unemployment rate is constructed. To use this indicator in the regression would therefore introduce an artificial correlation. Also, including the (growth of) the working population in the regression does not seem satisfactory in that the participation rate of this labour force increased notably during the period under investigation.

[26] In the developed world, a large part of imports is demand-induced. For instance, import demand in The Netherlands consists for 55% of capital and intermediate goods (Naastepad 2006). We expect the ratio of intermediate and capital imports in total imports to be of a similar magnitude in other developed countries.

ment is positive. Furthermore, there may be an interest-induced wealth effect which would imply a negative effect of the interest rate on unemployment. In conclusion, the sign of the coefficient of the interest rate is indeterminate. In addition, we expect the interest rate to have a negative effect on the growth of investment. Hence, its inclusion may take away part of the effect attributed to the growth of investment, compared to a regression without the interest rate.

- The growth of labour productivity is controlled for. Its expected effect is to increase unemployment. Note that the effect of productivity on unemployment in the literature is ambiguous. The model above assumes a positive effect. Some Keynesian extensions to the NAIRU model would assume a negative effect (see for instance Storm and Naastepad 2007a and Rowthorn 1995; 1999). However, the negative effect of labour productivity in these extensions presupposes that the NAIRU is an attracter for unemployment. From a theoretical point of view, this feature clearly is non-Keynesian. Furthermore, it is empirically doubtful whether the NAIRU is a strong attracter (Arestis and Sawyer 2005).
  Another mechanism offered is that higher labour productivity reduces unemployment by enhancing international competitiveness. However, Kaldor's paradox (Kaldor 1978, see for a modern confirmation of the paradox Fagerberg 1996) holds that the negative relation between exports and unit labour costs lacks empirical validity. Theoretically, it is a non-Keynesian argument for it would imply a negative relationship between labour demand and unit labour cost. So we remain with our assumption that in a Keynesian model labour productivity should have a positive impact on unemployment.
- We also control for lags of the dependent variable, determining the lag structure by the significance of the last added lag.
- Finally, country-specific effects, time-specific effects and country-specific time trends are controlled for, as in the original Nickell *et al.* (2005) regression.

Apart from the variables used by Nickell *et al.* (2005), most variables are taken from Eurostat's Ameco Database. For a detailed explanation of data-sources and summary statistics of the variables, see the appendix.

The benchmark regression equation has the following form:

$$d.u = \beta_0 + \beta_1 \hat{I} + \beta_2 Controls + \beta_3 l.d.u + \beta_4 C_{fe} + \beta_5 T_{fe} + \beta_6 C_{tt} + \varepsilon_{it} \qquad \text{equation 4.5}$$

where the dependent variable $d.u$ denotes first differences of the unemployment rate, $\hat{I}$ denotes the growth of investment, $l.d.u$ a vector of lags of differences of unemployment, C_{fe} and T_{fe} country and time-specific fixed effects respectively and C_{tt} country-specific time trends. ε_{it} denotes the error term. The controls are: the growth of exports, the growth of government expenditure, the interest rate, and the growth of labour productivity.

One should note that our model is estimated in first differences; we may therefore pick-up mainly short-run effects. Hence it is not possible to provide a direct interpretation in terms of the long run relation between unemployment and the independent variables. However, one of the employed robustness tests is averaging the data over 5-year intervals. This should remove much of the short-run dynamics that may be picked up by the coefficients when estimating the model with the original 1-year data. Furthermore, the main point of the chapter is on comparing the robustness of empirical support for the two different theoretical approaches to explain unemployment.

Moreover, we shall also undertake robustness tests, using the unemployment rate instead of its first differences as the explanatory variable.

4.3. Robustness tests

The aim is to compare the robustness of results of an empirical study inspired by the NAIRU theory with the Keynesian model sketched above. To facilitate this comparison, we follow the approach used by Baccaro and Rei (2005). This provides a battery of robustness checks which are generally applicable to any estimate which makes use of panel data. Furthermore, we use robustness checks that are specific to the study at hand, such as including and excluding control variables in specifying the regression equation. First, the Nickell *et al.* (2005) regression model will be subjected to three study-specific robustness checks. Then we estimate the Keynesian model and check the sensitivity of its results by subjecting it to a battery of robustness checks, including the following:

- Experiments with the lag structure of the dependent variable in order to find the empirically appropriate lag and to see whether the results are sensitive to the specific lag structure of the model;
- Estimating the model using a variety of corrections for possible forms of structure in the error term. Hence we apply OLS and different feasible generalised least squares techniques. These checks are particularly important in this case, because the time-dimension of the sample is too limited to provide accurate estimators of a panel-specific form of autocorrelation.
- Estimating the model with time-specific effects and/or country-specific time trends. Nickell *et al.* (2005) include year dummies and country-specific time trends in their model to control for autonomous 'global' shocks and for country-specific trends in unemployment respectively. However, one might question the extent to which these shocks and time trends are genuinely autonomous. In other words: is not the OECD-wide rise in unemployment (and/or the country-specific time trends in deviation from those shocks) the phenomenon that we aim to explain by our variables in the first place? If so, inclusion of the dummies and trends removes a crucial part of the variance that we wish to explain with our variables of interest. Experimenting with specifications by including or excluding time controls and trends allows one to assess their importance for the explanatory power of the model;
- Testing down with a variety of control variables. We investigate the sensitivity of the results with respect to the specific set of (additional) control variables included;
- Breaking-up the sample by time periods. This allows the sensitivity of the results to be checked with regard to the specific time period for which data are included in the regression;
- Performing a country-wise leave-one-out approach. This robustness check ascertains whether the results of the regression are dominated by a specific country;
- Estimating the model in 5-year averaged data as well as in the original 1-year data. Running the regression with 5-year averaged data has the advantage of averaging-out short-run fluctuations that are not of interest when searching for long-run mechanisms. Furthermore, averaging data reduces the noise created by random sampling errors. Clearly, the drawback of using averaged data is the loss of data points. In this case, the reduction results in a rather low ratio of data points to

regressors. The regression results of the averaged model should therefore be treated with caution. They can, however, indicate the extent to which relationships in the original 1-year model are driven by short-run fluctuations.

4.4. A robustness contest: NAIRU vs. Keynes

In this section, a battery of robustness tests will be applied to a NAIRU model (the Nickell *et al.* 2005 model) and to the Keynesian model laid out in this chapter.

4.4.1. Nickell et al. 2005

Nickell *et al.* (2005) present an empirical analysis of unemployment patterns in OECD-countries from the 1960s to the 1990s. Their conclusions are strongly supportive of the view that rigid labour market institutions cause higher unemployment.
In this section three problems concerning the non-robustness of their results will be discussed. These relate to minor changes in the economic and/or econometric approach of their main regression (Nickell *et al.* 2005, p.14, table 5, column (1)). We demonstrate that the results are not robust to minor modifications in the estimation procedure or to the exact specification of the regression equation. Our suggested modifications are suitable according to econometric tests, or follow from economic reasoning.
We concentrate on three problems concerning sensitivity of the estimates to the specific approach:

- Nickell *et al.* (2005) use an iterated generalised least squares method (IGLS). They provide no explanation of their preference for the iterated rather than the standard (three step) feasible GLS (FGLS) method. Applying the standard FGLS method to their data, we obtain results that differ substantially from their IGLS results.
- Nickell *et al.* (2005) include only a one-year lag of unemployment in the regression equation. However, inclusion of two-year and three-year lags in the equation yields a significant coefficient on these regressors. More importantly, it significantly changes the parameters of the labour market institution indicators and substantially reduces the auto-correlation in the residuals. The latter is important because auto-correlation in the residuals leads to a bias in the estimates if a lagged dependent variable is included (in case the inclusion of the lagged dependent does not remove the auto-correlation completely). Note that this source of potential bias is additional to the one indicated by Nunziata (2005). He correctly acknowledges that the inclusion of a lagged dependent variable would lead to biased estimates in a fixed-effects context (regardless of the existence of auto-correlation in the residuals). This bias is proportional to the size of the auto-correlation coefficient and is not extensive in data sets where T is relatively large as compared to N (Nickell 1981). In this case, however, not only do we have a source of bias in that the lagged dependent variable is included in combination with country-dummies, we also have auto-correlation in the residuals. The bias caused by the latter, considering that the lagged dependent variable is included in the regression, may well be of greater magnitude than the bias that Nunziata and Nickell refer to. And it does not diminish with an increase of the time span. In any case, a reduced auto-correlation in the residuals would lead to a reduction of the bias.
- Nickell *et al.* (2005) use interaction variables to estimate the combined effect of two indicators of labour market institutions. They define an interaction term as multiplication of the two variables concerned, after expressing them as deviations from their country means. This construction of interaction variables implies that a

change in one of the interacted variables at present will affect unemployment rates of a country at all times, even in the past. One may doubt the realism of this approach. Furthermore, the Nickell *et al.* (2005) results are sensitive to a more intuitive definition of the interaction terms, i.e. the simple multiplication of both variables involved.

Problem one: sensitivity with respect to the estimation procedure

Nickell *et al.* (2005) implicitly use an iterated GLS procedure. They provide no arguments as to why they prefer iteration over the more widely-used standard FGLS approach which leads to different results on several coefficients.

The columns labelled 'Nickell *et al.* (2005)' and '(1)' in Table 4.1 present a comparison between an iterated and a 'standard' FGLS method, estimating the same model with the same data[27]. The following changes can be observed. The (insignificant) coefficient for employment protection changes sign (i.e. it now reduces unemployment instead of increasing it). The coefficients for benefit duration and for union density become insignificant, whereas the coefficient of the total employment tax rate becomes significant (at a 5% level). Also, the money supply shock becomes insignificant, at twice its original size (coefficients on the money supply shock are not reported in Table 4.1. We report only results with respect to labour market institutions, as they are the focus of this part of the study).

[27] The author would like to express his gratitude to Luca Nunziata for making the data available and also for his comments.

Table 4.1. Results of various robustness tests of the estimates by Nickell *et al.* (2005) (dependent variable: unemployment, t and z-values in brackets)

	Original estimates, by	**Our alternative estimates (4 versions)**			
Independent variables:	**Nickell *et al.* 2005**[a,b]	**(1)**[c]	**(2)**[b]	**(3)**[b,d]	**(1,2,3)**[c,d,e]
l.u	0.86***	0.87***	1.17***	0.87***	1.21***
	(48.49)	(46.35)	(31.83)	(49.88)	(35.97)
l2.u			-0.31***		-0.41***
			(-5.55)		(-11.65)
l3.u			-0.08**		
			(-1.92)		
employment protection	0.15	**-0.04**	0.04	**-0.47*****	**-0.38*****
	(0.91)	(-0.19)	(0.20)	(-3.42)	(-1.97)
benefit repl. ratio	2.21***	2.47***	1.80***	**0.26**	**0.27**
	(5.44)	(5.63)	(4.04)	(0.64)	(0.61)
benefit duration	0.47***	**0.38**	**0.38**	**-1.35*****	**-1.25*****
	(2.49)	(1.54)	(1.52)	(-4.08)	(-3.41)
*ben. dur.*ben. repl.*	3.75***	4.35***	3.18***	4.41***	4.12***
	(3.97)	(4.24)	(3.19)	(4.57)	(3.89)
Δunion density	6.99***	**3.23**	**2.65**	7.52***	**2.14**
	(3.17)	(1.42)	(1.34)	(3.34)	(0.96)
coordination	-1.01***	-0.95***	**-0.12**	**1.05**	**1.04**
	(-3.54)	(-3.23)	(-0.36)	(1.61)	(1.44)
*coord.*union density*	-6.98***	-5.92***	-4.00***	**0.01**	**0.07**
	(-6.12)	(-4.80)	(-4.00)	(0.03)	(0.20)
tot. empl. tax rate	1.51**	**2.18*****	**1.10**	**10.70*****	**6.79*****
	(1.72)	(2.27)	(1.18)	(4.01)	(2.34)
*coord.*tot. empl. tax*	-3.46***	-2.84***	**-1.81**	-4.65***	-2.69***
	(-3.29)	(-2.41)	(-1.64)	(-4.27)	(-2.25)
time dummies	yes	yes	yes	yes	yes
country dummies	yes	yes	yes	yes	yes
country-specific trends	yes	yes	yes	yes	yes
N	20	20	20	20	20
NT	600	600	600	600	600
ρ_1	0.38***	0.34***	0.14***	0.34***	**0.07**
	(9.52)	(8.66)	(3.18)	(9.03)	(1.63)

Notes:

(a) Author's reproduction of original estimates by Nickell *et al.* (2005).

(b) Estimated using the Iterated GLS prodedure c.f. table (5), column (1) in Nickell *et al.* (2005). Stata-command XTGLS (…), p(hetero) corr (psar1) rhotype(theil), igls;

(c) Estimated using the same procedure as in *a* but performing FGLS instead of IGLS. Stata-command: XTGLS (…), p(hetero) corr (psar1) rhotype(theil);

(d) In this specification, the interaction variables are defined as: *interaction*

$(x_{1,it}, x_{2,it}) = (x_{1,it} * x_{2,it})$, instead of the original *interaction*

$(x_{1,it}, x_{2,it}) = (x_{1,it} - \bar{x}_{1,i.})(x_{2,it} - \bar{x}_{2,i.})$;

(e) In this combination of the specification and estimating procedure, only lag 1 and 2 of the dependent are significant and therefore included in the estimate (lag 3 is insignificant and therefore omitted);

- ***, **, * denote 1, 5, 10% significance respectively;

- statistics printed in **bold** change sign and/or significance when compared to the Nickell *et al.* (2005) estimates;

- ρ_1 denotes the coefficient for first order auto-correlation in the residuals of the regressions;

- Because of space considerations, the coefficients for the shock variables are not reported. When interesting, they are mentioned in the text.

- a description of the variables can be found in Nickell *et al.* 2005

Problem two: sensitivity with respect to the lag structure

Nickell *et al.* (2005) include only a one-year lag of the dependent variable (i.e. unemployment) in the regression equation. They comment on the high value of the coefficient of the lagged dependent variable: 'This reflects a high level of persistence and/or the inability of the included variables to fully capture what is going on' (p. 15). One could argue, especially when following this motivation, that more unemployment lags should be included in the regression if they have a significant meaning in explaining current unemployment. Column (2) of Table 4.1 shows the results of a regression with two years' extra lags (i.e. adding a two-year and a three-year lag to the one-year lag. Adding a 4-years' lag does not further add to the explanatory power of the model.

All three lags of unemployment are statistically significant in explaining present unemployment. Also, if we follow Hausman's (1978) approach: the fact that coefficients of the other regressors change or become (in)significant, points to the appropriateness of including these extra lags. Their inclusion is thus appropriate from an econometric point of view. Furthermore, we see that the coefficient of lag 1 of unemployment has become larger, the other two lags of unemployment having a negative coefficient of such magnitude that the total effect of past on current unemployment in the equation with two extra lags differs little from the original.

Looking at the coefficients of the other regressors, however, we observe that benefit duration, union density, coordination of bargaining, the total employment tax rate and the interaction of coordination and total employment tax rate have become *in*significant. The money supply shock has become significant.

Finally, the problem of auto-correlation in the residuals (resulting in biased coefficients) has decreased, with an order of magnitude of 2.5. The significance of the auto-correlation also decreases considerably.

Problem three: sensitivity to a more intuitive definition of the interaction terms

Nickell *et al.* (2005) define interaction terms as follows (p.14, Table 5): 'all variables in the interaction terms are expressed as deviations from the sample means.' By sample mean, they denote the mean for a specific country[28]. Formally, they calculate an interaction term as: $interaction(x_{1,it}, x_{2,it}) = (x_{1,it} - \bar{x}_{1,i.})(x_{2,it} - \bar{x}_{2,i.})$, where $\bar{x}_{1,i.}$ and $\bar{x}_{2,i.}$ denote the average value over time for a specific country. Starting with this definition, we can deduce the following implication of their regression model: a change in one (or both) of the interacted variables at present, affects not only the current or future unemployment rates, but also propagates into all past unemployment rates. To clarify: assume that one (say: x_1) of the interacted labour market indicators changes for a specific country i in year s. Then, the country mean $\bar{x}_{1,i.}$ of that indicator also changes. As this changed mean of the interacted variable enters into the regression

[28] This definition is not stated in the original paper. We found it through trial and error. First, we calculated the interaction variables using various definitions. If the World mean is used to de-mean both variables interacted, a low correlation with the interaction variable used by Nickell *et al.* (2005) is obtained. If the country-specific means are used, the correlation with the original demeaned variables is above 99% for all interaction terms except union density interacted with coordination. For the latter, the correlation is above 90%. This may be because the union density variable provided in the original database is rounded. Furthermore, comparing two regressions using the Nickell *et al.* (2005)-specification and altering only the two highly correlated interaction terms, did not alter the results of the regression.

equation of all periods of the country, the change at time s changes all unemployment rates in the present, future *and past*. This is obviously inadequate.
If the interaction terms are modelled more intuitively, with the simple multiplication of both variables concerned (i.e. $interaction(x_{1,it}, x_{2,it}) = (x_{1,it} * x_{2,it})$), such problems are avoided.
An additional benefit is that we do not need to know the position of a country relative to its average to be able to interpret the sign of the coefficient of the interaction variables in terms of a change in the size of the interacted variables
More importantly, one can observe from Table 4.1, column (3) that there are substantial differences between the Nickell *et al.* (2005) estimate and that with our intuitive definition of the interaction variables. To start with, employment protection legislation turns negative and becomes significant (i.e. it *reduces* rather than *increases* unemployment). The same happens to benefit duration. Bargaining coordination turns positive and insignificant, as does the interaction of bargaining coordination and union density. Total employment tax rate has a far greater impact and is significant.

A combination of the three modifications

The modifications treated above generate considerable changes of the results obtained by Nickell *et al.* (2005) if implemented in isolation from each other. It is interesting to see what happens to their estimates if all the adaptations are implemented simultaneously. This is shown in the last column of Table 4.1.
Looking at the estimates (and comparing the column labelled 'Nickell *et al.* (2005)' with column '(1,2,3)'), we observe that 7 out of 9 of the coefficients for (interacted) labour market institutions change sign or become (in)significant. While Nickell *et al.* (2005) estimate a (non-significant) positive effect of employment protection and benefit duration (i.e. increasing unemployment), these both change sign and become significant (i.e. employment protection and benefit duration now *reduce* unemployment). Benefit replacement ratio becomes insignificant as do union density and the interaction between the latter and coordination of bargaining. Coordination of bargaining turns positive and becomes insignificant. Total employment tax rate becomes significant, together with the money supply shock.
If we look at the problem of first order auto-correlation in the residuals (which would result in biased estimates due to the inclusion of lagged dependent variables in the regression), we see that it has almost vanished. The coefficient of auto-correlation reduces from 0.38 to 0.07 and becomes (just) insignificant at the 10% level. To conclude, the results obtained by Nickell *et al.* (2005) suffer from lack of robustness when subjected to minor changes in specification, which are defendable from an econometric and/or economic point of view. This justifies serious doubts about the influential results and policy conclusions drawn by Nickell *et al.* (2005).

4.4.2. The Keynesian model

The analysis above shows that the effect of labour market institutions in the Nickell *et al.* (2005) model lacks robustness. However, if we turn our attention to their control variables, we observe that the coefficients of the latter are much more stable. In particular, the controls for demand and productivity seem to out-perform the labour market institutions in explaining unemployment. Below, a Keynesian model will be put to the (robustness) test. This model emphasises the centrality of (investment) demand in explaining unemployment and includes controls for productivity.

Static models with yearly data

We expect that estimation of the regression equation 4.5 in static form will suffer from omitted variable bias due to absence of the lagged dependent variable[29]. The estimates are interesting, however, because they provide a first idea about the robustness of the investment effect on unemployment. Including or excluding country-specific effects, time-specific effects, and country-specific time trends, and/or estimating the model by OLS or FGLS with the appropriate correction (i.e. for panel-specific heteroscedasticity and a common ar1 coefficient) does not affect the significance of investment growth (in all specifications it is significant at the 1% level) and it has the expected negative effect on unemployment with a value ranging between -1.98 and -2.79.

Dynamic models with yearly data

Let us now turn to more consistent estimators by including lagged dependent variables in the regression (Table 4.2). For theoretical reasons, dynamic effects are included, because the investment – savings equilibrium does not settle instantaneously. Hence, changes in our explanatory variables are not fully absorbed immediately. From an empirical point of view, as many lags are included as is justified by the data. The maximum lag proves to be three, the fourth lag no longer being significant.
Including a lagged dependent variable introduces a bias in the fixed effects estimator. Following Nunziata (2005), we consider this bias to be moderate and the fixed effects estimator to perform as well as or better than many alternatives due to the time-span of the data ($T \approx 30$). The dynamic model does become inconsistent, however, if auto-correlation in the residuals is still present in spite of including the lagged dependent variable.
Columns (1) to (3) are estimated using OLS and serve two purposes. Firstly, they allow us to find out how many lags of the dependent variable are to be included. Secondly, and perhaps more importantly, they show that the results of our model are insensitive to the specific structure of dynamism that is assumed in the regression. This should be contrasted with the sensitivity of Nickell *et al.*'s (2005) results and the performance of indicators for labour market institutions in general in the models estimated by Baccaro and Rei (2005). It can be observed that country dummies are insignificant in the dynamic regressions, as they were in the static regressions as opposed to year dummies. More importantly, the properties of the estimator are improved when more lags are included. If the third lag is included, the model is free from significant auto-correlation when a common ρ is assumed[30]. The preferred estimation (column 4) is one with only a correction for panel-specific heteroscedasticity because the time dimension of the sample is too small (T ranges from 2 to 31 with an average of 17) to warrant a reasonable estimation of panel-specific auto-correlation

[29] Because it takes time for the investment-savings equilibrium to settle, there are theoretical reasons for including the lagged dependent variable. Post-estimation diagnostic tests also point in this direction. Because of this objection, the results of static regressions are not reported. However, they can be obtained from the author on request.

[30] The inclusion of a fourth lag of the dependent variable - although not significant - rules out common auto-correlation with a significance level of 1.00. As it is not significant, however, it is not included in the reported models. Note that the results of the estimates are not sensitive to its inclusion.

terms. But by means of a sensitivity check, estimates with this correction have been performed. The results (column 5) show robustness for this manipulation.

Table 4.2. Keynesian specifications: dynamic models to explain the difference in unemployment, estimated on yearly data, 20 OECD countries, 1960 - 1995

	(1)	(2)	(3)	(4)	(5)
Method **Indep. vars:**	**OLS**	**OLS**	**OLS**	**FGLS, p(h)**	**FGLS, p(h;ar1)**
l.du	0.29***	0.40***	0.34***	0.33***	0.40***
	(5.19)	(6.73)	(5.77)	(6.79)	(7.63)
l2.du		-0.24***	-0.11*	-0.09*	-0.16***
		(-4.33)	(-1.69)	(-1.66)	(-2.89)
l3.du			-0.21***	-0.19***	-0.16***
			(-3.66)	(-3.64)	(-3.19)
$\hat{I}$	-1.92***	-1.80***	-1.86***	-1.87***	-1.68***
	(-8.75)	(-8.47)	(-8.96)	(-10.20)	(-10.18)
$\hat{e}$	-2.47*	-2.31***	-2.38**	-2.11**	-1.65*
	(-1.94)	(-1.88)	(-2.00)	(-2.21)	(-1.93)
$\hat{g}$	-1.62***	-1.36**	-1.39**	-1.26***	-1.04**
	(-2.37)	(-2.06)	(-2.16)	(-2.65)	-2.50)
r	0.00	0.01	0.02	0.00	-0.00
	(0.20)	(0.61)	(0.81)	(0.11)	(-0.01)
$\hat{\lambda}$	0.40	0.90	-0.00	1.87	0.22
	(0.15)	(0.35)	(0.00)	(0.93)	(0.11)
C_{fe}	yes	yes	yes	yes	yes
T_{fe}	yes	yes	yes	yes	yes
Wald(C_{fe})	F(15,218)=0.55	F(15,217)=0.65	F(15,216)=0.76	χ^2(15)=19.33	χ^2(14)=16.37
	p=0.91	p=0.83	p=0.72	p=0.20	p=0.29
Wald(T_{fe})	F(33,218)=2.12	F(32,217)=2.03	F(31,216)=2.21	χ^2(31)=79.94	χ^2(31)=98.71
	p=0.00	p=0.00	p=0.00	p=0.00	p=0.00
LR(p(h))	χ^2(15)=69.44	χ^2(15)=52.96	χ^2(15)=49.05	χ^2(15)=49.05	χ^2(15)=33.10
	p=0.00	p=0.00	p=0.00	p=0.00	p=0.00
LR(ar1)	χ^2(1)=1.50	χ^2(1)=3.64	χ^2(1)=0.27	χ^2(1)=1.07	χ^2(12)=21.71
	p=0.22	p=0.06	p=0.61	p=0.30	p=0.04
LR(p(ar1))	χ^2(16)=30.64	χ^2(16)=36.09	χ^2(16)=30.13	χ^2(13)=22.54	χ^2(13)=22.54
	p=0.02	p=0.00	p=0.01	p=0.05	p=0.05
adj. R^2	0.60	0.62	0.65		
N	16	16	16	16	16
NT	273	273	273	273	273
k	55	56	57	57	57
Σcovars	1	1	1	16	32

Notes:
***, **, * mean significance with α=1,5,10% respectively; Wald(…), LR(…) mean Wald, LR-test; p(h) means panel-specific heteroskedasticity in the residuals; ar1 means common ar1 coefficient in the residuals; p(ar1) means panel-specific ar1 coefficient in the residuals; N denotes the number of panels; NT denotes the number of observations; k denotes the number of parameters; Σcovars denotes the number of estimated covariances and auto-correlations in the residual variance/covariance matrix. Figures between brackets denote t- and z-statistics. Data sources: see appendix.

Column (4) shows the results of our preferred model with three lags of the dependent variable and a correction for panel-specific heteroscedasticity in order to obtain more

efficient estimators. Investment growth has a coefficient of -1.87[31] and is significant at the 1% level. The coefficient implies that a positive change in the growth rate of investment of 10% results in an extra decrease of the unemployment rate with a value of 0.187%. The control variables also perform as expected, only the level of significance of the growth of labour productivity is low (i.e. 35%). The growth of exports has a coefficient of -2.11 and is significant at 5% level. The growth of government expenditure is also significant (at 1% level) with a coefficient of -1.26. The interest rate is not significant, which is not surprising when we recall that its coefficient reflects two counteracting effects (the effect on the savings propensity and a wealth effect).

The growth of labour productivity is not significant, perhaps because labour is hoarded (for a empirical confirmation of labour hoarding over the cycle, see Burnside *et al.* 1993), making labour productivity in the short run unrelated to unemployment. Estimating the regression with the use of averaged data (see Table 4.4), confirms this hypothesis, because labour productivity is significant when 5-year averaged data are used[32]. As there is correlation between the different explanatory variables, Table 4.3 provides a sensitivity analysis for the inclusion of both insignificant and significant controls.

To assess the economic relevance of the findings in column (4) of Table 4.2 we can perform a simulation. Unemployment in many OECD countries started rising after the first oil crisis in 1973. We can split the period of observation in a low-unemployment period before the first oil crisis (i.e. until 1973 unemployment in the sample remained steady at 2.3%) and a period of high and rising unemployment after the first oil crisis (i.e. unemployment grew with 0.27%-points per annum to generate a sample average over the period 1973 - 1995 of 6.67%). The change in the first difference of unemployment between the two periods is 0.282%.

Our model would single out investment growth as the greatest contributor to reduced unemployment, explaining about 98% (0.277%) of the rise in unemployment. Export growth and the growth of government demand explain 25% and 17% respectively.

[31] It is possible to calculate an approximation for the implied savings ratio from this value of β_1 by differentiating the regression equation 4.5) and adopting the assumption of a constant ratio of investment to GDP. The implied savings ratio equals about 10%. Considering that the sample average of the savings ratio is 17%, the result is considered satisfactory and economically plausible.

[32] However, the coefficient takes an implausible value of around 15 (the exact value depends on the specification).

Table 4.3. Keynesian specifications: dynamic models to explain the difference in unemployment, estimated on yearly data, 20 OECD countries, 1960 - 1995, FGLS estimations with errors corrected for panel-specific heteroskedasticity

	(1)	(2)	(3)	(4)	(5)
Method / **Indep. vars:**	**FGLS, p(h)**	**FGLS, p(h)**	**FGLS, p(h)**	**FGLS, p(h)**	**FGLS, p(h)**
l.du	0.38***	0.37***	0.37***	0.38***	0.42***
	(7.24)	(7.57)	(7.77)	(7.81)	(11.16)
l2.du	-0.09*	-0.09*	-0.09*	-0.09*	-0.11*
	(-1.66)	(-1.75)	(-1.69)	(-1.72)	(-2.77)
l3.du	-0.17***	-0.16***	-0.16***	-0.16***	-0.09*
	(-3.32)	(-3.41)	-3.46)	(-3.37)	(-2.30)
$\hat{I}$	-1.80***	-1.67***	-1.65***	-1.66***	-1.60***
	(-9.98)	(-10.13)	(-10.10)	(-10.66)	(-12.13)
$\hat{e}$	-2.42***	-1.58**	-1.51**		
	(-2.79)	(-2.04)	(-1.97)		
$\hat{g}$	-1.17***	-1.20***	-1.19***	-0.96**	
	(-2.60)	(-2.85)	(-2.83)	(-2.38)	
r	0.00				
	(0.11)				
$\hat{\lambda}$	1.83	1.66			
	(0.99)	(0.92)			
C_{fe}	no	no	no	no	no
T_{fe}	yes	yes	yes	yes	yes
Wald(T_{fe})	$\chi^2(31)$=81.11	$\chi^2(31)$=104.16	$\chi^2(31)$=103.18	$\chi^2(31)$=125.27	$\chi^2(31)$=136.71
	p=0.00	p=0.00	p=0.00	p=0.00	p=0.00
LR(p(h))	$\chi^2(15)$=46.41	$\chi^2(18)$=63.55	$\chi^2(18)$=62.68	$\chi^2(18)$=63.66	$\chi^2(19)$=107.83
	p=0.00	p=0.00	p=0.00	p=0.00	p=0.00
LR(ar1)	$\chi^2(1)$=0.37	$\chi^2(1)$=-0.02	$\chi^2(1)$=-0.04	$\chi^2(1)$=-1.94	$\chi^2(1)$=0.29
	p=0.54	p=1.00	p=1.00	p=1.00	p=0.59
LR(p(ar1))	$\chi^2(16)$=39.25	$\chi^2(19)$=47.10	$\chi^2(19)$=53.02	$\chi^2(19)$=47.58	$\chi^2(20)$=61.20
	p=0.00	p=0.00	p=0.00	p=0.00	p=0.00
N	16	19	19	19	20
NT	273	327	327	327	625
k	40	39	38	37	36
Σcovars	16	19	19	19	19

Notes:
***, **, * mean significance with α=1,5,10% respectively; Wald(…), LR(…) mean Wald, LR-test; p(h) means panel-specific heterskedasticity in the residuals; ar1 means common ar1 coefficient in the residuals; p(ar1) means panel-specific ar1 coefficient in the residuals; N denotes the number of panels; NT denotes the number of observations; k denotes the number of parameters; Σcovars denotes the number of estimated covariances and auto-correlations in the residual variance/covariance matrix. Figures between brackets denote t- and z-statistics. Data sources: see appendix.

Table 4.3 provides estimates with the preferred correction: FGLS regressions which allow for panel-specific heteroscedasticity. When compared to the estimates in the former table, the first column removes the country dummies. The results do not change substantially. Moreover, the possible problem of common auto-correlation becomes even less relevant. Removing the interest rate (column 2) totally eliminates the problem of common auto-correlation in the residuals, which increases confidence

in the properties of the estimator in the second column of Table 4.3. Column (3) shows our preferred model, because it is the most efficient (i.e. it has all insignificant regressors removed). The results once again confirm our theoretical expectations: investment has a highly significant negative impact on unemployment, with a coefficient of -1.65. Exports and government expenditure are also significant with coefficients of -1.51 and -1.19 respectively, i.e. they also reduce unemployment. These findings imply that investment growth explains 94% (i.e. 0.264% of the rise of 0.282% in the difference of unemployment). Export growth and the growth of government expenditure explain 20% and 17% respectively.
In column (4) the first significant regressor is removed. Nonetheless, the coefficient of growth of investment remains stable at around -1.6 and holds a high significance level. Even in column (5), with the last (significant) control variable removed (the growth of government expenditure), this still is the case.
It may be observed that the 0-hypothesis of no panel-specific auto-correlation in the residuals has to be rejected for all specifications. Keeping the aforementioned objections in mind, therefore, we test the robustness of the results for this correction. The results remain stable[33].

Models with averaged data

Table 4.4 shows estimates using data averaged over 5-year intervals. Our primary reason for doing this is to check whether the results of estimates using yearly data are driven mainly by short-run effects. Using five-year averaged data should swamp these effects, allowing conclusions to be drawn as to the applicability of the model to pick up effects in the longer run. Furthermore, using averaged data should filter out the effects of business cycles on unemployment, investment and other variables. Therefore, using averaged data allows for more reliable causal interpretations of the effects of regressors. Additionally, the properties of the estimators might improve, because first-order auto-correlation in the error term may be reduced. When using averaged data, obviously, we loose observations, impairing both the power and significance of econometric tests.

[33] The only regressor that is affected is the growth of exports, which loses significance. Estimates are available on request.

Table 4.4. Keynesian specifications: static models to explain the difference in unemployment estimated on 5-year averaged data, 20 OECD countries, 1960 - 1995

	(1)	(2)	(3)	(4)
Method				
Indep. vars:	**OLS**	**OLS**	**OLS**	**OLS**
$\hat{I}$	-3.40***	-3.63***	-2.31***	-2.40***
	(-6.05)	(-5.87)	(-4.01)	(-3.18)
$\hat{e}$	-5.34**	-2.07	-2.46	-0.74
	(-2.27)	(-0.60)	(-0.93)	(-0.13)
$\hat{g}$	0.26	0.61	-2.54*	-2.27
	(0.22)	(0.44)	(-2.04)	(-1.21)
r	-0.02	0.00	-0.02	-0.00
	(-0.64)	(0.08)	(-0.40)	(-0.03)
$\hat{\lambda}$	11.73**	20.38**	20.28**	29.49**
	(2.08)	(2.36)	(2.47)	(2.26)
C_{fe}	no	yes	yes	yes
T_{fe}	no	no	yes	yes
C_{tt}	no	no	no	yes
Wald(C_{fe})		F(14,29)=0.75 p=0.71	F(14,24)=0.94 p=0.54	F(12,12)=0.40 p=0.94
Wald(T_{fe})			F(5,24)=5.44 p=0.00	F(4,12)=4.32 p=0.02
Wald(C_{tt})				F(15,12)=0.47 p=0.91
LR(p(h))	χ^2(14)=33.56 p=0.00	χ^2(12)=49.46 p=0.00	χ^2(12)=21.89 p=0.04	χ^2(10)=30.18 p=0.00
LR(ar1)	χ^2(1)=-6.97 p=1.00	χ^2(1)=13.61 p=0.00	χ^2(1)=11.59 p=0.00	χ^2(1)=30.61 p=0.00
LR(p(ar1))	χ^2(13)=12.41 p=0.49	χ^2(13)=16.38 p=0.23	χ^2(13)=14.22 p=0.36	-
adj. R^2	0.51	0.47	0.70	0.57
N	15	15	15	15
NT	49	49	49	49
k	6	20	25	37
Σcovars	1	1	1	1

Notes:
***, **, * mean significance with α=1,5,10% respectively; Wald(...), LR(...) mean Wald, LR-test; p(h) means panel-specific heterskedasticity in the residuals; ar1 means common ar1 coefficient in the residuals; p(ar1) means panel-specific ar1 coefficient in the residuals; N denotes the number of panels; NT denotes the number of observations; k denotes the number of parameters; Σcovars denotes the number of estimated covariances and auto-correlations in the residual variance/covariance matrix. Figures between brackets denote t- and z-statistics. Data sources: see appendix. – signifies that it is not possible to perform this test.

Again, we start with the simple pooled OLS model (column (1), Table 4.4). Considering the results of the diagnostic tests, the model performs remarkably well. It can be seen that none of the forms of auto-correlation are present in the results. Labour productivity does however pick up an implausibly large effect when using averaged data. This may point to a misspecification error in the averaged model, but it can also be an artefact of the limited number of observations due to averaging. However, as a check

of whether the results are stable for the demand-variables, the exercise still has some value.

It can be observed that the negative signs of investment and exports are consistent with the theoretical prediction, as is the positive sign of labour productivity. Government expenditure and the interest rate are not significant. The next column introduces country-specific effects, which are not significant. They affect only the significance level of the growth of exports, but do not substantially change the results of other regressors. However, it can be seen that inclusion of country-specific effects does introduce problems with the structure of the residuals. The third column also introduces time-specific effects. They are significant. Their inclusion causes government expenditure to obtain the theoretically expected negative sign and to become significant. Problems of panel-specific heteroscedasticity and common auto-correlation are still present in this model, however. Column (4) also introduces country-specific time trends (analogous to Nickell *et al.* 2005). This model comes close to being completely specified, so the results should be taken as indicative. Neither country-specific effects nor country-specific time trends are significant. Investment and labour productivity are significant. They both have the expected sign. Exports and government expenditure have the expected negative sign, but are not significant. The interest rate is neither significant. It may be observed that the error terms have a pattern for which one can correct in order to obtain more efficient estimates. Applying the appropriate correction, however, reduces the residual degrees of freedom to a dangerously low level, allowing only for a tentative interpretation of the coefficients. More importantly, the results are robust for these manipulations and the coefficient of investment is stable when other regressors are removed, using a stepwise procedure[34].

4.4.3. Combination of Nickell et al. (2005) and Keynesian variables

So far, we have seen that the Keynesian explanation of unemployment is more robust than the NAIRU-explanation. However, we have confined ourselves to testing the robustness in a stand-alone setting. This gives both theories a fair chance to explain unemployment in isolation. It also raises the question, however, as to which theory is more powerful when combined in the same regression equation. Table 4.5 shows results of estimates, that combine the specification of Nickell *et al.* (2005) with the Keynesian variables. The aim is to test which specification performs better. The table provides two comparisons. The first column shows a regression explaining the unemployment rate using as regressors the variables from the Keynesian specification supplemented with those of Nickell *et al.* (2005). The second column explains the *difference* in the rate of unemployment using the Keynesian specification and the *differences* of the Nickell *et al.* (2005) variables as regressors. Although one may argue that the second specification, by construction (in differences) is favourable to the Keynesian explanation, the first surely is not. The first column is constructed by plugging the Keynesian variables straight into the Nickell *et al.* (2005) specification. Considering that the former variables are in *growth rates*, they are not expected to be very significant when explaining the *level* of unemployment. Thus, the first column gives the Nickell *et al.* (2005) variables a more than fair chance to yield a significant and theoretically consistent explanation of unemployment.

[34] These estimates are not reported, but they are available from the author on request.

Table 4.5. Combinations of Nickell *et al.* (2005) and Keynesian models to explain unemployment, yearly data, 20 OECD countries, 1960 - 1995

	(1)		(2)	
Dependent and Nickell *et al.*'s independent variables in Independent variables:	**levels**		**first differences**	
l.u	0.87***	(31.89)	0.29***	(4.76)
employment protection	-3.66***	(-4.06)	-5.47	(-1.63)
benefit repl. ratio	-2.38**	(-2.02)	-1.15	(-0.61)
benefit duration	-3.26***	(-4.32)	-0.13	(-0.11)
*ben. dur.*ben. repl.*	5.66**	(2.19)	2.39	(0.59)
Δunion density	-15.83***	(-3.19)	-0.15	(-0.04)
coordination	-0.33	(-0.73)	-1.16	(-1.41)
*coord.*union density*	-1.53	(-0.60)	1.60	(0.18)
tot. empl. tax rate	5.57***	(3.34)	0.16	(0.06)
*coord.*tot. empl. tax*	1.19	(0.64)	-7.22**	(-2.03)
labour demand shock	-27.32***	(-6.87)	-7.46**	(-2.33)
TFP shock	-25.16***	(-9.96)	-12.46***	(-3.35)
real import price shock	-3.62	(-1.33)	2.55	(0.96)
money supply shock	-0.14	(-0.38)	-0.20	(-0.89)
real interest rate	13.61***	(2.91)	2.03	(0.73)
$\hat{I}$	-0.66***	(-3.54)	-1.41***	(-6.04)
$\hat{e}$	-0.67	(-0.62)	-0.00	(-0.74)
$\hat{g}$	-3.25***	(-5.06)	-2.92	(-3.46)
r	-0.08*	(-1.77)	-0.04	(-1.17)
$\hat{\lambda}$	1.50	(0.65)	4.00	(1.38)
C_{fe}	yes		yes	
T_{fe}	yes		yes	
C_{tt}	yes		yes	
N	16		16	
NT	274		273	
k	84		84	
Σcovars	32		32	

Notes:
***, **, * mean significance with α=1,5,10% respectively; N denotes the number of panels; NT denotes the number of observations; k denotes the number of parameters; Σcovars denotes the number of estimated covariances and auto-correlations in the residual variance/covariance matrix. Figures between brackets denote t- and z-statistics. The estimation procedure follows Nickell *et al.* (2005) except that the standard feasible generalised least squares estimator is used. Data sources: see appendix.

Table 4.5 shows that many Nickell *et al.* (2005) regressors are still significant. However, the majority has signs that are *opposite* to the signs reported by Nickell *et al.* (2005). Employment protection legislation, benefit replacement ratio, benefit duration and change in union density are all significantly negative; in other words, they seem to reduce unemployment. Next, union coordination and its interaction with both union density and total employment tax rate are insignificant. Only the interaction between the benefit duration and replacement rate, and the total employment tax rate are significantly positive, confirming the prediction by Nickell *et al.* (2005). As regards the latter's prime suspects, therefore, it can be concluded from column (1) in Table 4.5 that they do not confirm the NAIRU hypothesis. Of the Nickell *et al.* (2005) variables, the control variables do a much better job in explaining unemployment. Most notable

are the labour demand shock and the TFP shock, which are both significant and negatively signed, and the real interest rate which is positively signed. This result, together with those of the robustness analysis in Table 4.1, suggests that, from Nickell *et al.*'s (2005) specification, the control variables provide a much better explanation of unemployment than the labour market institutions. The Keynesian variables, on the other hand, perform reasonably well. All variables have the expected sign and the growth of investment and that of government expenditure are significant at the 1% level.

When we plug the differences of the Nickell *et al.* (2005) variables into the original Keynesian regression (column (2)), we see that none of the (differenced) labour market institutions provide a significant explanation of the (difference) in unemployment. Once again, however, all regressors from the Keynesian explanation have the expected sign, and the growth of investment and that of government expenditure are significant.

4.5. Discussion and conclusions

In the previous paragraphs we have demonstrated the lack of robustness of the NAIRU model, which offers rigid labour markets as the culprit of the unemployment problem. Furthermore, we have evaluated the statistical support for a Keynesian explanation.

As the focus of the chapter is on comparing the robustness of both empirical approaches, the data to be explained was kept as similar as possible, using the Nickell *et al.* (2005) unemployment rate as the dependent variable. Concerning the Keynesian regression equation, this has the implication that labour supply was abstracted from. This constitutes a potential caveat, for it may introduce an omitted variable bias. However, this bias is predicated on labour supply being highly correlated with the other variables in the regression. From a theoretical point of view, there seems to be no compelling reason to suspect that this would constitute a problem, for demand – and especially investment demand – would hardly depend on labour supply, especially not in a Keynesian model. Investment is most usually theorized to depend on an accelerator component, a profitability component (Arestis and Sawyer 2005; Stockhammer 2004b) and an autonomous component reflecting animal spirits. From an empirical point of view, the inclusion of various fixed effects and trends as robustness checks in the regression, controls for fixed effects and trends in labour supply.

In contrast to the NAIRU approach, our estimates of the Keynesian model show a great deal of robustness when subjected to a battery of sensitivity checks. We have estimated the regression model in static and in dynamic form. Use was made of OLS and FGLS techniques, correcting for a number of possible error structures. We tested the significance of control variables and searched whether results would change if they were removed from the model. The model was estimated using yearly and averaged data. Finally, we employed a leave-one-out approach to see whether the results are driven by a particular country, and checked whether they may be driven by a particular time period. In spite of these manipulations, investment demand remained highly significant and its coefficient remained of the same magnitude. Using averaged data, there was some loss in significance for export and government demand. Perhaps this is because the results based on yearly data are driven by short-run effects mainly. However, for government demand, the finding may also have to do with the counter-cyclical fiscal policy that many governments follow.

Baker *et al.* (2005); Howell *et al.* (2007) and Baccaro and Rei (2005; 2007) show that the results of a number of empirical studies supporting the view that rigid labour markets are responsible for high unemployment, collapse when subjected to one or more of these tests. In addition to this, we can now conclude that the Nickell *et al.* (2005) results even lack robustness when their own regression specification, with some minor and plausible modifications, is estimated on their own data. Contrary to the sensitivity of these results, the Keynesian model shows great resilience over the employed robustness tests.

The exercise in this chapter illustrates the importance of paying attention to the robustness of regression results. Some influential studies clearly do not stand up to a robustness test. When using panel data techniques in particular, such tests should be applied in order to limit the opportunities for what Freeman (2005) calls "'lawyer's case' empiricism in which priors dominate evidence."

The results of the robustness tests show that the NAIRU model which emphasises the centrality of rigid labour markets in explaining unemployment, is outperformed by a Keynesian model which puts investment demand at the focal point of the explanation. Policy conclusions are almost self-evident: governments should stop focusing on rigid labour markets when attempting to fight unemployment. There are no robust empirical findings to support such a focus. Instead, concentration on factors that determine investment demand would seem more warranted.

5. Is wage-cost saving labour market deregulation a free lunch? - Evidence from 19 OECD countries, 1960-2004[35]

5.1. Introduction

Taking Walrasian general equilibrium theory as point of departure, it is easy to argue that European unemployment could be reduced by curbing wage costs and by making labour markets more flexible. For many years now, economic think tanks have argued that the 'flexibilization' of European factor markets (notably of labour markets) would help in the realization of higher job growth and extra welfare gains (see OECD 2007, notably box 2.2 by Anthony Annet). The call for more flexible labour markets usually includes a demand for the easier firing of personnel, the realization of greater wage flexibility (notably in the downward direction), or the reduction of minimum wages and social benefits (see e.g. OECD 1999a, 2003b). This corresponds to the consensus among many scholars about the harmful effects of extensive labour market regulation (sometimes interacting with economic shocks) and wage inflexibility on unemployment (see e.g. Nickell *et al.* 2005, Nunziata 2005 and Blanchard and Wolfers 2000).

We argue that a strategy of wage cost reduction via more flexible labour markets in the OECD area may be problematic. We do not deny that such a strategy may encourage job growth, but maintain that this is not a 'free lunch'. Rather than stimulating extra GDP growth, it may lead to a low-productive and highly labour-intensive growth model. In paragraph 5.3, this hypothesis will be tested on panel data from 19 OECD countries over the period 1960 to 2004. Theoretical arguments and statistical illustrations will be given paragraph 5.3.

Our argument is illustrated with the aid of four figures. Figure 5.1 shows that, since the mid-1960s, real wage growth has been more modest in the 'flexible' Anglo-Saxon countries than in the rigid labour markets of Continental Europe. Various types of labour market institutions in the 'Liberal Market Economies' (Hall and Soskice 2001), such as easier firing, weaker trade unions, more modest social benefit systems, more decentralised wage bargaining, etc. have indeed helped to moderate real wage growth. Figure 5.2 shows what most economists would expect after having seen Figure 5.1: lower wage growth is related to a substantially higher growth in hours worked.
Figure 5.3 shows something remarkable, however. Lower wage growth did not lead to higher GDP growth in the Anglo-Saxon countries as compared to the European countries. Only recently (since the 1990s) has Anglo-Saxon GDP growth been higher. In the preceding period, however, GDP growth in Continental Europe was higher. In a long-term view, it seems reasonable to conclude that our Figures 5.1 and 5.3 do not show evidence of a clear relationship between GDP growth and real wages. The logical implication of Figures 5.2 and 5.3 is that labour productivity growth must be appreciably lower in Anglo-Saxon countries compared to Continental Europe, up to the 1990s. Figure 5.4 shows that this is indeed the case. The figures shed new light on the job creation success of the Anglo-Saxons in Figure 5.2: the Anglo-Saxons indeed created more labour hours, but this can hardly be ascribed to higher total output. The main reason is that their GDP per working hour grew at a lower rate.

[35] A paper based on this chapter has been accepted for publication in the *Journal of Post-Keynesian Economics* (in joint authorship with Prof. dr. A. H. Kleinknecht).

Our group of Continental European countries includes the Netherlands. One should note that, since the 1980s, this country is not typical anymore for rigid Europe. During the 1980s and 1990s, the Netherlands experienced a development of wages, jobs and labour productivity similar to that of the Anglo-Saxon countries, although within a different institutional framework (Naastepad and Kleinknecht 2004). Following the famous 'Dutch Disease' of the 1970s, the Netherlands suffered severe and rapidly rising unemployment. Other than the Anglo-Saxon countries, however, the Netherlands achieved a very modest wage growth due to voluntary commitments made by the trade unions while maintaining many of their rigid labour market institutions, at least for 'core' workers.[36]

As in the Anglo-Saxon countries, this policy was quite successful in creating jobs and only few 'heretics' dared to utter any criticism, suggesting that the policy of wage moderation and flexibilization of (part of) the work force might be damaging to innovation and labour productivity growth (Kleinknecht 1994; Van Schaik 1994; Naastepad and Kleinknecht 2004).

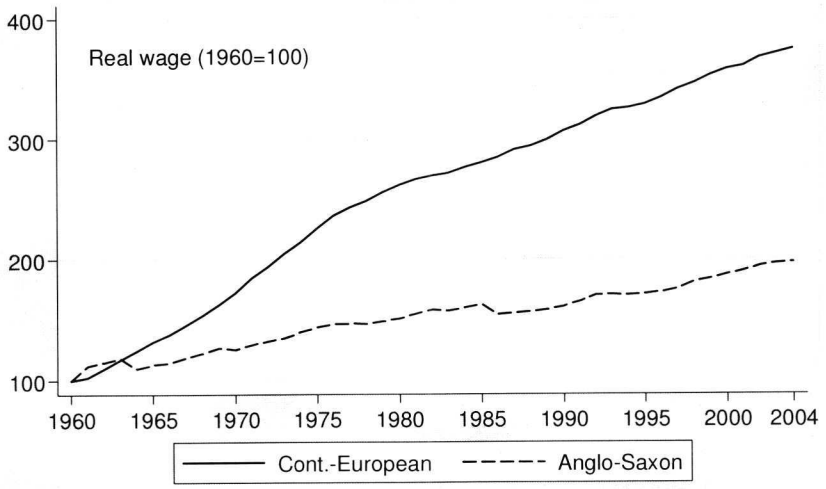
Many scholars objected to this suggestion using three main arguments. First, we should be happy with the high job growth, in spite of the associated losses in labour productivity growth. Secondly, it was argued that modest wage growth allows the hiring of workers with lower productivity. As far as there was a labour productivity growth slowdown, it mainly had to do with the employment of low-productive people that otherwise would not have worked at all.[37] Last but not least, it was argued that there was no proof of a causal relationship from (modest) wage growth to (low) labour productivity growth. It was reasoned that, in the statistical relationship between the two, causality runs from productivity growth to wage growth, and not *vice versa* (see Jansen 2004). Many observers found this plausible; it being in line with the old neoclassical view that technological change is 'manna from heaven'. This chapter will question that popular belief.

In paragraph 5.2, theoretical arguments will be presented in favour of reversed causality, which will be tested by means of a panel data analysis of 19 OECD countries (paragraph 5.3). This finding has far-reaching consequences, among others for the discussion about whether rigid European labour markets should indeed be made more flexible. This will be discussed in the concluding section.

[36] One should note that the continued protection of 'insiders' does not exclude that there was a rising share of flexible 'outsiders' with non-typical working arrangements since the 1980s. Employment of the latter lead to substantial wage bill savings, which supported the policy of modest wage claims (Kleinknecht *et al.* 2006).

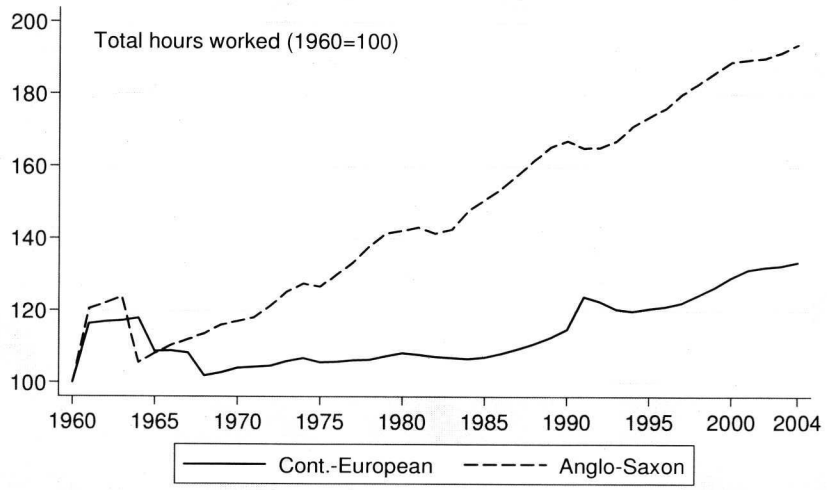
[37] When discussing our results, we will return to assessing the validity of this argument.

Figure 5.1. Development of real wages: Anglo-Saxon versus Continental European countries (1960=100)



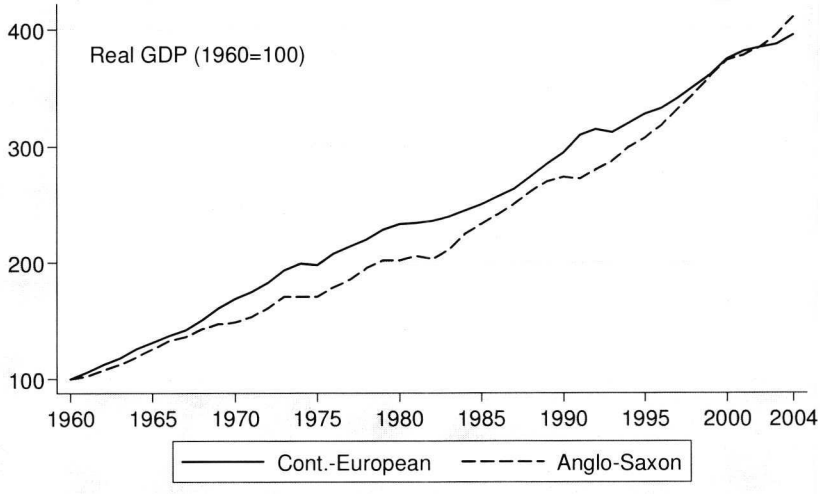
Anglo-Saxon countries: Australia, Canada, New Zealand, UK and USA;
Cont.-European countries: Austria, Belgium, Denmark, Finland, France, Germany, Italy, Netherlands, Portugal, Spain, Sweden;
Source: Database of the Groningen Growth and Development Centre (http://www.ggdc.net/).

Figure 5.2. Development of total hours worked: Anglo-Saxon versus Continental European countries (1960=100)



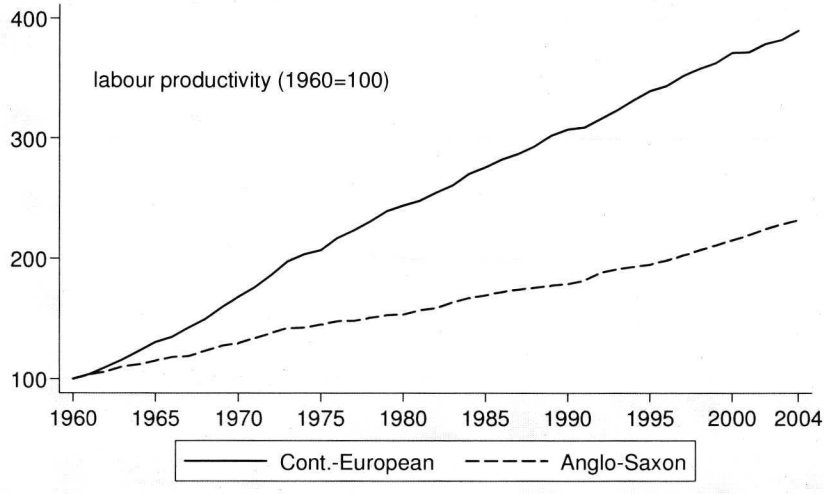
Anglo-Saxon countries: Australia, Canada, New Zealand, UK and USA;
Cont.-European countries: Austria, Belgium, Denmark, Finland, France, Germany, Italy, Netherlands, Portugal, Spain, Sweden;
Source: Database of the Groningen Growth and Development Centre (http://www.ggdc.net/).

Figure 5.3. Development of GDP: Anglo-Saxon versus Continental European countries (1960=100)



Anglo-Saxon countries: Australia, Canada, New Zealand, UK and USA;
Cont.-European countries: Austria, Belgium, Denmark, Finland, France, Germany, Italy, Netherlands, Portugal, Spain, Sweden;
Source: Database of the Groningen Growth and Development Centre (http://www.ggdc.net/).

Figure 5.4. Development of labour productivity: Anglo-Saxon versus Continental European countries (1960=100)



Anglo-Saxon countries: Australia, Canada, New Zealand, UK and USA;
Cont.-European countries: Austria, Belgium, Denmark, Finland, France, Germany, Italy, Netherlands, Portugal, Spain, Sweden;
Source: Database of the Groningen Growth and Development Centre (http://www.ggdc.net/).

5.2. Theoretical arguments and further illustrations

In our opinion, there are at least five theoretical arguments in favor of the view that causality may run not only from productivity to wages, but also in the opposite direction: from wage growth to labour productivity growth. These arguments are the following:

(1) In standard neoclassical theory, an increase in the relative price of labour leads profit-maximizing firms to substitute capital for labour, shifting along a given production function, until the marginal productivity of labour equals the given real wage. Causality in this argument runs from relative factor prices to choice of technique and hence to productivity of labour.

(2) Using vintage models, it is easy to demonstrate that more aggressive wage policies adopted by trade unions will cause the quicker replacement of old (and more labour intensive) vintages of capital by new and more productive ones. A policy of modest wage claims allows firms to exploit old vintages of capital over longer periods (see Den Hartog and Tjan 1980; Foley and Michl 1999). This can result in the ageing of the capital stock (shown to have been one of the reasons behind the Dutch productivity crisis; see Naastepad and Kleinknecht 2004).

(3) According to the theory of induced technological change, a higher relative wage rate (wage share) increases the labour-saving bias of newly developed technology (Hicks 1932; Kennedy 1964; Ruttan 1997; Foley and Michl 1999). Ceteris paribus, a higher real wage growth will lead to a higher wage share, thus increasing the rate of the labour saving bias in induced technological change.

(4) From the viewpoint of Schumpeterian creative destruction, it can be argued that innovating firms (compared to their non-innovative counterparts) can better cope with aggressive wage claims by trade unions. Innovators have market power due to mono-

poly rents from unique product and process knowledge that acts as an entry barrier to their markets. Higher real-wage growth enhances the Schumpeterian process of creative destruction in which innovators push out non-innovators. Conversely, modest wage growth and flexible labour relations can enhance the likelihood of survival of low quality entrepreneurs. While their survival is favourable to employment in the short-run, it leads ultimately to a loss of innovative dynamism (Kleinknecht 1998).
(5) According to Schmookler's (1969) 'demand-pull' theory (for an assessment see Brouwer and Kleinknecht 1999), higher effective demand enhances innovative activity. Analogically, *Verdoorn's Law* (1949) suggests that output growth has a positive impact on labour productivity growth (see recently McCombie *et al.* 2002). All this implies that a strategy of wage cost reduction might impede innovation and labour productivity growth if it leads to a reduction of effective demand.[38]
A common element in these five arguments is that they propose a positive causal relationship from real wage growth to labour productivity growth. Some theories point to a direct linkage between wages and labour productivity growth. Others, e.g. the 'creative destruction' argument, suggest that overall innovation activity may slow down in response to lower wage cost pressure. Some arguments would lead us to expect that wages would affect productivity growth in the short or medium term (arguments 1, 2, and 5), while others are more likely to have an effect in the medium to long-term (arguments 3 and 4). Lags of up to nine years are therefore included in our regression estimate.[39]

In addition to wages, there may be other influences on productivity and innovation that are related to institutional differences between 'Liberalised' and 'Coordinated' market economies. Advocates of the flexibilization of labour markets have forwarded four arguments of why rigid labour markets may impede productivity growth. Firstly, rigidity could reduce the reallocation process of labour 'from old and declining sectors to new and dynamic ones' (for a review of the effects of labour market institutions on economic performance, see Nickell and Layard 1999). Second, the difficult or expensive firing of redundant personnel can frustrate labour-saving innovations at the firm level (Bassanini and Ernst 2002a; Scarpetta and Tressel 2004). Third, well-protected workers may work less hard. Fourth, there is a possibility that well-protected and powerful personnel could appropriate rents from innovation and productivity gains through higher wage claims, thus reducing the incentive to take innovative risks (Malcolmson 1997). The latter argument might indeed be relevant to countries that have de-centralised bargaining regimes. It is less likely to be relevant to rigid 'Rhineland' labour markets that rely more strongly on centralised or coordinated bargaining.

Against these arguments, the following counter-arguments appear relevant:
First, shifting personnel from old and declining to new and innovative activities may be hampered more by lack of adequate qualifications than by difficult firing. Easier firing and shorter job durations can discourage investment in training as pay-back periods tend to become shorter, thus making the shift of personnel to new activities more difficult. Moreover, new and innovative activities are likely to pay better than

[38] Bhaduri & Marglin (1990) argue that this may be the case if an economy is 'wage-led' rather than 'profit-lead'.
[39] Another reason to include nine-year lags is to avoid endogeneity problems, which would theoretically arise if the residuals of the regression were serially correlated. Including nine lags avoids this problem; see below.

old and declining industries. Why could we then not rely on voluntary movements of personnel?
Second, in many countries, redundant personnel need not be a problem for labour-saving innovations as a high percentage leaves their firms voluntarily.[40]
Third, protection against dismissal may actually enhance productivity performance, as secure workers will be more willing to cooperate with management in developing labour-saving processes and in disclosing their (tacit) knowledge to the firm (Lorenz 1992, 1999). People threatened by firing have incentives to hide knowledge about how their work could be done more efficiently.
Fourth, rigid labour markets may be favourable in industries where a Schumpeter II ('routinized') innovation model is relevant. The latter is based on the continuous accumulation of knowledge for (often) incremental innovations. Some parts of that knowledge consist of ill-documented 'tacit' knowledge based on personal experience that is hard to transfer. rigid labour markets are typically characterised by longer job tenures and the use of internal rather than external labour markets may favour accumulation of knowledge and of 'tacit' knowledge, in particular.
Fifth, shorter job durations in an Anglo-Saxon 'hire and fire' system may reduce trust, loyalty and commitment to the firm. Such a loss of 'social capital' has at least two disadvantages: (1) Knowledge about new technology and trade secrets may more easily leak to competitors; stronger positive externalities make investment in knowledge less attractive. (2) Lack of commitment to the firm makes workers less ready sometimes to take 'one step extra', beyond what is determined in their contract. This is important because labour contracts tend to be incompletely specified, offering room for opportunistic behaviour. The latter points may explain why flexible Anglo-Saxon countries have substantially larger management bureaucracies, compared to 'Rhineland' countries (Storm and Naastepad 2007c).
Sixth, longer-term contracts may strengthen a firm's historical memory and favor processes of organisational learning.
Seventh, easier firing of personnel shifts the power balance in favor of (top) management. People may no more dare criticizing management decisions. Lack of critical feedback from the shop floor may favor problematic management practices, top managers believing they are great visionary leaders that can hardly fail.
In addition to lower wage growth, such arguments about flexibility may contribute to explain why Anglo-Saxon countries tend to experience lower productivity growth compared to 'Rhineland' countries, as shown in Table 5.1.

Table 5.1 summarizes key indicators of the long-run performance of five typical 'Anglo-Saxon' countries (Australia, New Zealand, Canada, UK and USA) compared to a group of 11 typical EU-countries. The third column in Table 5.1 suggests that the Anglo-Saxon countries have shown superior growth performance in labour hours from the 1960s to the present. Contrary to what many observers might assume, however, this has little to do with differences in GDP growth: it is caused mainly by differences in growth of GDP per hour worked, causing high employment elasticities of GDP growth (third column).

We can see that employment elasticities of GDP growth in Continental Europe were even negative during the 1960s and 1970s. Despite high GDP growth, absolute num-

[40] Kleinknecht *et al.* (2006) report that, on average, 9-12% of a firm's personnel in the Netherlands leave voluntarily each year, the exact percentage depending on the state of the business cycle. Nickell & Layard report that this figure amounts to over 10% (1999, p. 363).

bers of working hours (slightly) diminished! From the 1980s to the present day, employment elasticities in the Continental European countries have been (modestly) positive. On the other hand, the Anglo-Saxon group has shown positive employment elasticities of GDP growth since the 1960s, and, in each period, the coefficients are substantially higher than in Europe (ranging between 0.34 and 0.55). It should be noted that the three columns in Table 5.1 have a logical link: the relationship between GDP growth and that per hour worked determines the growth of labour hours per 1% GDP growth in the third column.

Table 5.1. GDP growth, labour productivity growth and labour intensity of GDP growth. Anglo-Saxon countries compared to Continental European countries

	Average annual GDP growth		Average annual GDP growth per hour worked		Growth of labour hours per 1% GDP growth	
	Cont.-European	Anglo-Saxon	Cont.-European	Anglo-Saxon	Cont.-European	Anglo-Saxon
1950-1960	5.5	3.3	4.2	3.6	0.23	-0.09
1960-1973	5.1	4.1	5.2	2.7	-0.03	0.34
1973-1980	2.7	2.4	3.0	1.1	-0.14	0.55
1981-1990	2.6	3.2	2.4	1.4	0.07	0.55
1990-2000	2.4	3.1	1.9	1.9	0.21	0.40
2000-2004	1.3	2.5	1.1	1.6	0.15	0.35

Notes:

- Anglo-Saxon countries: Australia, Canada, New Zealand, US and UK.
- Cont.-European countries: Austria, Belgium, Denmark, Finland, France, Germany, Italy, Netherlands, Portugal, Spain, Sweden
- Source: Database of the Groningen Growth and Development Centre (http://www.ggdc.net/); non-weighted averages across countries.

Table 5.1 suggests that the superior long-term employment record of the Anglo-Saxon countries is caused primarily by weaker labour productivity growth, and at best to a minor extent by superior GDP growth. More recently, however, this pattern has changed. During the 1990s, Anglo-Saxon labour productivity growth approached Continental European standards; in the most recent period (2000-2004), it has even slightly exceeded that of the EU.

At present, we can only speculate about these changes. One reason, of course, for the resurgence of Anglo-Saxon productivity growth is the ICT revolution. The declining EU productivity growth (and improved job growth) may be due to the gradually increasing influence of Anglo-Saxon labour market practices in mainland Europe. In addition, the post-2001 recession seemed to hit EU countries more adversely than the USA. This may have depressed measured EU productivity growth through lower capacity utilisation and/or the Verdoorn effect.

5.3. Panel data estimates

To test our hypothesis that wage growth influences labour productivity growth, data are used from 19 OECD countries over the period 1960-2004. The majority of these data come from the *Total Economy Database (May 2006)* of the *Groningen Growth and Development Centre*, documented on the internet (http://www.ggdc.net/). The dependent variable is growth in value added per labour hour. In the regression, lags of the dependent variable are included as right hand variables to allow for dynamics in

the relationship. In such a model, the absence of serial correlation in the residuals is required to obtain consistent estimators. The key independent variable, of course, is the annual percentage growth of real wages. We include this variable with lags in order to avoid endogeneity problems[41].

In this context, the absence of serial correlation is essential not only because of our inclusion of a lagged dependent variable in the regression. It is also necessary because we explicitly allow for reversed causation with respect to the growth of real wages - i.e. that (some lags of) the growth of labour productivity will cause the growth of real wages - while still obtaining consistent estimators. In the Appendix, a mathematical proof for this weak exogeneity condition is provided. Furthermore, in the Appendix (Table 10.4), a test is documented that does not reject the hypothesis of no serial correlation in the residuals of our main regression (column 1, Table 5.2). Nine lags are included in the regression specification in order to obtain this feature. This lag-structure seemingly is long, but from the above theoretical arguments we expect significant effects of changes in wages on growth of labour productivity even in the long run.

We checked the robustness of the estimators of the main regression for a possible over-parameterization by tentatively removing all the insignificant lags of labour productivity growth and real wage growth from the regression. Our results turned out to be robust for this manipulation. However, when removing some of the lags, problems with autocorrelation in the residuals arise. It should be noted that the problem of autocorrelation came back in quite a number of alternative specifications of our basic model that we ran for robustness checks.

We use a dynamic fixed effects estimator, which is known to be biased if estimated by OLS, even in the case of no serial correlation in the residuals. Nickell (1981) shows, however, that this bias is $O(1/T)$ and therefore becomes less important as T grows. The intuition behind this result is that the endogeneity of the lagged dependent variable stems from it being correlated with lagged values of the error term of the regression. The lagged residual (which correlates with the lagged dependent) appears on the right hand side of the regression equation after the within-transformation, as a component of the time-averaged error term. The contribution of the lagged error term in the average error term becomes smaller, however, as the time dimension increases. Thus the endogeneity bias becomes smaller if the time dimension increases for the time average of the error term consists of only one error term that is correlated with the lagged dependent, while the error terms of all the other times are not.[42] Extending the time-dimension therefore amounts to diminishing the contribution of the correlated error term. In the limiting case, the contribution of this sole error term is negligible.
Judson and Owen (1999) test the bias of the LSDV (Least Squares Dummy Variables estimator, i.e. a dynamic fixed effects estimator) for the AR(1) case with the use of Monte Carlo simulations. They compare it with various other estimators, including the standard GMM estimators with lags of the dependent variables as instruments. Their results suggest that "The LSDV estimator performs just as well or better than many

[41] This operation makes the independent variables predetermined when compared to the dependent.
[42] Technically, the lagged dependent variable is correlated not only with its contemporaneous error term, but also with other lagged error terms. However, in the I(0) case, this correlation dies out over time, which explains why the results obtained by Nickell (1981) and Lee (2006) hold in the I(0) case and do not hold in the I(1) case.

alternatives when T=30" (p. 10). In our sample, T is about 45. In our case, we include more than one lagged dependent variable. Lee (2006) extends the Nickell (1981) case for higher-order autoregressive panel models and obtains the same result (i.e. that the bias is $O(1/T)$).

Apart from lags of the real wage growth – the variable of our main interest – we add control variables, including:
STATE DEPENDENCY: Past labour productivity growth may forecast future productivity growth. It may be that conditions that favoured (or impeded) productivity growth in the past will persist and create some state dependency. It has been argued that this variable is essential: high (low) labour productivity growth in the past may have caused high (low) wage growth, and may also cause high (low) productivity growth in the present. If state dependency in labour productivity growth indeed exists, non-correction for past productivity growth may lead to misspecification in that (state dependent) productivity gains would probably be ascribed to high wage growth, rather than to past productivity gains (this point was made by Jansen 2004, p. 418).
GAP: The relative difference between a country's labour productivity level and that of the country with the highest level of labour productivity in the sample. The larger a country's distance from the best-practice country, the greater are the possibilities for imitation and 'catching up'. We therefore expect GAP to have a positive sign. To avoid endogeneity problems, this variable is included with a two-year lag, so it is not correlated with the dependent variable by construction.
VERDOORN: The Verdoorn relationship (sometimes called the Kaldor-Verdoorn relationship) assumes a positive impact of annual GDP growth on labour productivity growth.
COUNTRY: In order to correct for unobserved country-specific influences on labour productivity growth, country dummies are added.
YEAR: To correct for general time-specific impacts, we include year dummies.
CAPACITY UTILISATION: This variable is added as our measure of labour productivity (value added per labour hour) is sensitive to fluctuations in capacity utilisation over the business cycle, due to labour hoarding. For example if, in a business cycle upswing, growing use of hoarded labour was accompanied by a growth of real wages, the extra growth of value added per labour hour might wrongly be ascribed to rising wages. Therefore, robustness checks were made including various indicators of capacity utilisation in the regression. We alternatively used the growth of the capital/output ratio, the change in the output gap as well as various alternative measures of fluctuations in capacity utilisation.
Precise definitions of all variables are given in the Appendix (Table A2). Descriptive statistics are presented in Table A3.

Our regression equation has the form:

$$\hat{\lambda} = \alpha_i + \sum_k \beta_{1,k} \hat{w}_{t-k} + \sum_k \beta_{2,k} \hat{\lambda}_{t-k} + \beta_3 \hat{Q} + \beta_4' Z + \varepsilon \qquad \text{equation 5.1}$$

Where $\hat{\lambda}$ denotes the growth of labour productivity; $\hat{w}_{t-k}$ the growth of real wages at time t-k; $\hat{Q}$ the growth of output; α_i are country fixed effects and ε is an error term. Z is a vector of control variables.

Although we are mainly interested in the coefficients that reflect the effect of wage growth on labour productivity growth, one should note that our regression equation shares features with the regression equations found in the literature on estimating the

dynamic version of the Verdoorn law. Apart from some of our controls, regression equation 5.1 is similar to the regression equations used in Drakopolous and Theodosiou (1991) and Fase and Winder (1999). Drakopolous and Theodosiou (1991) follow the approach suggested by McCombie and De Ridder (1983), using the ratio between actual and potential output as an indicator for capacity utilisation. As a robustness check, we also implemented this suggestion.
Fase and Winder (1999) use a cointegration approach to test for a long-run relationship between labour productivity, output and the real wage, which they interpret as Verdoorn's regularity.[43] They derive this specification starting from a CES-production function. The real wage (growth) then controls for substitution between labour and capital. Clearly, we do not just interpret the coefficient for real wage growth as the substitution elasticity in a neoclassical production function. We take into account all the mechanisms mentioned above. Moreover, we add control variables which stem from other frameworks than a production function approach.

Following the famous Baumol argument, services may have lower productivity gains than manufacturing or agriculture. It could therefore be argued that one should control for the share of services in the total economy. A counter-argument could be that service shares may be endogenous: a strategy of low wage and low labour productivity growth may favor the emergence of low-productive (personal) services. Moreover, it could be argued that at least part of the apparent shift from manufacturing to service employment in the past 20-30 years is a statistical artefact: many services (e.g. catering, cleaning or security) were in the past performed by employees of manufacturing firms and were statistically counted as 'manufacturing' work. Once contracted-out, those same activities are called 'services' although, in real terms, little change occurs. Nevertheless, we tentatively included, in several versions of our estimates, the contribution of services to total GDP. These versions are not documented in Table 5.2, as service shares turned out insignificant and had little influence on the other coefficients.

It is obvious that our dependent variable is influenced by fluctuations in capacity utilisation. We therefore explore the impact of alternative measures for the latter. One possible measure is percentage changes in the capital/output ratio. Model 2 in Table 5.2 includes (a contemporaneous and a lagged value of) the growth of the capital/output ratio. As expected, the inclusion of this capacity measure causes a loss of significance of the Verdoorn-coefficient. In fact, the Verdoorn effect becomes even insignificant. It is reassuring, however, that the coefficients of the other variables (notably of the wage growth variable) change little when including the growth of the capital/output ratio. In addition to the regressions documented in the table, we ran several other regressions with increasing lags of the capital/output ratio. This did not alter the results. While inclusion of the capital/output ratio allows for a better control for capacity effects, this is not our preferred version. Inclusion of the capital/output ratio may be problematic as the validity of the construction of the capital stock may be doubted (Robinson 1953/54; Felipe and Fisher 2003). This entails the risk of obtaining biased coefficients due to errors-of-measurement. Furthermore, it may be argued that correction for fluctuations in capacity utilisation is at least partly done by including GDP growth (i.e. the Verdoorn-effect) in the regression.

[43] It is impossible, however, to establish the direction of causality within the cointegration relation. Therefore, we do not use a cointegration term in our own model.

When including an alternative measure of capacity utilisation (i.e. changes in the difference between actual and potential output), the Verdoorn effect becomes significant again (model 3). This also holds when including inflationary pressure as an alternative capacity utilisation measure (not documented here). Finally, we document in model 4 a version that is perhaps most popular in the literature: a contemporaneous term for the Verdoorn coefficient and the difference between actual and potential output (both without lags). This model behaves as expected: both coefficients are significant and have the expected sign. With this version, however, the residues have a significant degree of autocorrelation which raises doubts about consistency.

Table 5.2. Factors that explain labour productivity growth in year t, 1960-2004. Summary of fixed-effects GLS panel estimates on yearly data

Independent variables	Model 1	Model 2	Model 3	Model 4
Real Wage growth$_{it-1}$	0.081***	0.074***	0.079***	0.091***
Real Wage growth$_{it-2}$	0.020	0.010	0.0060	0.060**
Real Wage growth$_{it-3}$	0.077***	0.068***	0.073***	0.094***
Real Wage growth$_{it-4\ to\ 9}$	0.170**	0.131*	0.168**	0.294***
Productivity growth$_{it-1}$	0.082**	0.079*	0.067	-0.122***
Productivity growth$_{it-2}$	-0.044	-0.033	-0.039	-0.153***
Productivity growth$_{it-3}$	-0.044	-0.034	-0.025	-0.076*
Productivity growth$_{it-4\ to\ 9}$	0.046	0.084	0.038	-0.015
GAP$_{it-1}$	0.037***	0.039***	0.049***	0.049***
VERDOORN$_{it}$ (GDP growth in year t)	0.55***	0.031	0.47***	0.35***
VERDOORN$_{it-1}$ (GDP growth in year t-1)	-0.31***	0.25	-0.25***	
Capacity utilisation$_{it}$				
growth of capital/output ratio in year t		-0.65***		
Δ output gap in year t			0.00046	0.0015*
Capacity utilisation$_{it-1}$				
growth of capital/output ratio in year t-1		0.52***		
Δ output gap in year t-1			-0.0011	
COUNTRY (dummy)	yes	yes	yes	yes
YEAR (dummy)	yes	yes	yes	yes
Total effect of real wage growth on growth of labour productivity (in the long run)	0.36***	0.31***	0.34***	0.39***
Number of observations	631	631	545	559
Log-likelihood	1929	1937	1687	1696

Notes:

* significant at 10% level; ** significant at 5% level; *** significant at 1% level

- Regressions (1 – 4) are estimated using a fixed effects GLS panel estimator which allows panel-specific heteroskedasticity (stata-command: XTGLS (…), p(h); see Stata Manual, Release 6, p. 360).
- Model 1 was tested for the appropriateness of allowing panel-specific heteroskedasticity, using a Chi2-test (result: Chi2 (18) = 5521).
- Model 1 was tested for the presence of autocorrelation in the residuals, using a regression of the residuals on their own lags (up to fifteen-year lags). All forms of autocorrelation were rejected. We tested how many lags of wage growth and productivity growth had to be included in order to get rid of significant autocorrelation. Nine successive lags of real wage growth and of labour productivity growth were necessary to achieve this. The first two models above do not exhibit significant autocorrelation in the residuals.
- The total (long run) effect of wage growth is calculated as and tested using a Chi2-test for a non-linear model.
- Model 1 was subjected to several robustness checks. First, we used a 'leave one out' approach for the countries. Secondly, we subdivided the sample into various periods. Thirdly, a regression was run including country-specific time trends instead of (as well as supplementary to) time-specific effects. The results proved robust for such manipulations. Fourthly, testing the possible impact of past wage growth and of past productivity growth on present productivity growth, we experimented with shorter and longer time lags (first 1 year and then successively adding lags of up to 9 years). It turned out that, with all successive time lags, the total effect of real wage growth on the growth of labour productivity is significantly positive. Fifthly, we ran a regression including an indicator for the share of services to capture productivity effects resulting from changes in the sectoral composition of the economy. This did not affect our regressors.
- To test whether our results might be due to over parameterization, we ran a regression including only significant lags of labour productivity growth and wage growth. The results are robust for this experiment.
- Finally, models 1 and 2 were re-estimated using Instrumental Variables (stata-command: IVreg2) for Verdoorn$_{it}$ (model 1) and Verdoorn$_{it}$ and Capacity$_{it}$ (model 2) with heteroskedastic robust standard errors. Up to nine year lags of the suspected variables were used as valid (according to Hansen's J-test) and relevant (according to Anderson's IV-relevance test) instruments. Apart from the loss of some significance, that is to be expected when using instruments, the results did not change substantially.
- See Appendix Table A4 for a more detailed report of all regression results of model 1.

As to the size of the coefficients, it is possible to distinguish between short-term and long-term effects in that lagged values of different regressors were included in the model. The long-term value can be interpreted as the accumulated effect of all short-

term effects through time. The accumulation process runs as follows: a permanent difference (with a magnitude of, say, 1) in an explanatory variable (say: x) has the (first order) effect of raising labour productivity growth after 1 year with its coefficient $b_{x,1}$ (where the 1 indicates that there is a 1 year time lag between the rise of the independent and tits effect on the dependent). In the next year, we not only have the first order effect $b_{x,1}$ but also two second order effects: (1) a direct second order effect caused by the rise of the second lag of x (equal to $b_{x,2}$) and (2) an indirect second order effect through the growth of the lagged value of dependent on the dependent. This effect equals $b_{x,1}*b_{\lambda growth,1}$; where $b_{\lambda growth,1}$ denotes the coefficient of the first lagged value of labour productivity. In the following year we not only have first and second order, but also third order effects. Adding all the effects of the different orders and letting time progress to infinity, yields the following formula with which to calculate the long-run effect of a permanent change of one unit in the variable x: $\sum_{T=Tb}^{T=Te}(b_{x,it-T})/(1-\sum_{\tau=\tau b}^{\tau=\tau e}(b_{\text{labour productivity growth, it}-\tau}))$ where the symbols T_b and T_e denote the begin and end lag of x and τ_b and τ_e the begin and end lag of labour productivity growth. When we interpret the coefficients reported in Table 5.2, a short (first-order) and a long-term value will be reported.

Furthermore, our estimates suggest that there is some evidence of state dependency in labour productivity growth. Labour productivity growth delayed has, in several versions of our model, positive effects on labour productivity growth. It should be emphasised that a very careful control for effects of past labour productivity growth on future labour productivity growth is required, due to the arguments mentioned above (Jansen 2004). This is a reason for our inclusion of up to nine years lags, which gives a maximum chance of measuring any possible influence of this variable. Another advantage from inclusion of these lags is that they eliminated auto regression in our residuals. While short-lagged labour productivity growth tends to be significant in most versions, the long-run, cumulative, effect of lagged labour productivity growth on the current growth of labour productivity is modest. An F-test based on our main regression (column 1, Table 5.2) on whether the cumulative effect is significantly different from zero could not reject the null-hypothesis (p-value = 0.4). This indicates that, in the long run, labour productivity growth is no self-propelling force[44].

The GAP variable behaves as expected: a country's one-percent distance in productivity level towards the country with the highest level leads, on average, to 0.037% extra growth of its labour productivity in the short term and to 0.039% extra growth in the long term.

The Verdoorn effect has a long-run value between 0.24 and 0.37 which corresponds to the lower bound of results commonly found in the literature. The Verdoorn coefficient on the contemporaneous GDP growth has a value of around 0.5, the lagged value being negative with a magnitude of around 0.25. The negative sign of the lag may come as a surprise. On the other hand, recent contributors to the literature on the Verdoorn law also recognise that there is some "instability" of the law in a time series perspective (McCombie *et al.*, 2002, p. 106).

[44] Which may be expected, labor productivity growth being I(0).

In our main regression, the total Verdoorn effect is 0.37 and significant. Depending on the indicator we use for the capacity utilisation, the Verdoorn effect remains significant or becomes insignificant. If we include the growth of the capital/output ratio, the capacity utilisation indicator picks up the significant effect. This would imply that the Verdoorn coefficient is mainly capacity driven. However, above we noted the problematic nature of the concept and measurement of the capital stock. Another caveat behind this specification is that GDP growth has a high degree of multicollinearity with the growth of the capital/output ratio.[45] Implementing the McCombie and De Ridder (1983) specification yields a significant Verdoorn coefficient[46].

In models 1 and 3, it was found that a double inclusion of GDP growth was appropriate, judging from the significance levels. By the way, as mentioned above, model 4 documents a version, perhaps more popular in the literature, with only the contemporaneous Verdoorn coefficient. This model behaves as expected but is less reliable due to auto regression in the residuals. For the purpose of the present study, the Verdoorn relation is used simply as a control variable. We trust that the versions documented in the tables are plausible. Fortunately, whichever version of a Verdoorn specification was used, all other variables (and notably the coefficient of wage growth) remained robust.

Our main result, of course, relates to the coefficients of wage growth. From the cumulative effects of the coefficients of wage growth and of lagged labour productivity growth, it can be concluded that a one-percentage point reduction in wage growth will result in a long-run 0.31 - 0.39% reduction of labour productivity growth. The coefficient is lowest (0.31) if the capital/output ratio is included (model 2). These results come close to those reported by Naastepad (2006) based on Dutch data. Naastepad reports a coefficient of 0.52. This slightly higher coefficient is to be expected, as Naastepad's regressions do not control for reversed causality.

We interpret these results in the light of the theoretical arguments discussed in section II. There is one competing hypothesis for explanation of our results: the *growth in low-productive jobs hypothesis*. According to our arguments, real wages cause changes in labour productivity because they not only influence labour productivity of newly created jobs but, more importantly, they change labour productivity growth of existing jobs. This interpretation contradicts the view expressed by the OECD (2003a). They interpret the finding that "a weak trade-off may exist between gains in employment and productivity" as arising from newly created jobs at the bottom of the labour market: "For example, decentralization of wage bargaining and trimming back of high minimum wages may tend to lower wages, at least in the lower ranges of the earnings distribution. Similarly, relaxing employment protection legislation (...) may encourage expansion of low-productivity/low-pay jobs in services." (Box 1.4, p. 42.).

[45] As an additional robustness check, we used the first difference of inflation as an alternative control for capacity utilisation. The results (not documented here) turned out to be quite similar to the regressions using the output gap as an indicator for capacity utilisation.

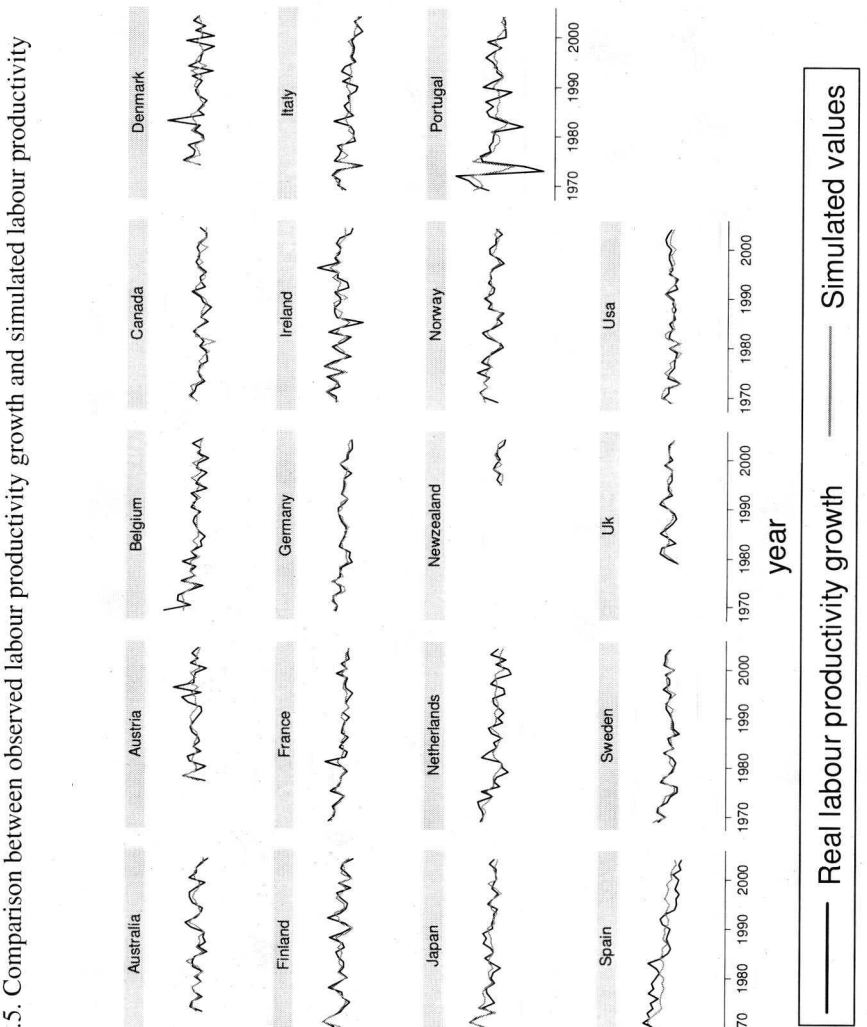
[46] Another potential caveat in estimating the Verdoorn relation is that it is possibly endogenous to labour productivity. We therefore also experimented with instrumentation, which lead, as expected, to a loss of significance of the coefficient representing the Verdoorn relationship. These versions are not documented in Table 5.2, as instrumentation tended to yield similar outcomes. The only difference is that levels of significance tended to be slightly lower, which is to be expected when instruments are used

These low-productive jobs – the OECD's reasoning continues – are created in flexible countries, but not in rigid countries due to too high (minimum) wages or social benefits. In this view, the loss in average labour productivity growth is mainly a negative by-product of extra jobs created in the low wage segment.

In our view, the reasoning by the OECD is unsatisfactory for several reasons. First, it does not take account of our theoretical arguments that suggest a causal link from wage growth to labour productivity growth. The vintage argument and the creative destruction argument, in particular, would lead us to expect losses in productivity growth in existing jobs. Secondly, if correct, the OECD argument would imply that the 'flexible' Anglo-Saxon countries exhibit a higher GDP growth than the rigid Europeans do. This can be derived as follows. If modest wage growth and flexible labour relations do not affect labour productivity growth in existing jobs (as implied in the OECD argument), then the new (albeit low-productive) jobs in flexible countries should result in extra GDP growth. Our Figure 5.3 presents evidence against this hypothesis: in the long run, GDP growth in the Anglo-Saxon countries seems not to depart from European GDP growth. Finally, from a normative viewpoint, it may be asked whether it is wise to have people locked in low-productive jobs since, in the near future, Europe will face an ageing population. The share of people at working age will shrink. To meet that challenge, it seems wise to enable highly productive work by systematically investing in education, rather than to have many low-educated people trapped in work that produces little value added.

Finally, as a GLS procedure is used, we cannot rely on an R^2-statistic. To illustrate the realism of our model, therefore, a dynamic simulation is used. Figure 5.5 compares statistically observed labour productivity growth to labour productivity growth that is simulated, using the estimated coefficients taken from model 1. We consider these simulations satisfactory and reassuring.

Figure 5.5. Comparison between observed labour productivity growth and simulated labour productivity growth



5.4. Conclusions

At first sight, both Figure 5.1 and Figure 5.2 seem to confirm what everyone would expect: modest wage growth in flexible Anglo-Saxon economies leads to a substantially higher growth in labour input. This seems to confirm the neoclassical belief of a trade-off between wages and employment. However, Figure 5.3 shows that – contrary to popular belief – high Anglo-Saxon job growth can hardly be attributed to enhanced GDP growth. Figure 5.4 shows what tends to be overlooked: between the 1960s and early 1990s, the 'flexible' Anglo-Saxon countries showed much weaker labour productivity growth than the rigid European economies. Our panel data analysis shows that a causal link indeed exists between wage growth and labour productivity growth, 1% extra wage growth causing about 1/3% extra productivity growth.

We discussed a competing explanation of this effect, i.e. the *growth in low-productive jobs* hypothesis as proposed by the OECD (2003a). We argued that, if correct, this hypothesis would predict a higher GDP growth in the flexible Anglo-Saxon countries: if productivity growth of *existing* jobs remained unchanged and the reduction of labour productivity growth was exclusively due to hiring of (otherwise unemployed) people with low qualifications, then there should be extra GDP growth in the flexible Anglo-Saxon countries. Figure 5.3 shows this is not the case.
There is of course evidence of a higher GDP growth in the USA, notably since the 1990s, but this may have different reasons, e.g. rising real estate prices that unleashed a mortgage boom. It has been shown elsewhere that 'mortgage Keynesianism' related to booming housing markets may cause substantial extra GDP growth, at least in the short run.[47] Figure 5.3 shows that, in the long run (1960s to the present), GDP growth in the Anglo-Saxon countries is <u>not</u> higher than in Europe. We conclude that lower wage growth reduces labour productivity growth also in <u>existing</u> jobs and that this is a major cause behind the higher growth of labour hours in the Anglo-Saxon countries (Figure 5.2).

Table 5.1 illustrates the same argument, suggesting that the stronger growth of labour hours in the Anglo-Saxon countries since the 1960s has little systematic relationship with (higher) GDP growth. The main driving force behind superior employment growth was weaker labour productivity growth. As GDP per working hour grew more slowly than in the EU since the 1960s, the Anglo-Saxon countries needed many more hours of work in order to achieve a one-percent growth of GDP. Seemingly, the relatively modest wage growth in the Anglo-Saxon countries (compared to the EU) drove them into a relatively low-productive and more labour-intensive growth model.

There are, of course, reasons to be pleased with high job growth. It is good for the social cohesion of society; the reduction of unemployment reduces the need for social transfers and thus helps to curb public expenditures and the tax burden (or the built up of government debt). On the other hand, it might be asked whether such a growth model is as attractive as it looks (see also Ebersberger and Pyka 2002). We see several reasons for doubt.

[47] According to simulations with the Morkmon model of the Dutch Central Bank, rapidly rising housing prices and related extra mortgages by house-owners in the Netherlands caused an extra growth of GDP by about 1% in 1999 and 2000 (DNB 2002, p. 29-38). As US housing prices roughly doubled between 1995 and 2005, similar (perhaps even higher) effects may apply to the US economy.

First, a highly labour-intensive GDP growth means loss of welfare in terms of leisure time. Would it not have been better to maintain high wage cost pressure and thus high rates of labour productivity growth? If, as a result, unemployment should reach levels that are considered socially unacceptable, trade unions could still proceed with a strategy of reducing labour hours per employee. While Faggio & Nickell complain about a 'mistaken belief' (2007, p. 437) that shorter working hours would reduce unemployment, Table 5.1 suggests that this strategy was highly successful in the past. The table shows that, during 1960-1973, a 5.1% GDP growth rate in Europe coincided with an even slightly negative elasticity of labour hours growth with respect to GDP (-0.03). In other words, the absolute numbers of hours worked declined, on average, by 0.15% per year (i.e. 5.1% GDP growth times -0.03). In spite of the negative employment elasticity of GDP growth, most EU countries tended towards full employment in the early 1970s. This was achieved because, at that period, trade unions managed to reduce working hours per week and to negotiate longer holidays. This would appear to be a more intelligent strategy than to create jobs by sacrificing wages, thereby bringing down labour productivity growth. In any case, free time is also welfare.

Second, many economists still propagate that rigid labour markets in Continental Europe should be made more flexible. In fact, the call for more flexible labour relations is one for lower wages. It is interesting to confront such claims to evidence from micro-data. For example, firm-level estimates in the Netherlands indeed show that firms employing higher shares of flexible personnel pay lower wages. Estimates of sales equations, however, also show that firms with high shares of flexible labour (paying lower wages) do not conquer market shares from rigid firms. The explanation is that firms with plenty of flexible labour realise lower productivity gains (Kleinknecht *et al.* 2006). Here again, we see that an orientation towards wage reduction is paying less than expected: lower wages are, to a significant degree, compensated by lower labour productivity growth.

Third, many observers will probably agree that, in view of Europe's ageing population, labour will become scarce in the near future. Together with a shrinking working population, demand by elderly people for care services will grow, services that are likely to be quite labour-intensive. In this context, it must be asked whether the Anglo-Saxon countries are well served with their low-productive and labour-intensive growth regime. Efforts can be made, of course, to augment labour market participation, but such a strategy has its limitations: the higher labour participation becomes, the more difficult it is to increase it further. A labour-extensive growth regime (as in the 1960s and 1970s in Europe; see Table 5.1), based on high wage cost pressure and high rates of labour productivity growth, would seem more promising if the aim is to master the challenges of a smaller working population and of a rising share of pensioners in need of care services.

Finally, our analysis suggests new research in two directions. First, our estimates raise some doubt about the realism of the Verdoorn Law. Several chapters in McCombie *et al.* (2002) provide evidence in favor of the *Verdoorn Law* (or the Kaldor-Verdoorn Law): labour productivity growth also depends on growth of GDP. This has an important policy implication. As supply side thinkers beat the Keynesians in the 1980s and 1990s, many governments in Europe became reluctant to engage in fiscal stimulation of the economy during recessions. If the evidence in favor of Schmooklerian 'demand-

pull' effects for product innovation (Brouwer and Kleinknecht 1999) and of Verdoorn effects for labour productivity growth were indeed valid, this would imply that neglect of demand in economic policy might, during certain periods, have weakened innovation and productivity growth in Europe. Given the role of innovation and productivity for exports (Hughes 1986; Carlin *et al.* 2001; Kleinknecht and Oostendorp 2002), this is likely to weaken the competitive position of European suppliers on international markets. Seen from this perspective, the defeat of Keynesianism would appear not to have been helpful to the European Commission's Lisbon agenda. The question is, however, how real is the Verdoorn effect? Our results suggest that the Verdoorn relationship might be less stable than is often assumed and at least part of the evidence of Verdoorn effects may have been driven by fluctuations in capacity utilisation. Given the obvious relevance of this issue, our results call for more in-depth analyses of the Verdoorn Law.

Second, many large macro-econometric models of the economy still treat labour productivity as being independent of wages. They do not recognise that downward wage flexibility, wage-cost saving flexibilization of labour relations or other ways of curbing wage-costs would harm labour productivity growth. It would now be interesting building the causal relationship between wages and labour productivity explicitly into such models, using our above coefficients. We definitely believe that a number of model outcomes and policy implications will change significantly.

6. Revisiting the causal relationship between wages and productivity: a robustness test

6.1. Introduction

In chapter 5, we present theoretical and empirical evidence in favour of the hypothesis that the growth of the real wage has a positive feedback on labour productivity growth. In this chapter, we test the robustness of the results obtained in chapter 5. But we also present theoretical arguments that lead us to hypothesize that not only wage *growth* positively affects productivity growth, but that also the wage *share* in total production costs affects productivity growth in a positive way.

The latter hypothesis avoids some restrictions that limit the policy options for raising productivity growth by raising the wage growth. This possibility is restricted in practice, because not all of the real wage growth is absorbed by productivity growth (the coefficient lies between 0.31 and 0.39). Hence it is not feasible to keep real wage growth at a higher rate indefinitely; for this would eventually lead to a profit squeeze (the wage share would eventually approach 1). In other words: our policy freedom to raise productivity growth by raising wage growth is still restricted by the room to raise wage growth that is provided by productivity growth in the first place. This restriction, however, is avoided if we can raise productivity growth by raising the wage *share* in National Income. For there is no theoretical limitation to keeping the wage share somewhat higher indefinitely. There is strong evidence that in all OECD countries the labour share in National Product has significantly declined since the mid-1980s. If our hypothesis is correct that the share of labour income in National Product is positively related to labour productivity growth, then the decline of the wage share offers itself as one of the explanations of the tendency towards a general decline of labour productivity growth across the OECD.

We first discuss the theoretical background of this hypothesis. Then we turn to the empirical approach that differs from the approach chosen in the former chapter. We next discuss how our new approach may affect the results of our empirical analysis. We then turn to the exact empirical setup and results and then round up with conclusions.

6.2. Theoretical arguments of why the wage share causes productivity growth

We present three arguments in favour of our hypothesis that the wage share has a positive effect on labour productivity growth.

Argument 1: Labour saving induced innovation can be stated as a function of the share of wages in total costs

Firms may aim to increase the productivity of a certain factor of production with the aim of reducing the use of this factor. They have a higher incentive to economize on labour when the share of labour costs in total production costs is higher. That would imply that a higher wage share spurs firms to speed up labour productivity growth.

We can check the consistency of this line of reasoning in two steps. In the first step, we determine the incentive structure for the firm (this results in equation 6.3). We do this by splitting the reduction of production cost into a contribution from labour productivity growth and from other factors. In the second step, we determine how this

incentive structure translates into labour productivity growth (eventually resulting in equation 6.8).

Total production costs can be written as:

$Xp = (WL + RK)$ equation 6.1

where X denotes real output, W and R denote compensation for labour and capital respectively and L, K denote labour inputs and capital inputs respectively.
This expression states that the price of production (Xp) can be split into the costs for labour (WL) and the costs for capital (RK). The latter component may also be seen as profit income.
Division by units of output (X) allows us to write unit costs (p) as:

$p = (WL + RK)/X = W/\lambda + R/\chi$ equation 6.2

where λ denote labour productivity and χ capital productivity.
If we rewrite equation 6.2 into growth rates, we obtain:

$\hat{p} = -ws * \hat{\lambda} - (1 - ws)\hat{\chi}$ equation 6.3

where *ws* denotes the share of wages in total production costs.
From equation 6.3 we observe that the percentage reduction in prices is negatively proportional to the percentage growth of labour productivity.

Foley and Michl (1999, p. 275 - 278) describe a model of induced technical change where labour productivity growth is a positive non-linear function of the share of wages in total costs. They arrive at this conclusion by analyzing the incentive structure for individual firms to increase labour productivity. This incentive structure follows from the distribution of costs per unit of output of labour and capital, as given in equation 6.3.

Foley and Michl (1999) pose the planning problem for the entrepreneur-manager of the firm as follows:

$\min(-ws * \hat{\lambda} - (1 - ws)\hat{\chi})$ equation 6.4

This means: try to reduce unit costs as much as possible by increasing labour and/or capital productivity. To determine what is possible, Foley and Michl (1999) assume a technical progress function (equation 6.5) that exhibits a trade-off between the growth of labour productivity versus the growth of capital productivity.

$\hat{\chi} = f(\hat{\lambda})$; where $f'; f'' < 0$ equation 6.5

$f' < 0$ denotes that the path of technical progress exhibits a trade-off between growth of labour productivity versus growth of capital productivity. Furthermore, a very large increase in labour productivity requires a proportionately larger fall in the increase in capital productivity ($f'' < 0$).
If we substitute equation 6.5 in equation 6.4, we can explicit the entrepreneurial planning problem as follows:

$\min(-ws * \hat{\lambda} - (1 - ws) f(\hat{\lambda}))$ equation 6.6

with corresponding first order condition:

$$d(-ws * \hat{\lambda} - (1 - ws) f(\hat{\lambda})) / d\hat{\lambda} = 0$$ equation 6.7

And thus:

$$f'(\hat{\lambda}) = -\frac{ws}{(1 - ws)}$$ equation 6.8

If we fill in an appropriate technical progress function in equation 6.8 we end up with a non-linear, positive relationship between the wage share and the growth of labour productivity.

Argument 2: The wage share is an indicator of the fairness of the distribution of income

Fairness is a notion that appears frequently in business decisions (Freeman 1998). The share of wages in the income distribution can be taken as an indicator of how fairly workers are compensated for their contributions to productivity. The higher this ratio is, the more likely it is that workers will perceive their income as fair. Akerlof and Yellen have, in a series of papers (Akerlof 1982, Akerlof 1984, Akerlof and Yellen 1986, Akerlof and Yellen 1990), cited evidence that pay equality promotes teamwork and that work group effort norms depend on the perceived fairness of pay and pay differentials (see also Buchele and Christiansen 1999). Hence a higher wage share in National Income promotes a higher effort towards improving productivity growth.

Argument 3: The wage share is a measure of labour's stake in productivity growth.

The wage share can be interpreted as a measure of the extent to which labour benefits from realizing productivity advances. When the wage share is higher, labour benefits more and has a higher motivation to help realizing productivity advances. We have argued before that labour's input in the innovation process is crucial. Many productivity enhancing ideas stem from worker's experience on the shop floor. And the implementation of process-innovations often depends crucially on the collaboration of labour. Furthermore, learning-by-doing effects and the disclosing of tacit knowledge crucially depend on the contribution of workers (Buchele and Christiansen 1999, Dekker and Kleinknecht 2008).

6.3. Empirical approach

As a robustness check of the results reported in Table 5.2 we here follow a different approach to estimate roughly the same relationship. This approach uses 5-year average values of the data, which is common in the growth literature (as a recent example see Van Schaik and Van der Klundert 2008). The advantage of this approach is that 5-year averages eliminate short-run fluctuations in the data, like business-cycle effects. The drawback clearly is the drop in observations. Judging empirically from the average duration of business cycles (for instance reaching from peak to peak), it seems that they take about 10 years rather than 5 years. Hence we should rather use 10-year averages instead of 5-year averages to clean for business-cycle effects. From a practical point of view, of course, using 10-year averages is hardly feasible because of the

implied 90% reduction in data points. Hence, in spite of our theoretical preference for longer-time averages, we follow the existing literature in using 5-year averages. We do, however, control for fluctuations of longer duration by including time dummies in the regression.

Furthermore, we use instrumental variables to avoid endogeneity problems. In the original approach, we used predetermined independent variables that were lagged by at least one year to the dependent variable. Here, we use contemporaneous independent variables. We instrument them with appropriate lags (more on this below).

In line with chapter 5, we use the following variables to explain the growth of labour productivity:

- GDP growth, a proxy for the Verdoorn effect;
- Gap, to control for catching-up effects due the possibility of benefitting from spillovers if there is a gap with the technology leader;
- And, depending on the specification:
- Lagged productivity growth, to control for state dependency;
- Capacity utilisation, to control for business cycle effects;
- Share of services, to control for the famous Baumol effect (productivity growth may be lower in service sectors).

And we add as an explanatory variable:

- The share of wages in the total costs of production.

6.4. Expected results of the regression

The change in the empirical approach may cause one or more of our original regressors (Chapter 5) to behave somewhat differently. We will discuss this issue for each regressor.

The hypothesized effect of wage growth on productivity growth remains positive. We do not expect that using 5-year averaged data and adding the wage share in the equation changes qualitatively its effect on productivity growth. The theoretical channels through which this variable affects productivity growth, i.e. neoclassical substitution, induced innovation, a vintage effect, creative destruction and a wage-led Verdoorn effect remain unchanged.

The lagged dependent variable may be less significant, as the use of 5-year averaged data clears capacity effects and it introduces a 5-year gap between the dependent and its lagged value. Thus we do not necessarily expect the lagged dependent variable to explain current labour productivity growth significantly.

Considering the Gap variable (that proxies for catch-up-effects), we change the exact proxy for the technology gap (now following Van Schaik and Van der Klundert 2008). Hence we expect a change in the coefficient.

Considering the Verdoorn effect (the coefficient of GDP-growth), the results may change in the new empirical set-up. For when we use 5-year averaged data, capacity

effects are (partly) averaged-out. Judging from the results in Chapter 5, we noted our suspicion that the Verdoorn-effect could be caused by short-run fluctuations in capacity utilization. This suspicion is built on the result that the introduction of a measure of capacity utilization takes away the significance of the Verdoorn effect, while in versions without control for capacity utilization, it is significant. The regression set-up with 5-year averaged data allows for an additional test of our suspicion.

The hypothesized effect of the wage share on productivity growth is, of course, positive.

6.5. Econometric approach

In order to empirically test the model, we run a regression on panel data. We have observations for 20 OECD countries spanning from the 1960s to the 2000s[48]. We use the Arellano and Bond (1991) method to estimate a panel data model that includes Fixed Effects and uses instrumental variables. In this method, the fixed effects are swept away by first differencing the equation. Hence the – first differenced – regression equation that is being tested, can be written as follows:

$$\Delta\hat{\lambda}_{it} = \beta_1\Delta\hat{w}_{it} + \beta_3\Delta\hat{Y}_{it} + \beta_4\Delta Catchup_{it} + \beta_5\Delta ws_{it} + \beta_6\Delta X_{it} + \Delta\varepsilon_{it} \qquad \text{equation 6.9}$$

Where $\hat{\lambda}$ denotes the growth of labour productivity, $\hat{w}$ is the growth of real wages, $\hat{Y}$ is the growth of Gross Domestic Product, *Catchup* is the log of the ratio between the productivity of a specific country and that of the productivity leader, *ws* denotes the share of wages in National Income and X contains a vector of control variables, which includes fixed country effects (which are swept away by first differencing) and fixed time effects, and – depending on the precise specification – a lagged dependent variable, a dummy for the unification of Germany, or the share of services. The β's are the coefficients, the subscripts i, t denote panel (country) and time respectively. ε denotes the idiosyncratic error term.

Before running a regression with this equation, it should be noted that there is a potential endogeneity bias that concerns two of the independent variables. First, we explicitly allow for labour productivity growth to cause wage growth. Hence, $\hat{w}$ should be instrumented. Furthermore, $\hat{Y}$ might be caused by labour productivity growth.
To correct for this problem, we use an instrumental variables approach. The reader may note that introducing a lagged dependent variable in the fixed effects context generates an additional endogeneity problem. Hence we also instrument the lagged dependent variable in all specifications where it is included.

Our instrumental variables approach is based upon Arellano and Bond (1991). This approach uses all available predetermined lags of possibly endogenous regressors as instruments. The set of instruments consists of two parts: first, there are the predetermined lags of possibly endogenous regressors (in our case: $\Delta\hat{w}_{it}$ and $\Delta\hat{Y}_{it}$ and, in some specifications, $\Delta\hat{\lambda}_{it-1}$); second, there are the remaining exogenous regressors

[48] The exact time-span of an indicator differs somewhat with respect to country and data-source. The maximum span runs from 1958 to 2008.

($\Delta Catchup_{it}$, Δws_{it} and ΔX_{it}). Arellano and Bond (1991) use all instruments that can be built by the predetermined lags of possibly endogenous regressors, based on the assumption that there is no serial correlation of order 2 or higher in the errors of the first differenced equation. They define all possible individual moments that can be constructed from the combination of (a) the error term of a differenced regression equation for an individual year and (b) a predetermined lag of a possibly endogenous regressor. Building the set of instruments in this way, the first part of the instrument set consists of moment (GMM)-style instruments based on lags of the possibly endogenous regressors. The second part consists of traditional (IV)-style instruments based on the exogenous regressors. Below, we explicitly state what the instrument matrix looks like.
We tested the validity of the instruments by the common Hansen and Sargan tests as well as by the Arellano Bond test for second order autocorrelation in the residuals. We also tested for higher order autocorrelation in the residuals which was, however, never significant.
As can be seen in Table 6.1, the exogeneity of the instruments cannot be rejected.
The extent to which we can use lags of the endogenous variables to construct the GMM-style moments is limited by the dimensions of our dataset. We run the risk of obtaining misleading results if the set of moment-conditions (instruments) becomes large compared to the number of countries in our panel. This so-called over-fitting bias is shown to be $O(j/N)$, where j denotes the number of instruments and N denotes the number of countries (Arellano 2003). The limit for the number of instruments that is suggested, is $j = N$ (Arellano and Bond 1998). However, this limit should be considered more like a rule of thumb than a guarantee that the bias is small. Hence we test the robustness of our estimates by changing the instrument set (see Table 10.6 in the appendix).

Returning to the over-fitting bias, in our case, with 20 countries and roughly 6 waves of 5-year periods in the sample, we already reach this boundary when we include just one lag in the list of GMM-style instruments. This follows when we realize that, including only 1 lag as GMM-style instruments, we have 2*6 GMM-style instruments for our possibly endogenous variables and about 7 IV-style exogenous instruments for the additional variables. We thus obtain an instrument to groups ratio of about 20:20. Hence we restrict ourselves to using only one lag of moment-style instruments.

To generate valid moment conditions from predetermined lags of the possibly endogenous variables, we include them with a 2 period lag as instruments. The necessity to use a 2 period lag instead of just 1, follows from the fact that the error term of the first-differenced equation would still be (possibly) correlated with a 1 period lag of a (possibly) endogenous variable. Hence we can start generating the GMM-style instruments from a 2 period lag onwards.

Denoting the instrumented variables by adding a (Z), we estimate the following regression equation:

$$\Delta\hat{\lambda}_{it} = \beta_1\Delta\hat{w}_{it}(Z) + \beta_3\Delta\hat{Y}_{it}(Z) + \beta_4\Delta Catchup_{it} + \beta_5\Delta ws_{it} + \beta_6\Delta X_{it} + \Delta\varepsilon_{it} \qquad \text{equation 6.10}$$

To give an example of what the instrument matrix Z looks like, consider that we run regressions where we use data for the 5-year averages centred around the years 1970 up to 2000. Then, the instrument matrix can be regarded as stacked country-specific

$$\text{instrument matrices } Z_i: \quad \begin{array}{c} \\ \\ \\ \\ \end{array} \begin{array}{c} \underline{\text{GMM-style}} \\ \\ \\ \\ \end{array} \begin{bmatrix} \Delta I'_{i,1960} & 0 & \cdots & 0 & : & \Delta X'_{i,1970} \\ 0 & \Delta I'_{i,1965} & \cdots & 0 & : & \Delta X'_{i,1975} \\ \vdots & \vdots & \ddots & \vdots & : & \vdots \\ 0 & 0 & \cdots & \Delta I'_{i,1990} & : & \Delta X'_{i,2000} \end{bmatrix} \begin{array}{c} \underline{\text{IV-style}} \\ 1970 \\ 1975 \\ \vdots \\ 2000 \end{array}$$

Where $\Delta I'_{it} = \left[\Delta w_{g,it}; \Delta GDP_{g,it}\right]$ are the GMM-style instruments built from lags of the possibly endogenous variables and $\Delta X'_{it}$ are the IV-style instruments from exogenous variables.

To test the robustness of our outcomes for the specific instrument list, we perform two tests. First, we switch the GMM-instrument list by using the third lag of the predetermined regressors (see Table 10.6 in the appendix). Second, disregarding the over-fitting bias problem, we perform regressions using all the available lags as instruments. The former does not alter the coefficients of our regressions substantially, although significance falls somewhat. The latter also keeps the coefficients stable, while it increased the significance (not reported).

Finally, to overcome possible drawbacks caused by 5-year averaging of the data, we perform the regression for all reported specifications 5 times. We do this by rolling over the calculated 5-year averages when selecting the subset of data to be used for estimation. For example, we first pick our subsample to run the regression by centring our averages on the years 1970, 1975, ..., 2000. Then, we perform a second regression using data that centre around the years 1971, 1976,...,2001. The third regression rolls over the moving averages centred on the next year, until we reach 5 regressions.
The roll-over procedure generates two benefits:
First, it limits the drawback, introduced by taking 5-year averages, of reducing the amount of observations by a factor 5. The roll-over procedure allows us to use the remaining 4/5th of the data to perform robustness tests on the results. Second, we cannot be accused of possible data-mining in opportunistically selecting the centre-years of our regression-subsample.
The estimation results are reported in such a way that the robustness of the results for rolling over the moving-averages can be readily seen. This will be explained below.
For a description of the data and descriptive statistics, see the appendix, paragraph 10.3.

6.6. Regression results

6.6.1. Reported statistics

In order to summarize the regression statistics for the 5 rolling estimates, we report the average value of the coefficient, the significance based on the average p-value and the significance based on the average z-value. Note that the significance based on the average z-value does not necessarily correspond with the significance based on the average p-value, for the transformation from z to p is not linear. Judging significance

from the average z-value would lead us to be over-confident in the significance of the estimates, while taking the average p-value as the indicator, would lead us to underestimate the significance of the coefficient. The following example illustrates this. Suppose that two of our rolling-regressions result in pairs of (z,p) values of $(z,p)_1=(0,0)$ and $(z,p)_2=(4,<0.01)$. This would imply average values of (z,p) of (2,~0.5). Thus, judging significance from the average z-value, we would be led to believe that the average significance is about 5%, while the average p-value would imply a significance of only 50%. In other words: a single extreme value in z would bias the average value of z in such a way that we are over-confident in the results, while a single outlier in p would bias the average in such a way that we are underconfident in the results.
In order to overcome such ambiguous signals, we also report the count of times that a rolling-regression yields a coefficient with a p-value smaller than a specific significance threshold. We do this for the 10%, 5% and 1% value.
The combination of these statistics allows us to infer not only - from the count - how many times a coefficient reached a certain significance level, but also how robust the significance is. The latter can be interpreted from the significance level based on the average z compared to the significance level based on the average p-value. If they both are close to the value corresponding to the most counted significance level, then the results of the rolling-regressions that did not generate coefficients with that particular significance level, have near-significant regressors. If the average z and p-values are far away from the value implied by the count (and far away from each other), the results of the rolling regressions that yielded insignificant coefficients are far from significant.

6.6.2. Results

The table below covers the results of the regressions. Our baseline regression (I) includes wage growth, wage share, catch-up and Verdoorn as explanatory variables. It turns out that the lagged dependent variable (the average growth of labour productivity lagged 1 year) is insignificant, as displayed in model (II). The Verdoorn coefficient is insignificant in our baseline model. So we report a regression without it in column (III). Furthermore, we experiment with controls for the share of services (model IV) and a dummy for the unification of Germany (model V).

Table 6.1. Results of Arellano-Bond regressions explaining the growth of labour productivity ($\hat{\lambda}$), on 5-year averaged values for 20 OECD countries from the 1960s to the 2000s

Independent variables		**(I)**	**(II)**	**(III)**	**(IV)**	**(V)**
$\hat{w}$		0.46$^{**/**}$	0.35$^{*/**}$	0.44$^{**/**}$	0.45$^{**/**}$	0.41$^{**/**}$
	P_1,5,10	1,4,5	1,2,4	1,4,5	2,3,4	0,3,5
ws		0.24$^{***/***}$	0.17$^{**/**}$	0.23$^{***/***}$	0.23$^{***/***}$	0.22$^{***/***}$
	P_1,5,10	4,5,5	2,3,4	2,5,5	4,5,5	4,5,5
Catchup		-0.05$^{*/**}$	-0.06$^{***/***}$	-0.06$^{**/**}$	-0.07$^{*/**}$	-0.05$^{*/**}$
	P_1,5,10	1,2,3	4,5,5	1,3,4	2,2,3	1,3,4
Verdoorn ($\hat{Y}$)		0.16$^{/}$	0.08$^{/}$		0.09$^{/}$	0.21$^{/}$
	P_1,5,10	0,0,0	0,0,0		0,0,0	0,0,0
$\hat{\lambda}_{-1}$ $^{(a)}$			-0.11$^{/}$			
	P_1,5,10		0,1,1			
Services					-0.03$^{/}$	
	P_1,5,10				0,0,0	
Germany						-0.02$^{/**}$
	P_1,5,10					2,3,3
Sargan		$\overline{P}$ =0.48 ; $P_{\bar{z}}$ =0.45	$\overline{P}$ =0.55 ; $P_{\bar{z}}$ =0.51	$\overline{P}$ =0.47 ; $P_{\bar{z}}$ =0.45	$\overline{P}$ =0.68 ; $P_{\bar{z}}$ =0.68	$\overline{P}$ =0.55 ; $P_{\bar{z}}$ =0.54
	P_1,5,10	0,0,0	0,0,1	0,0,0	0,0,0	0,0,0
Hansen		$\overline{P}$ =0.45 ; $P_{\bar{z}}$ =0.45	$\overline{P}$ =0.82 ; $P_{\bar{z}}$ =0.83	$\overline{P}$ =0.46 ; $P_{\bar{z}}$ =0.46	$\overline{P}$ =0.54 ; $P_{\bar{z}}$ =0.54	$\overline{P}$ =0.42 ; $P_{\bar{z}}$ =0.42
	P_1,5,10	0,0,0	0,0,0	0,0,0	0,0,0	0,0,0
Ar2		$\overline{P}$ =0.48 ; $P_{\bar{z}}$ =0.46	$\overline{P}$ =0.60 ; $P_{\bar{z}}$ =0.42	$\overline{P}$ =0.32 ; $P_{\bar{z}}$ =0.28	$\overline{P}$ =0.46 ; $P_{\bar{z}}$ =0.42	$\overline{P}$ =0.43 ; $P_{\bar{z}}$ =0.41
	P_1,5,10	0,0,0	0,0,0	0,0,1	0,0,0	0,0,0

Notes:
*,**,*** denote average significance of 10%, 5%, 1% respectively.
Stars on the left side of "/" display the significance based on the average P value. Stars on the right side denote the significance based on the average z value (t-distributed). P values are calculated based on standard errors that are robust to general heteroskedasticity and autocorrelation. Numbers indicating P_1,5,10 denote the count of a 1%, 5%, 10% significant result out of the 5 rolling regressions.
$\overline{P}$ denotes the significance level based on the average p-value; $P_{\bar{z}}$ denotes the significance level based on the average z-value.
All regressions are estimated with a Fixed Effects Arellano Bond procedure that uses available lags to instrument the possibly endogenous regressors ($\hat{w}$ and $\hat{Y}$). Stata routine: Xtabond2 (Roodman 2009) with options noleveleq small robust. *Services* denotes the share of services; *Germany* denotes a dummy for the unification of Germany. Fixed time effects are included in all the regressions. *Sargan* and *Hansen* denote the respective over-identification tests for validity of the instruments. The Sargan-test is not vulnerable for over-fitting, but it is not robust. The Hansen test is robust, but vulnerable for over-fitting. The *Ar2* is the Arellano-Bond test for presence of second order autocorrelation in the residuals of the regression.
(a) Instruments of the lagged dependent are based on lag 2 of the dependent. Over-fitting bias is a problem with this regression.

Our baseline regression (I) shows that our variables that explain the growth of labour productivity behave more or less as expected. The tests for the validity of our instruments are not worrying. They indicate that the H_0 of valid instruments[49] cannot be rejected. The validity of the instruments remains stable over the specifications that we test.
Wage growth, in our baseline model, picks up a coefficient of 0.46 with an average significance level of 5%. This result implies that a 1% extra growth of the real wage

[49] The Sargan and Hansen tests have a H_0 of no correlation between the instruments and the error terms of the regression. The Ar2 test has a H_0 of no second order correlation between the errors of the first differenced regression equation.

causes an additional growth of productivity of 0.46%. The coefficient reaches the 10% significance level in 5 out of 5 of the rolling regressions, reaching 5% in 4 out of 5. Judging from the similarity between the significance based on the average p-value compared to the significance based on the average z-value, there is not too much spread in the significance of the individual rolling regressions.

Furthermore, we can see that the effect of wage growth remains rather stable over the various alternative specifications (II – V). It has a value between 0.35 and 0.46 with an average significance of 10% to 5% (reaching an average of 5% in all but 1 specification). In all but 2 of the individual rolling regressions over the various specifications, wage growth reaches a significance level of at least 10%.

Looking at the effect of the wage share, we see that it is the most significant and robust variable that we include in the regression. It has an average coefficient that ranges from 0.17 to 0.24. This implies that a 1% rise in the wage share has the effect of pushing up productivity growth by about 0.2%. Considering that the wage share has fallen about 10% in the years represented in the sample, the result implies that we could boost productivity growth by about 2% if the wage share returns to pre-1970 rates. The coefficient reaches a significance level of 5% in 23 out of 25 of the rolling regressions for the 5 alternative specifications. The correspondence between the significance based on average p-values on the one hand and z-values on the other indicates that the significance is quite robust.

The proxy for technological catch-up also performs as expected, although it is not as robust over the specifications as the wage share. In the baseline model, it reaches a coefficient of -0.05. The coefficient implies that a 10% reduction of the gap between a country's productivity relative to that of the leader would result in a 0.6% lower growth rate. In the baseline specification, the coefficient has an average significance level of 10% (based on the average p-value) to 5% (based on the average z-value). Over the various specifications, it reaches a significance ranging from 10% to 1%. Looking at the baseline specification, the difference between the significance implied by the average z-value and that by the average p-value indicates that the non-significant regressions yielded a rather insignificant coefficient. However, the results show quite some robustness over the various specifications. The coefficient does not change so much in value and reaches a robust significance level of at least 10%.

The Verdoorn effect is robustly insignificant in our regressions. This is not a surprise, considering that we use 5-year averaged data in the regressions. The results confirm our suggestions put forward in chapter 5 that the Verdoorn effect may be mainly driven by short run capacity effects[50]. The Verdoorn coefficient is rather small and instable, ranging from 0.08 to 0.21. In none of the specifications is the coefficient significant at any level. If we drop Verdoorn from the specification (model III), we can still significantly explain the growth of labour productivity.

Our specification (II) tests for the effect of the lagged dependent variable. It turns out that our model is capable of explaining the growth of labour productivity without the need of a lagged dependent. As mentioned above, this is not wholly surprising, for the use of 5-year averaged values implies a 5-year lag of the dependent. This seems to be too long for it to still have an effect on current productivity. It reaches a rather low coefficient which is on average insignificant. It reaches the 5% significance level only in 1 out of the 5 rolling regressions.

[50] We also run a model that included capacity utilisation. While leaving the results of the other coefficients unchanged, it is not significant. This suggests that capacity effects are indeed cleaned out by averaging the data.

Following the Baumol argument, we run a model with a measure for the share of services in the regression. The argument runs that in services, often being highly labour intensive, it is much harder to realise productivity increases. Thus it could be that the growth of labour productivity is explained by the relative weight of the service sector in the economy. As this sector generally pays low wages, this may be the underlying latent variable that in fact causes low productivity and low wages. Our model (IV) tests whether this effect indeed dominates our results. We find that – although the share of services does pick up a negative (but insignificant) effect – it does not adversely affect the significance of the other regressors in the model.
Finally, in model (V) a dummy for the unification of Germany turns out neither very significant nor robust. It reaches a 5% significance level in 3 out of 5 of the rolling regressions. However, the significance based on the average z-value (0,04) is much more favourable than the significance based on the average p-value (0,12). This points to the significance being rather unstable: in 2 rolling regressions the significance is below 1%, in 1 it is below 5%. Hence in the other 2 rolling regressions, the significance must have been above 26.5%. More importantly, including the dummy does not affect the coefficients of our model.
Considering the effect of the time dummies (not reported here), they turn out highly significant over the range of specifications. This is – as mentioned above - not surprising, as there are a couple of prolonged global recessions in the sample period, which cover a longer time-span than we can clean with our 5-year averages. Examples are the enduring slumps in the mid-1970s, in the early 1980s and the slumps of the beginning of the 1990s and after 2001 (the collapse of the dotcom bubble). Controlling for such global shocks by means of time dummies turns out to be necessary.

Finally, we test the robustness of our results for the specific estimator employed. Table 10.7 of the appendix reports the results of the two-step estimator (the more efficient feasible generalised least squares estimator that corrects the coefficients for patterns of heteroskedasticity and autocorrelation in the error terms) of the regressions reported in Table 6.1. We can see that the coefficients remain stable, while some significance is lost (although our variables of interest still remain rather significant).

6.7. Discussion and conclusions

In this chapter, we check the robustness of the results in chapter 5 where we found that wage moderation has a detrimental effect on labour productivity. The original estimates point to a coefficient of 0.31 to 0.39. Hence an average fall of 1% in wage growth results in an approximate fall of 0.35% in labour productivity growth.
While the regressions in chapter 5 are based on yearly data, our robustness check is based on 5-year averaged data. It thus averages out short run fluctuations. Furthermore, instead of using predetermined values of the regressors, we employ an instrumental variables approach based on the Arellano-Bond method of using available lags as instruments in a Method of Moments setting.
Furthermore, we change the regression specification somewhat, in that we add the wage share to the model. We have theoretical reasons for doing this. We find that the share of wage costs in total GDP is directly proportional to the incentives firms have to generate labour productivity growth. From the theory of induced innovation, we can derive that higher wage shares provide stronger incentives for firms to commit resources to generating labour saving technological progress. Furthermore, the share of wages in National Income can be interpreted as an indicator of fairness of the

distribution of income. Finally, a higher share of wages in National Income gives workers a higher stake in generating productivity advances.
The robustness check results in a somewhat higher coefficient of wage growth of a value of around 0.40. Furthermore, we obtain a coefficient of around 0.20 of the wage share. This finding is not only consistent with the hypothesis that wage moderation is detrimental for labour productivity, but it also adds an extra dimension to it. It was argued above that the effect of wage growth on labour productivity growth may be interpreted as a short run result, in the sense that wage growth cannot exceed labour productivity growth indefinitely. However, the wage share can remain at higher levels indefinitely. Hence we obtain the result that, also in the long run, wage moderation slows down productivity growth. We conclude that the general decline of the wage share in National Income across most OECD countries since the mid-1980s is one of the factors responsible for the OECD-wide deceleration of labour productivity growth in recent decades.
In spite of the theoretical reasons backing this result, this may still be surprising. We have argued before that many innovations are capital embodied. One could argue that this is especially the case for labour productivity enhancing innovations. In this respect, investment is a prerequisite to generate productivity growth. One could argue that a high wage share is detrimental for investment and would therefore slow down labour productivity growth. Although we do not deny that this mechanism is valid, we would like to put forward a number of reasons why this does not invalidate our positive relationship between the wage share and productivity growth.
First, there are other factors that influence investment. From a neoclassical point of view, the variable that influences investment is not the profit share but the (marginal) rate of profit. A firm would stop investing in capacity when the marginal rate of profit of that investment equals the interest rate. The rate of profit is made up of the profit share multiplied with capacity utilisation. The effect of the wage share on capacity utilisation may well be positive, for instance when the economy is wage–led[51]. Hence the effect of the wage share on investment is indeterminate.

In a Keynesian model, the effect of capacity utilisation typically is independently modelled as an accelerator component. These types of models give more room for the wage share to have a positive effect on investment.

Second, if we go along with the idea that technology indeed often is capital embodied, this does not diminish the importance of the effect of the wage share on the direction in which technology develops. In other words: when profits are high and demand is buoyant, but wages are low, firms may invest but not in technology that increases labour productivity. Hence a high wage share is crucial to shape the development of technology in a labour saving way.

Another counterargument to our hypothesis that high wages cause high productivity has been offered by the OECD. It reads that a rise in the wage share, by raising unit labour costs, puts low-productivity workers out of jobs (OECD 2003a, box 1.4, page 42). Hence the productivity gains come at a cost: increased unemployment at the bottom of the labour market. In chapter 5, we have already discussed this line of reasoning, arguing that an increase in jobs at the bottom of the labour market can not

[51] See Bhaduri and Marglin (1990) for a model that allows for wage-led and profit-led economic expansion.

account for losses in productivity in Anglo-Saxon countries. A flaw of the OECD (2003a) reasoning is that it only takes into account the perspective of firms: If wages are higher then productivity, a job is not offered by the firm. However, if one starts from the perspective of the worker, the argument turns upside down: if wages at the bottom are too low, employment may not be offered, or it may be worthwhile to look for a better paying job (Galbraith 2008). Hence low wages at the bottom may actually cause these low-productive vacancies to stay unfulfilled and lead to a decline of low-productive jobs. From the perspective of workers, the OECD reasoning is turned upside down: a higher wage share may actually lead to more workers who are willing to work in low-productive jobs. This increases our confidence that a high wage share pushes up productivity.

We conclude that the results that we obtain in this chapter allow us to feel confident about those in chapter 5. The key finding is that there exists a feedback from wage growth to productivity growth. Moreover, we have provided theoretical and empirical arguments for the hypothesis that also the wage share in total costs positively affects productivity growth.

7. Summary, conclusions and further discussion

Labour market flexibility, productivity and employment

Ir. Robert Vergeer

Two questions have guided the research in this thesis:
What is the impact of labour market rigidity on rates of unemployment? In particular, how adequate are the (influential) conclusions from the OECD's Jobs Study (1994)?
What is the impact of labour market rigidity on (labour) productivity growth?
Besides theoretical discussions, this thesis evaluates mixed econometric evidence in the literature and provides alternative empirical estimates. Among others, we conclude that there are problems with the theoretical arguments backing the orthodox hypothesis that rigid labour markets cause higher rates of unemployment. Moreover, neoclassical theory is not conclusive about the impact of rigidity on (labour) productivity growth. Finally, empirical support for the main conclusions of the OECD's Job Study (1994) turns out to be far from robust.

A labour market is called rigid when it has non-market institutions that hinder the forces of demand and supply; such factors can be strong firing protection, high unemployment benefits or powerful trade unions. The orthodox theory rests upon the assumption of a unique rate of unemployment that is consistent with steady inflation, the so-called NAIRU which stands for Non-Accelerating Inflation Rate of Unemployment. The NAIRU is supposed to be the equilibrium value of unemployment that allows for non-accelerating inflation. Earlier or later, unemployment will converge towards that (NAIRU) equilibrium value. The more rigid the labour market is, the higher are inflationary pressures; hence the higher is the 'equilibrium' value of unemployment that is required to keep labour disciplined; i.e. to avoid a rise of inflation through wage cost pressure. Thus, orthodox theory hypothesises: the only route to bring down unemployment is to get rid of rigidities in labour (and possibly other factor) markets.

In chapter 2 we conclude that the orthodox view is theoretically far from sound. It suffers from circular reasoning in that it needs to assume a stable equilibrium rate of unemployment for its stabilising mechanisms to work. We demonstrate that neither can the real balance effect nor the central bank's interest rate policy reliably establish the NAIRU equilibrium. The former relies on stable income expectations by consumers and an exogenously given real wealth. The assumption an exogenously given real wealth is invalid when we acknowledge that money is endogenous. The assumption on stable income expectations is only credible if the real world exhibits a stable income and hence stable unemployment equilibrium. Hence the real balance effect assumes the very thing it is invoked to establish. The central bank's interest rate policy exhibits the same flaw in that it entails the assumption of a stable NAIRU in its feedback mechanism. Furthermore, it relies on the assumption of a stable natural rate of interest, which, again, can only realistically be assumed to exist if the real world exhibits a stable equilibrium rate of unemployment.
Furthermore, we demonstrate that the NAIRU is also affected by demand, capacity utilisation, productivity and the history of unemployment. In other words: focussing on labour market institutions in explaining unemployment generates an incompletely

specified model. This erodes the core of the NAIRU hypothesis that puts forward that the NAIRU is affected by labour market institutions, and not by demand, capacity, productivity or history. Moreover, research in this thesis suggests that rigid labour market institutions can have a theoretically ambiguous effect on unemployment. Raising employment protection may push up, but it may also bring down the NAIRU. It may bring down the NAIRU if the productivity-raising effects of high-trust labour relations (which are associated with strong employment protection) are stronger than the wage push-effect of a strengthened bargaining position of labour (Storm and Naastepad 2008).

To summarise, we have seen that the NAIRU is also affected by factors other than labour market institutions, notably demand and the history of unemployment. Furthermore, more rigid labour market institutions have an ambiguous effect on the NAIRU. Finally, we have seen that the mechanisms that allow us to interpret the NAIRU as the equilibrium value of unemployment are weak: they are theoretically inconsistent.
The conclusions above make OECD's believe in the NAIRU and its policy recommendations "a triumph of ideology over science." (Stiglitz 2002). In practice, this means that the central bank's interest rate policy aims to get unemployment at the level *it thinks* the NAIRU is.

With these theoretical objections in mind, our finding of a lack of robustness of regression evidence that is supposed to back the NAIRU hypothesis (chapters 2 and 4) may not come as a surprise. Using the database behind a highly influential paper by Nickell *et al.* (2005), we demonstrate that their results are not robust (chapter 4). Among scholarly studies that try to give empirical support to the NAIRU view, the work of Nickell and various co-authors (to be traced back to Nickell 1997) has inspired various others to pursue this line of research (e.g. Belot and van Ours 2001; 2004; Blanchard and Wolfers 2000). The basic approach stems from the NAIRU hypothesis: labour market institutions such as employment protection legislation, the amount and duration of benefits, union density or the total employment tax rate, are all expected to raise unemployment rates. Nickell *et al.* (2005) is a recent contribution in this line of research. Based on the work inspired by Nickell and various co-authers, the IMF 2003a; OECD 1999b; 2003a and the EU, in its Lisbon agenda, propagate the view that labour markets should be reformed.
We demonstrate that minor (and theoretically plausible) changes to the estimation approach of Nickell *et al.* (2005) can lead to major changes of their key outcomes: coefficients change sign, become significant or loose significance. In short, using the same data, time and country coverage, we can produce results that are almost exactly opposite to theirs. These findings lead us to slightly but decisively rephrase their conclusion into the following: "Broad movements in unemployment across the OECD can <u>not</u> be explained by shifts in labour market conditions" (rephrased from Nickell *et al.* 2005, p. 22)

Traditionally, lack of data and/or poor data quality have been advanced as reasons for the lack of robustness. While recognizing that data problems are serious, this thesis advances another candidate: the lack of sound theoretical foundations for regression specifications.
In chapter 4 we compare the robustness of empirical results based on a (version of a) NAIRU regression specifications by Nickell *et al.* (2005) to a fairly simple Keynesian

specification. Where the NAIRU specification puts labour market institutions at centre stage, the Keynesian specification centres on investment demand to explain unemployment. Compared to the NAIRU specification, our fairly simple Keynesian specification (still missing a number of possible refinements) turns out more robust in explaining unemployment.

With regard to our above-named second question ('what is the impact of rigid labour markets on productivity growth?') our theoretical discussion shows that neoclassical theory offers arguments in both directions: rigidity may favour or damage productivity growth (chapter 3). Two neoclassical arguments that hypothesise a positive effect of more rigid labour markets on productivity are the following. First, knowledge has public good characteristics. This means that the results of the innovative process can only imperfectly be appropriated by the firm (Romer, 1990). rigid labour markets may somewhat mitigate this problem, as people that stay longer with the same employer may be more loyal and will therefore less easily leak knowledge to competitors. This makes it more worthwhile for firms to invest in innovation. A second argument relates to the assumption that firms invest to little in firm specific knowledge of their employees. Then a union-caused compression of wages over the skill dimension increases the rewards for firms if they do, which may pull them towards the social optimal amount of investment in firm specific knowledge.

We continue our discussion with the observation that neoclassical theory tends to ignore a perspective that seems crucial if we want to analyse productivity: the labour-management relationship. The orthodoxy tends to analyse productivity gains as arising from a spot-market for labour where workers and firms trade effort against wages. This ignores the inherently imperfect nature of labour contracts; the obligations of the employer (e.g. paying a regular wage) may be well-specified, but what the employer gets back depends a lot on individual motivation and efforts of workers. These efforts may be imperfectly observable as there can be information asymmetry between workers and their supervisors, notably if skilful and complex tasks are to be performed. This thesis argues that work inherently involves a – to some extent durable – top-down power relationship between management and workers that can benefit from mutual trust and the mutual interest in continuing the relationship over longer periods. Productivity gains can be analysed as emerging from this relationship. One can argue that some power sharing between labour and management can give workers a say and a stake in the firm (Buchele and Christiansen 1999). A say in that they are able (involved in management decisions) and willing (protected from being fired as a result of productivity increases) to contribute to productivity advances. A stake in that they share (by means of wage growth) in resulting productivity increases.

Furthermore, empirical evidence on the effect of rigid labour markets on productivity tends to be – albeit mixed – rather more in favour of a positive effect. All empirical studies (with one exception) find a positive impact of rigid labour market institutions on labour productivity growth, while findings about total factor productivity growth are ambiguous. Chapter 5 provides empirical evidence for the view that wage increases push up growth rates of labour productivity (chapters 5). One percent extra wage growth leads, on average, to 0.31% - 0.39% more labour productivity growth, depending on the exact specification. Theoretical arguments behind this finding relate to neoclassical capital-labour substitution, vintage effects, induced technical change or Schumpeterian 'creative destruction'. Moreover, flexible 'hire and fire' labour relations

may damage the continuity of organisational learning in various ways (as discussed in chapter 2).
In addition, chapter 6 shows that the share of wages in national income also positively affects productivity growth. We find that a 1 percentage point rise in the wage share in National Income causes a 0.17% – 0.24% growth of productivity. Our finding is theoretically backed by the following three arguments. From the theory of induced innovation, we can derive that higher wage shares provide stronger incentives for firms to commit resources to generating labour saving technological progress. Furthermore, the share of wages in National Income can be interpreted as an indicator of fairness of the distribution of income, which can have an impact on workers' motivation. Finally, a higher share of wages in National Income gives workers a higher stake in generating productivity advances.
From the above we conclude: it is doubtful whether flexible labour markets bring down unemployment, but there are strong indications that they bring down labour productivity growth.

As a by-product of this thesis, we got doubt about the real relevance of the Verdoorn Law as reported in the literature (e.g. McCombie *et al.* 2003, Fase and Winder 1999). Our findings suggest that much of the empirical evidence in favour of the Verdoorn Law may have been driven by fluctuations in capacity utilization. Clearly, our outcomes call for further research on the relevance and impact of the Verdoorn Law.

Looking at the broader meanings of our findings, we can point to the importance of raising labour productivity in solving the aging problem. A simple 'back-of-the-envelope' calculation suggests that boosting labour productivity growth by an extra 0.5% per year, we would reach an extra GDP growth of over 25% by the year 2030 (keeping labour force participation constant). This would enable us to comfortably reach the needed growth to maintain living standards in spite of the ageing problem. The results of chapter 6 offer the possibility of raising the wage share as a way of achieving this rise in trend productivity growth.

In general, this thesis offers arguments against the orthodox perspective on rigid labour markets. It offers empirical and theoretical arguments in favour of rigid labour markets. Given the still overwhelming influence of orthodox thinking, these results may contribute to the beginning rather than to the end of the debate. This sounds like a trivial conclusion. However, reading only the orthodox literature, we would most likely not arrive at this conclusion. On the contrary: the conclusion would read like: "we need more flexible labour markets, no doubt possible!",
In this thesis, we quote a number of examples where orthodox scholars and policy advisers (OECD, IMF) have made this claim almost as if it is an indisputable fact[52]. The claim calls for the market as the unbeaten and unrivalled institution to maximize welfare for all. The call for market-friendly government policies is at the heart of the neoliberal agenda that rules the contemporary policy arena. As Howell *et al.* (2007) emphasise, governments that follow this policy advice are called to break down

[52] Howell *et al.* (2007) emphasise that 'the orthodox labor market rigidity view has become so widely accepted that a leading scholar could claim in a recent issue of the Journal of Economic Perspectives that "evidence supports the traditional view that rigidities that reduce competition in labor markets are typically responsible for high unemployment" without citing any peer-reviewed research (Saint-Paul 2004, p. 53)'.

"protective labour market institutions." That is, rigid non-market institutions like firing protection, welfare and unemployment benefits are to be reduced.

In spite of the weak evidence that backs the policy advice and the obvious cost to workers of implementing it, many governments tend to follow the neo-liberal pro-market agenda. This agenda, of course, is much broader than just the labour market. An example is the setup of the EU growth and stability pact with its limits on government deficits (3% of GDP) and national debt (60% of GDP). The plea for such limits is driven by a strong believe in inherently stable and efficient markets. We have argued in this thesis that this assumption is weak. Therefore, it is not surprising that, in practice, EU-governments have not kept to this limit, especially in times of an economic downturn.

Finally, we have to conclude that the evidence behind the call for labour market reforms is far from robust. As these reforms come with direct detrimental effects to workers and unemployed, it seems fair to raise the question whether political leaders should continue "to convince their electorates that it is necessary to swallow the medicine" (OECD researchers Scarpetta, Elmeskov and Martin, 1998, p. 242).
Another interesting point is the conclusion by Baker *et al.* (2004) that rigid labour markets are associated with a more egalitarian society. Palma (2009, p. 837) shows that neoliberal policies have lead to a "polarisation of incomes". Since the 1980s in the US, the income of the top 1% earners has grown at 4.7% per year while the poorest 90% have experienced a near stagnation (a decline of -0.1% per year). Note that this implies that only the richest 10% really benefited from economic growth over this period.
It seems fair to demand that – before implementing a policy of deregulating labour markets - we should have robust evidence that the policies that hurt workers and people at the bottom of the income distribution in the short run indeed are better for them in the long run. However, if there is one message that stands out from this thesis, it is that we do not have this robust evidence.

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9. Curriculum Vitae

Robert Vergeer was born in 1973 in Leiden. He graduated in 2003 from the faculty of Technology, Policy and Management, Delft University of Technology (Msc., cum laude). From 2003 till the end of 2005 he worked for SGBO, the research and consultancy department of the VNG, Dutch association of Municipalities. In the beginning of 2006, he started as a PhD student at the department Economics of Innovation at the faculty of Technology, Policy and Management, Delft University of Technology. Next to his position at the university, he also works as a parliamentary advisor in economic affairs for the Socialistische Partij.

Publications

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10. Appendix

This appendix contains information relevant for chapters 4, 5 and 6.

10.1. Appendix to chapter 4

Data for Germany refer to West Germany until 1992, after which they refer to united Germany. Two observations were considered outliers, because investment growth is of such magnitude that the observation gives a large leverage to the estimation results (notably: Finland 1993, Germany 1992). Note, however, that including these two observations in the regression does not change the qualitative results. In all (plots of) statistics below, the mentioned observations are dropped.
A description of the data taken from Nickell *et al.* (2005) can be found in their article. All data are taken from Eurostat's Ameco database (accessed 12-10-2006) unless otherwise mentioned.

$\hat{I}$ is calculated from the 'Net capital stock at 2000 prices: total economy';
$\hat{e}$ is calculated from 'Exports of goods and services at 2000 prices';
$\hat{g}$ is calculated from 'Total expenditure: general government :- ESA 1995';
r is the 'Real long-term interest rates, deflator GDP';
$\hat{\lambda}$ is calculated from 'LP per hour in EKS ppp' and taken from the Groningen Growth and Development Centre and the Conference Board, Total Economy Database, version May 2006, http://www.ggdc.net

The table below provides summary statistics for the variables:

Table 10.1. Summary statistics of the variables used in chapter 4

Variable	# obs.	Mean	Std. Dev.	Min	Max
$d.u$	683	0.17	0.87	-2.20	5.40
$\hat{I}$	678	0.03	0.20	-0.98	2.00
$\hat{e}$	698	0.06	0.06	-0.16	0.40
$\hat{g}$	329	0.09	0.09	-0.20	0.42
r	472	3.12	3.14	-10.90	14.30
$\hat{\lambda}$	672	0.03	0.03	-0.09	0.13

The figures below are country-wise time plots of variables for all 20 countries in the period 1960-1995. For some variables, gaps in the data are reflected in the omission of periods or countries.

Figure 10.1. Time series plots of differences in unemployment , 20 OECD-countries, 1960-1995

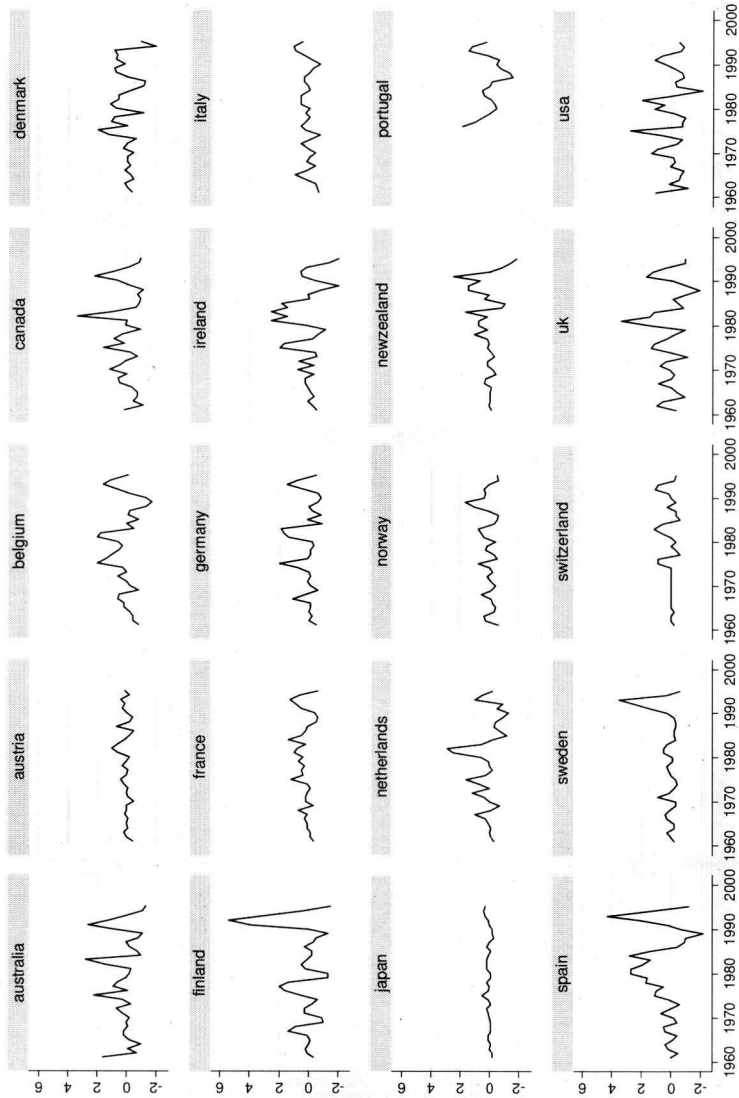


Figure 10.2. Time series plots of the growth of exports, 20 OECD-countries, 1960-1995

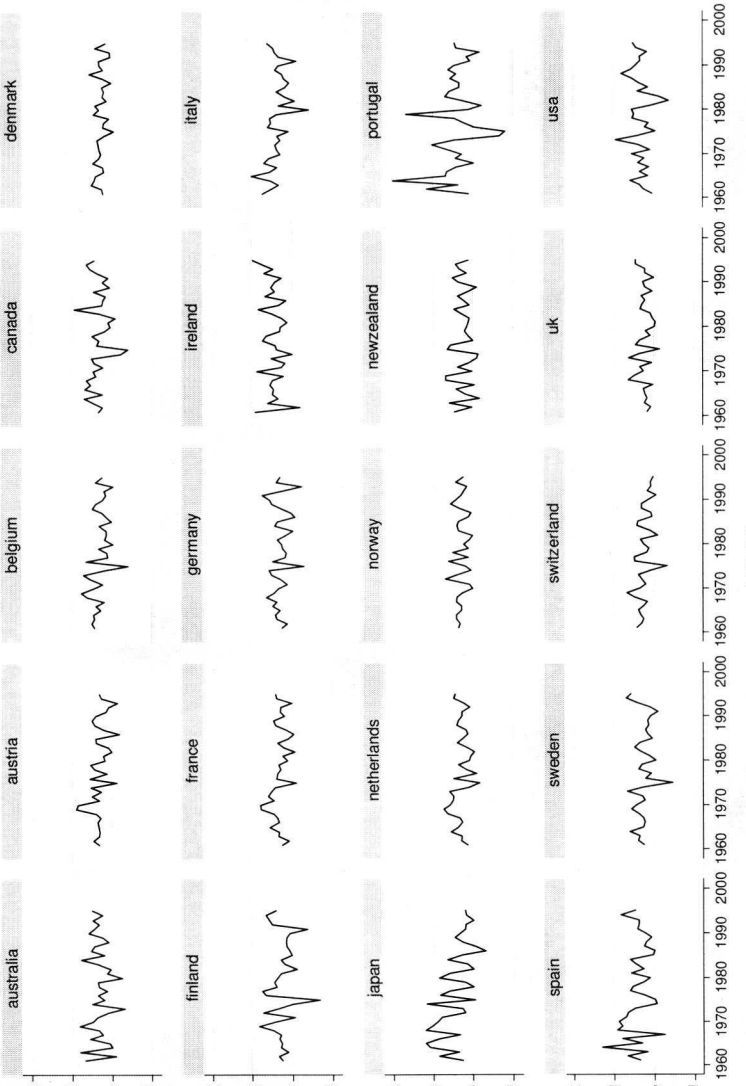


Figure 10.3. Time series plots of the growth of investment, 20 OECD-countries, 1960-1995

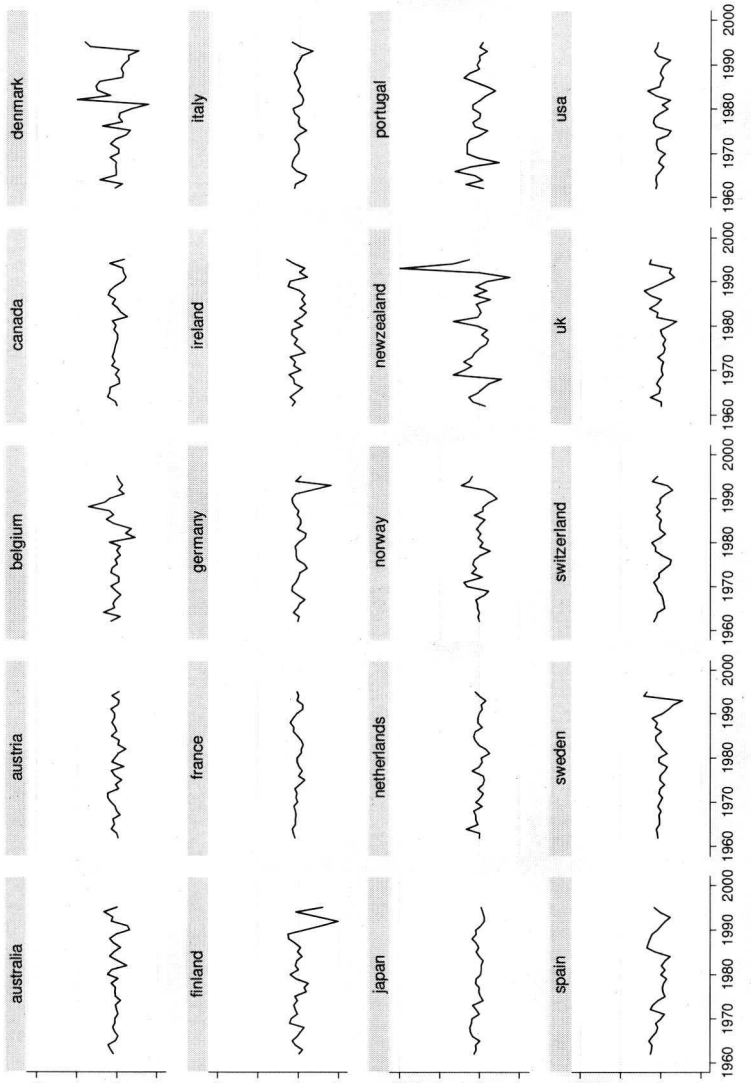


Figure 10.4. Time series plots of the growth of government expenditure, 19 OECD-countries, 1960-1995

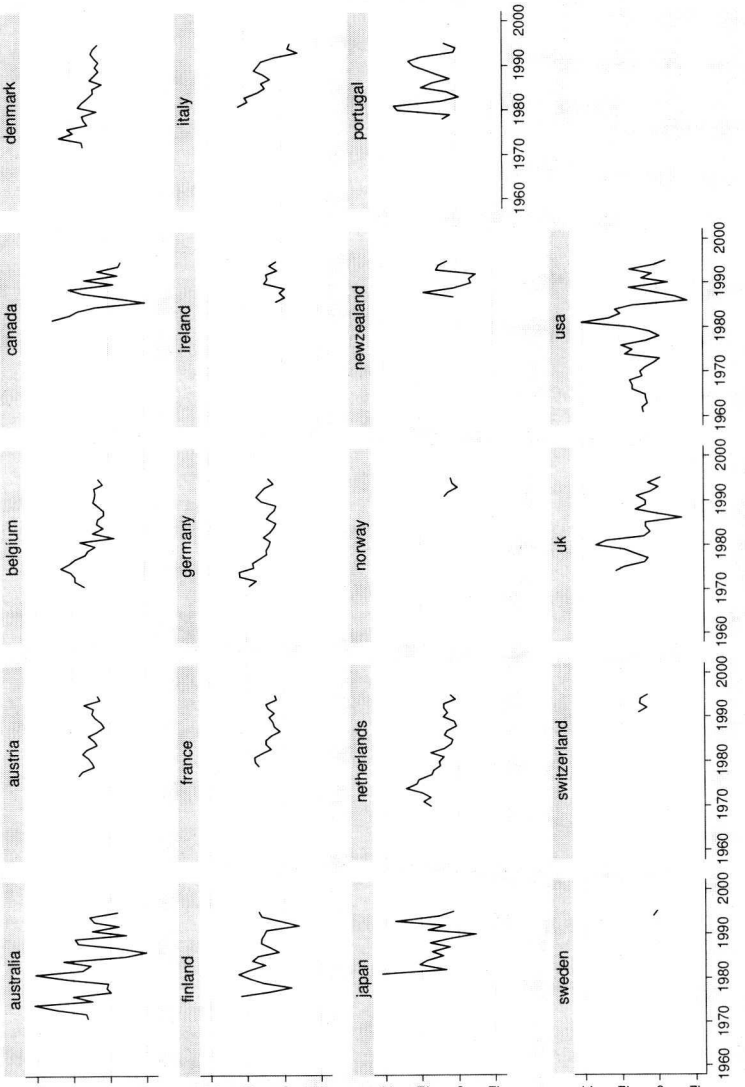


Figure 10.5. Time series plots of the long term real interest rate, 20 OECD-countries, 1960-1995

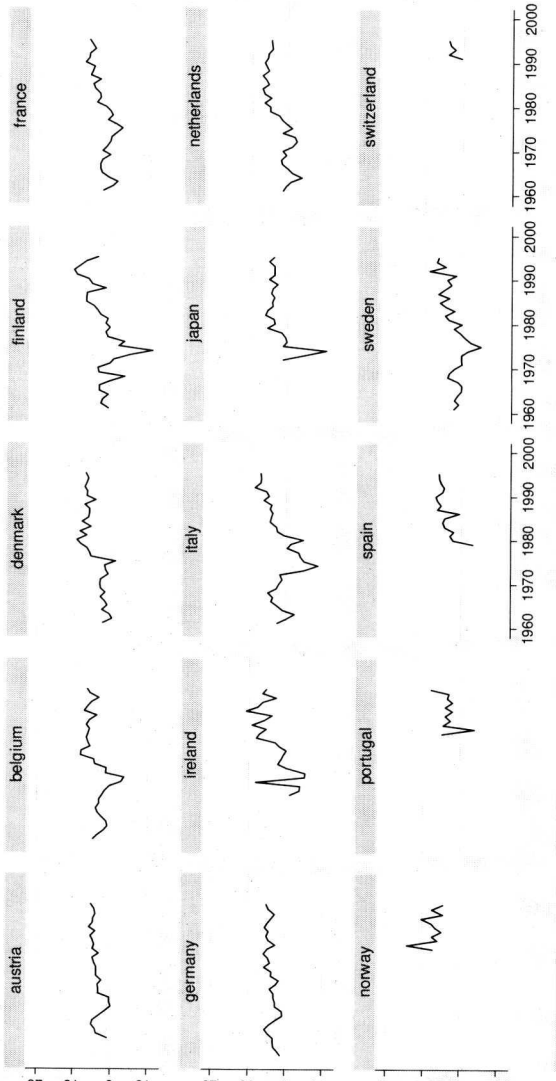
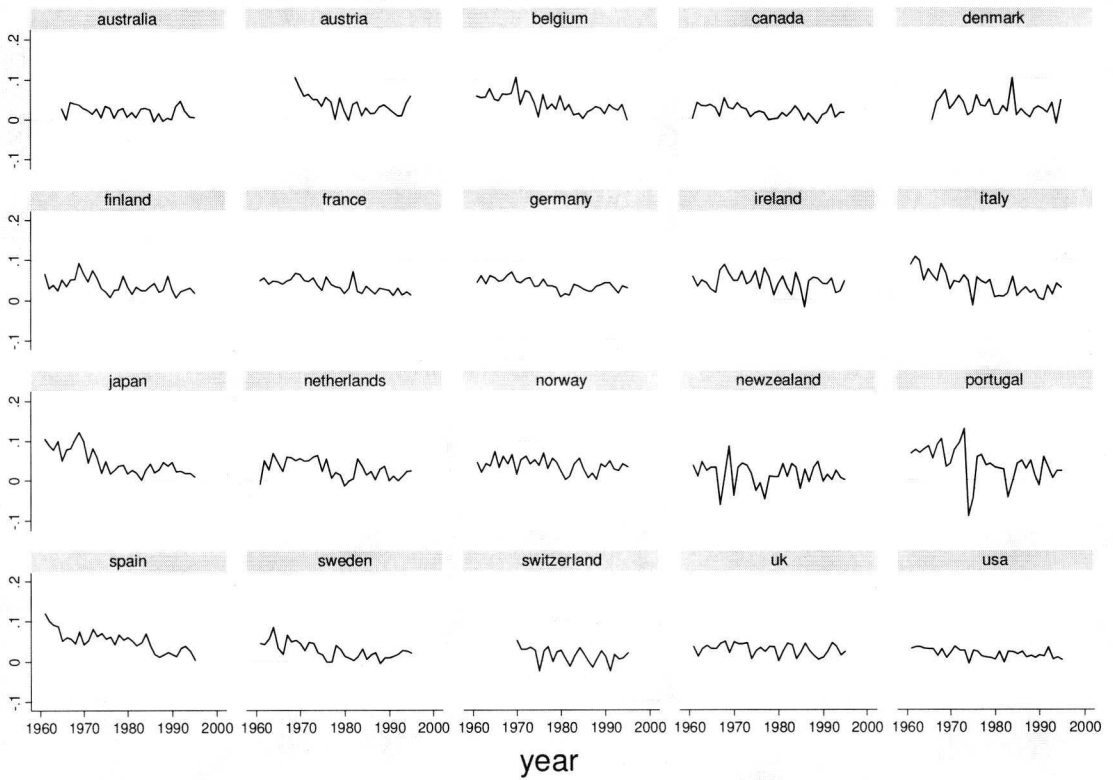


Figure 10.6. Time series plots of the growth of labour productivity, 20 OECD-countries, 1960-1995



10.2. Appendix to chapter 5

10.2.1. Description of data used in chapter 5

Data for the period 1960-2004 cover the following OECD countries:
Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Ireland, Italy, Japan, The Netherlands, New Zealand, Norway, Portugal, Spain, Sweden, UK and the USA. Series for Germany are for West-Germany until 1990; from then onwards they cover united Germany.

Sources of the data are:
The Conference Board and Groningen Growth and Development Centre, Total Economy Database, May 2006, http://www.ggdc;
Annual macroeconomic database AMECO from Eurostat, http://ec.europa.eu/economy_finance/indicators_en.htm
OECD Statistics, http://stats.oecd.org/WBOS/

All growth variables are calculated from the levels as: $x_{growth} = (x_t - x_{t-1})/\text{average}\ (x_{t-1};x_t)$

STATE DEPENDENCY = the growth of labour productivity. Labour productivity is obtained from the GGDC. It represents value added per hour worked and is expressed in 2005 US$ price levels with updated 2002 EKS Purchasing Power Parities (PPPs).

REAL WAGE GROWTH = the growth of the real wage.
The real wage is expressed in 2005 US$ price levels with updated 2002 EKS PPPs. It is calculated as: wage share in national income * labour productivity. The series for wage shares are at factor costs and include remuneration for the self-employed. They are obtained from the Eurostat-Ameco database. Labour productivity is described above.

GAP_{it} = $[MAX_i(\text{labour productivity}_{.t})$- labour $\text{productivity}_{it}]/MAX_i(\text{labour productivity}_{.t}))$. Labour productivity series are obtained from GGDC.

VERDOORN = the growth of GDP; GDP is obtained from the GGDC in 2005 US$ price levels with updated 2002 EKS PPPs

CAPACITY UTILISATION
- The growth of the capital/output ratio. Output is GDP as described above. The capital stock is obtained from Eurostat's Ameco database in 2000 Euros.
- Δ output gap is the first difference of the OECD's output gap, which refers to the difference between actual and potential gross domestic product (GDP) as a per cent of potential GDP.

10.2.2. Country-wise descriptive tables of the variables used in chapter 5

Table 10.2. Country-wise descriptive tables of the variables used in chapter 5

Australia

Variable	# observations	Mean	Std. dev.	Min	Max
labour prod. growth	41	0.02	0.01	-0.01	0.05
Real wage growth	41	0.02	0.03	-0.04	0.11
Gap	43	0.29	0.04	0.21	0.37
GDP growth	45	0.04	0.02	0.00	0.07
capital/output growth	45	0.00	0.02	-0.03	0.03
Δ output gap	37	-0.06	1.58	-3.76	3.22

Austria

Variable	# observations	Mean	Std. dev.	Min	Max
labour prod. growth	37	0.03	0.02	0.00	0.10
Real wage growth	37	0.03	0.02	-0.01	0.09
Gap	39	0.26	0.08	0.16	0.53
GDP growth	45	0.03	0.02	0.00	0.07
capital/output growth	45	0.00	0.02	-0.03	0.04
Δ output gap	37	-0.06	1.45	-3.69	2.71

Belgium

Variable	# observations	Mean	Std. dev.	Min	Max
labour prod. growth	45	0.03	0.02	-0.01	0.10
Real wage growth	45	0.03	0.03	-0.01	0.09
Gap	48	0.20	0.12	0.05	0.46
GDP growth	45	0.03	0.02	-0.01	0.07
capital/output growth	45	0.00	0.02	-0.03	0.05
Δ output gap	37	0.06	1.60	-4.96	2.51

Canada

Variable	# observations	Mean	Std. dev.	Min	Max
labour prod. growth	45	0.02	0.01	-0.01	0.05
Real wage growth	44	0.01	0.02	-0.03	0.04
Gap	47	0.23	0.08	0.11	0.38
GDP growth	45	0.04	0.02	-0.03	0.07
capital/output growth	45	0.00	0.02	-0.04	0.06
Δ output gap	37	0.01	1.79	-5.69	2.83

Denmark

Variable	# observations	Mean	Std. dev.	Min	Max
labour prod. growth	40	0.03	0.02	-0.02	0.10
Real wage growth	40	0.02	0.02	-0.05	0.08
Gap	42	0.28	0.05	0.20	0.40
GDP growth	45	0.03	0.02	-0.01	0.09
capital/output growth	45	0.00	0.02	-0.05	0.04
Δ output gap	35	0.04	1.77	-3.13	4.38

Finland

Variable	# observations	Mean	Std. dev.	Min	Max
labour prod. growth	45	0.03	0.02	0.00	0.09
Real wage growth	45	0.03	0.02	-0.02	0.09
Gap	47	0.38	0.09	0.27	0.57
GDP growth	45	0.03	0.03	-0.07	0.09
capital/output growth	45	0.00	0.03	-0.05	0.08
Δ output gap	32	0.04	2.40	-7.87	3.53

France

Variable	# observations	Mean	Std. dev.	Min	Max
labour prod. growth	45	0.03	0.02	0.00	0.07
Real wage growth	45	0.03	0.02	0.00	0.07
Gap	47	0.16	0.11	0.03	0.41
GDP growth	45	0.03	0.02	-0.01	0.07
capital/output growth	45	0.00	0.01	-0.03	0.04
Δ output gap	36	0.00	1.23	-3.34	2.21

Germany

Variable	# observations	Mean	Std. dev.	Min	Max
labour prod. growth	45	0.03	0.02	0.01	0.07
Real wage growth	45	0.03	0.02	-0.01	0.07
Gap	48	0.22	0.09	0.08	0.44
GDP growth	45	0.03	0.02	-0.01	0.07
capital/output growth	45	0.00	0.02	-0.03	0.04
Δ output gap	16	-0.12	1.31	-3.11	2.16

Ireland

Variable	# observations	Mean	Std. dev.	Min	Max
labour prod. growth	45	0.04	0.02	-0.02	0.09
Real wage growth	45	0.04	0.03	-0.02	0.11
Gap	48	0.43	0.16	0.15	0.66
GDP growth	45	0.05	0.03	0.00	0.11
capital/output growth	45	0.00	0.03	-0.07	0.04
Δ output gap	29	-0.17	1.95	-3.12	4.04

Italy

Variable	# observations	Mean	Std. dev.	Min	Max
labour prod. growth	45	0.03	0.03	-0.01	0.10
Real wage growth	45	0.03	0.03	-0.01	0.12
Gap	47	0.23	0.10	0.14	0.51
GDP growth	45	0.03	0.02	-0.02	0.08
capital/output growth	45	0.00	0.02	-0.03	0.06
Δ output gap	37	-0.10	1.69	-5.57	3.00

Japan

Variable	# observations	Mean	Std. dev.	Min	Max
labour prod. growth	45	0.04	0.03	0.00	0.11
Real wage growth	45	0.04	0.03	-0.01	0.11
Gap	47	0.48	0.11	0.36	0.74
GDP growth	45	0.04	0.04	-0.01	0.12
capital/output growth	45	0.00	0.03	-0.07	0.09
Δ output gap	37	0.03	1.81	-5.77	3.70

Netherlands

Variable	# observations	Mean	Std. dev.	Min	Max
labour prod. growth	45	0.02	0.02	-0.02	0.07
Real wage growth	45	0.03	0.03	-0.03	0.08
Gap	48	0.08	0.08	0.00	0.23
GDP growth	45	0.03	0.02	-0.01	0.08
capital/output growth	45	0.00	0.02	-0.03	0.04
Δ output gap	36	0.09	1.43	-2.86	2.18

New Zealand

Variable	# observations	Mean	Std. dev.	Min	Max
labour prod. growth	45	0.01	0.03	-0.06	0.08
Real wage growth	19	0.01	0.02	-0.01	0.04
Gap	48	0.38	0.11	0.00	0.52
GDP growth	45	0.03	0.03	-0.05	0.10
capital/output growth	45	0.00	0.03	-0.09	0.07
Δ output gap	27	0.04	1.67	-3.11	3.99

Norway

Variable	# observations	Mean	Std. dev.	Min	Max
labour prod. growth	45	0.03	0.02	0.00	0.07
Real wage growth	45	0.03	0.04	-0.10	0.11
Gap	48	0.14	0.13	0.00	0.38
GDP growth	45	0.04	0.02	0.00	0.07
capital/output growth	45	0.00	0.02	-0.04	0.03
Δ output gap	30	0.27	1.49	-3.06	3.18

Portugal

Variable	# observations	Mean	Std. dev.	Min	Max
labour prod. growth	45	0.03	0.04	-0.09	0.12
Real wage growth	45	0.04	0.05	-0.06	0.17
Gap	48	0.61	0.06	0.54	0.76
GDP growth	45	0.04	0.03	-0.04	0.11
capital/output growth	45	0.00	0.03	-0.06	0.09
Δ output gap	30	-0.10	2.21	-4.91	4.34

Spain

Variable	# observations	Mean	Std. dev.	Min	Max
labour prod. growth	45	0.04	0.03	-0.01	0.11
Real wage growth	45	0.04	0.04	-0.03	0.12
Gap	46	0.40	0.14	0.21	0.69
GDP growth	45	0.05	0.03	-0.01	0.12
capital/output growth	45	-0.01	0.03	-0.10	0.04
Δ output gap	29	-0.02	1.45	-4.06	2.98

Sweden

Variable	# observations	Mean	Std. dev.	Min	Max
labour prod. growth	45	0.03	0.02	-0.01	0.08
Real wage growth	45	0.03	0.02	-0.03	0.07
Gap	47	0.26	0.05	0.17	0.36
GDP growth	45	0.03	0.02	-0.02	0.07
capital/output growth	45	0.00	0.02	-0.03	0.04
Δ output gap	37	-0.07	1.58	-3.61	2.33

Uk

Variable	# observations	Mean	Std. dev.	Min	Max
labour prod. growth	45	0.03	0.01	0.00	0.05
Real wage growth	35	0.02	0.02	-0.02	0.06
Gap	47	0.30	0.04	0.24	0.37
GDP growth	45	0.02	0.02	-0.02	0.07
capital/output growth	45	0.00	0.02	-0.04	0.04
Δ output gap	37	0.11	1.77	-3.81	4.79

Usa

Variable	# observations	Mean	Std. dev.	Min	Max
labour prod. growth	45	0.02	0.01	-0.01	0.04
Real wage growth	45	0.02	0.01	-0.01	0.04
Gap	47	0.11	0.08	0.00	0.23
GDP growth	45	0.03	0.02	-0.02	0.07
capital/output growth	45	-0.01	0.02	-0.04	0.04
Δ output gap	37	0.03	1.81	-4.73	3.60

10.2.3. Full details of fixed effects GLS panel estimates in chapter 5 (model 1)

Table 10.3. Full details of fixed effects GLS panel estimates of Model 1 as summarized in Table 5.2

Independent	Coef.	z-value	P(>|z|)
Real Wage growth$_{it-1}$	0.081	3.07	0.00
Real Wage growth$_{it-2}$	0.020	0.76	0.45
Real Wage growth$_{it-3}$	0.077	2.89	0.00
Real Wage growth$_{it-4}$	0.014	0.53	0.60
Real Wage growth$_{it-5}$	0.0054	0.20	0.84
Real Wage growth$_{it-6}$	0.044	1.61	0.11
Real Wage growth$_{it-7}$	0.031	1.13	0.26
Real Wage growth$_{it-8}$	0.012	0.44	0.66
Real Wage growth$_{it-9}$	0.061	2.29	0.02
STATE DEPENDENCY: Productivity growth$_{it-1}$	0.082	1.96	0.05
STATE DEPENDENCY: Productivity growth$_{it-2}$	-0.044	-1.21	0.23
STATE DEPENDENCY: Productivity growth$_{it-3}$	-0.043	-1.21	0.23
STATE DEPENDENCY: Productivity growth$_{it-4}$	0.027	0.78	0.44
STATE DEPENDENCY: Productivity growth$_{it-5}$	0.070	1.99	0.05
STATE DEPENDENCY: Productivity growth$_{it-6}$	-0.032	-0.91	0.36
STATE DEPENDENCY: Productivity growth$_{it-7}$	-0.0056	-0.16	0.87
STATE DEPENDENCY: Productivity growth$_{it-8}$	-0.020	-0.58	0.56
STATE DEPENDENCY: Productivity growth$_{it-9}$	-0.0020	-0.06	0.95
GAP$_{it-1}$	0.037	4.45	0.00
VERDOORN$_{it}$ (GDP growth in same year)	0.55	17.40	0.00
VERDOORN$_{it-1}$ (GDP growth one year delayed)	-0.31	-8.44	0.00
COUNTRY (dummy)		Yes	
YEAR (dummy)		Yes	

Note:

- The regression is estimated using a fixed effects GLS panel estimator which allows panel-specific heteroskedasticity (stata-command: XTGLS (...), p(h); see Stata Manual, Release 6, p. 360).

10.2.4. Proof of consistency when there is no serial correlation in the residuals

For convenience, we rewrite the regression equation used in chapter 5 (equation 5.1) in the following form:

$$\hat{\lambda}_{it} = \alpha_i + (\hat{w}_{it-1},..,\hat{w}_{it-k},\hat{\lambda}_{it-1},..,\hat{\lambda}_{it-k})\beta_1 + Z_{it}'\beta_2 + \varepsilon_{it} \qquad \text{equation 10.1}$$

where $\hat{\lambda}$ denotes the growth of labour productivity, $\hat{w}$ denotes the growth of wages, Z a vector of control variables and ε is the error term. The subscripts i,t are for country, year respectively.

We want to allow for the reversed causation. Let us suppose that the reversed causation can be modelled as follows:

$$\hat{w}_{it} = c + (\hat{w}_{it-1},..,\hat{w}_{it-m},\hat{\lambda}_{it-1},..,\hat{\lambda}_{it-m})\gamma + \mu_{it} \qquad \text{equation 10.2}$$

where μ denotes the idiosyncratic error term and c includes all other exogenous observed and unobserved factors.

Now, suppose that, in equation 10.1, we have serial correlation in the residuals of the general form:[53]

$$\varepsilon_{it} = \omega_{it} + \sum_l \rho_{t-l} \varepsilon_{it-l} \qquad \text{equation 10.3}$$

where $\omega_{it} \sim IID, N(0, \sigma_\omega^2)$.

Then, by substituting equation 10.2 and equation 10.3 into equation 10.1, we obtain:

$$\hat{\lambda}_{it} = \alpha_i + (\hat{w}_{it-2}, .., \hat{w}_{it-(k+m)}, \hat{\lambda}_{it-1}, .., \hat{\lambda}_{it-(k+m)})\beta_1^* + Z_{it}^{*\prime}\beta_2^* + \omega_{it} + \sum_l \rho_{t-l}\varepsilon_{it-l} \qquad \text{equation 10.4}$$

From equation 10.4 we can see that the error terms are uncorrelated with the regressors if the condition: $\rho = 0 \forall l \leq k + m = 0$ holds.

Our regression equation contains 9 lags of the dependent variable and of wage growth. So k=9 in our case. The shortest lag for which there is serial correlation in the error terms of this equation is the 17th lag, so l=17. We can deduct that in the model for the reversed causation (equation 10.2), we can include up to 7 lags of productivity growth without obtaining biased coefficients in the regression of equation 10.1. We feel confident that such a long time horizon is not important in wage setting.

10.2.5. Coefficients of auto regressions of the residuals of Table 5.2, model 1

Table 10.4. Coefficients of auto regressions of the residuals of Table 5.2, model 1. (Summary of OLS estimates)

Independent variables:	**Coefficient**	**t-value**
LAG 1	-0.024	-0.60
LAG 2	0.038	0.94
LAG 3	-0.017	-0.42
LAG 4	-0.031	-0.74
LAG 5	0.052	1.29
LAG 6	-0.037	-0.89
LAG 7	0.057	1.38
LAG 8	-0.023	-0.53
LAG 9	0.066	1.48
LAG 10	-0.048	-1.07
LAG 11	0.014	0.30
LAG 12	-0.056	-1.19
LAG 13	-0.048	-0.99
LAG 14	-0.072	-1.47
LAG 15	-0.027	-0.55

Notes:

- None of the regressions yields a significant result, using a confidence level of 90%.
- All auto regressions include a constant term, using OLS. Stata-command: reg (...)

[53] Although theoretically we could allow for *panel specific* autocorrelation, in the context of our estimation this has little relevance because the time-span of our data is too limited to provide accurate estimates and standard errors of this form of autocorrelation (Baccaro and Rei 2005). Thus we pool the autocorrelation over the panels.

10.3. Appendix to chapter 6

10.3.1. Description of data used in chapter 6

Data for the period 1958-2008 cover the following OECD countries:
Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Ireland, Italy, Japan, The Netherlands, New Zealand, Norway, Portugal, Spain, Sweden, Switzerland, UK and the USA. Series for Germany are for West-Germany until 1990; from then onwards they cover united Germany. In the estimation, gaps in the data are filled by zero's.

Data description

λ_g = growth of labour productivity per worked our, source GGDC[54]

w_g = growth of the real wage, calculated as $\Delta \log(ws / \lambda)$ where ws denotes the wage share. Sources: λ GGDC; ws extended Penn World Tables[55]

GDP_g =the growth of GDP, GGDC

$Catchup_{it} = \log(\lambda_{it} / \lambda_{lt})$ where λ_{it} denotes the labour productivity of a specific country in year t and λ_{lt} denotes the labour productivity of the productivity leader in that same year. Measurements are taken in the beginning of the 5-year period. Source: GGDC

ws =the share of wages in National Income. Source: Extended Penn World Tables.
Share of services: Eurostat's Ameco database[56]
Capacity utilisation: Extended Penn World Tables.
All data is expressed in 5-year averages.

Table 10.5. Country-wise descriptive tables of the variables used in chapter 6

Australia					
Variable	**# observations**	**Mean**	**Std. dev.**	**Min**	**Max**
Labour prod. growth	44	0.020	0.007	0.001	0.036
Real wage growth	36	0.018	0.015	-0.007	0.047
GDP growth	44	0.037	0.009	0.022	0.057
Catchup	46	-0.263	0.032	-0.344	-0.208
Wage share	41	0.515	0.030	0.465	0.585
Services	0				

[54] The Conference Board and Groningen Growth and Development Centre, Total Economy Database, January 2009,http://www.conference-board.org/economics/
[55] http://homepage.newschool.edu/~foleyd/epwt/DataDoc3.0.htm, accessed 20-05-09
[56] version 22-04-09 accessed 25-05-09

Austria

Variable	# observations	Mean	Std. dev.	Min	Max
Labour prod. growth	44	0.035	0.018	0.009	0.071
Real wage growth	36	0.038	0.022	0.003	0.077
GDP growth	44	0.030	0.012	0.014	0.058
Catchup	46	-0.385	0.245	-0.901	-0.111
Wage share	41	0.519	0.025	0.468	0.558
Services	33	0.527	0.060	0.432	0.608

Belgium

Variable	# observations	Mean	Std. dev.	Min	Max
Labour prod. growth	44	0.031	0.019	0.008	0.067
Real wage growth	36	0.033	0.027	0.000	0.084
GDP growth	44	0.028	0.012	0.007	0.054
Catchup	46	-0.191	0.215	-0.681	0.000
Wage share	41	0.529	0.033	0.471	0.597
Services	38	0.569	0.082	0.416	0.687

Canada

Variable	# observations	Mean	Std. dev.	Min	Max
Labour prod. growth	44	0.016	0.009	0.001	0.035
Real wage growth	36	0.015	0.013	-0.007	0.041
GDP growth	44	0.035	0.013	0.007	0.061
Catchup	46	-0.188	0.053	-0.319	-0.117
Wage share	41	0.542	0.020	0.506	0.573
Services	37	0.610	0.057	0.506	0.687

Denmark

Variable	# observations	Mean	Std. dev.	Min	Max
Labour prod. growth	44	0.025	0.011	0.005	0.048
Real wage growth	36	0.028	0.016	0.009	0.060
GDP growth	44	0.025	0.011	0.008	0.051
Catchup	46	-0.249	0.128	-0.504	-0.096
Wage share	41	0.538	0.020	0.485	0.568
Services	43	0.558	0.080	0.397	0.674

Finland

Variable	# observations	Mean	Std. dev.	Min	Max
Labour prod. growth	44	0.034	0.012	0.020	0.066
Real wage growth	36	0.034	0.022	-0.001	0.080
GDP growth	44	0.031	0.017	-0.015	0.065
Catchup	46	-0.521	0.226	-0.939	-0.268
Wage share	41	0.525	0.036	0.472	0.596
Services	44	0.476	0.081	0.341	0.598

France

Variable	# observations	Mean	Std. dev.	Min	Max
Labour prod. growth	44	0.029	0.013	0.005	0.055
Real wage growth	29	0.028	0.014	0.007	0.058
GDP growth	44	0.029	0.014	0.011	0.056
Catchup	46	-0.196	0.186	-0.575	-0.006
Wage share	35	0.524	0.022	0.464	0.564
Services	43	0.534	0.097	0.383	0.681

Germany

Variable	# observations	Mean	Std. dev.	Min	Max
Labour prod. growth	44	0.026	0.018	-0.011	0.054
Real wage growth	16	0.008	0.012	-0.010	0.023
GDP growth	44	0.027	0.014	0.006	0.054
Catchup	46	-0.266	0.152	-0.611	-0.058
Wage share	21	0.545	0.015	0.524	0.568
Services	44	0.461	0.094	0.314	0.610

Ireland

Variable	# observations	Mean	Std. dev.	Min	Max
Labour prod. growth	44	0.039	0.013	0.009	0.062
Real wage growth	36	0.035	0.025	-0.007	0.078
GDP growth	44	0.049	0.018	0.018	0.091
Catchup	46	-0.615	0.287	-1.118	-0.244
Wage share	41	0.499	0.057	0.387	0.597
Services	37	0.471	0.073	0.356	0.596

Italy

Variable	# observations	Mean	Std. dev.	Min	Max
Labour prod. growth	44	0.030	0.023	0.000	0.081
Real wage growth	36	0.027	0.031	-0.011	0.088
GDP growth	44	0.027	0.014	0.009	0.057
Catchup	46	-0.272	0.220	-0.882	-0.069
Wage share	41	0.463	0.046	0.392	0.567
Services	44	0.442	0.090	0.296	0.567

Japan

Variable	# observations	Mean	Std. dev.	Min	Max
Labour prod. growth	44	0.039	0.024	0.015	0.094
Real wage growth	36	0.044	0.030	0.005	0.102
GDP growth	44	0.042	0.030	0.002	0.109
Catchup	46	-0.636	0.300	-1.388	-0.365
Wage share	41	0.519	0.049	0.425	0.572
Services	37	0.469	0.064	0.359	0.581

Netherlands

Variable	# observations	Mean	Std. dev.	Min	Max
Labour prod. growth	44	0.025	0.016	-0.006	0.053
Real wage growth	32	0.019	0.022	-0.021	0.063
GDP growth	44	0.030	0.013	0.007	0.055
Catchup	46	-0.150	0.118	-0.415	-0.031
Wage share	37	0.541	0.031	0.493	0.601
Services	37	0.598	0.075	0.461	0.713

New Zealand

Variable	# observations	Mean	Std. dev.	Min	Max
Labour prod. growth	44	0.014	0.010	-0.012	0.031
Real wage growth	36	0.008	0.012	-0.011	0.033
GDP growth	44	0.026	0.014	-0.003	0.051
Catchup	46	-0.463	0.070	-0.605	-0.351
Wage share	41	0.490	0.049	0.415	0.568
Services	18	0.636	0.029	0.582	0.678

Norway

Variable	# observations	Mean	Std. dev.	Min	Max
Labour prod. growth	44	0.032	0.012	0.003	0.053
Real wage growth	32	0.027	0.021	-0.009	0.068
GDP growth	44	0.035	0.009	0.016	0.048
Catchup	46	-0.209	0.212	-0.608	0.000
Wage share	37	0.515	0.041	0.436	0.590
Services	39	0.593	0.076	0.450	0.689

Portugal

Variable	# observations	Mean	Std. dev.	Min	Max
Labour prod. growth	44	0.032	0.022	0.007	0.078
Real wage growth	34	0.034	0.032	-0.014	0.089
GDP growth	44	0.037	0.020	0.007	0.071
Catchup	46	-0.905	0.204	-1.431	-0.714
Wage share	39	0.475	0.045	0.410	0.596
Services	30	0.394	0.067	0.294	0.505

Spain

Variable	# observations	Mean	Std. dev.	Min	Max
Labour prod. growth	44	0.036	0.025	-0.007	0.086
Real wage growth	36	0.037	0.026	0.000	0.086
GDP growth	44	0.042	0.021	0.015	0.097
Catchup	46	-0.620	0.326	-1.370	-0.281
Wage share	41	0.489	0.031	0.440	0.551
Services	28	0.509	0.050	0.401	0.581

Sweden

Variable	# observations	Mean	Std. dev.	Min	Max
Labour prod. growth	44	0.024	0.013	0.008	0.053
Real wage growth	36	0.020	0.019	-0.010	0.053
GDP growth	44	0.025	0.012	-0.001	0.050
Catchup	46	-0.264	0.078	-0.479	-0.178
Wage share	41	0.597	0.033	0.530	0.666
Services	39	0.559	0.067	0.425	0.650

Switzerland

Variable	# observations	Mean	Std. dev.	Min	Max
Labour prod. growth	44	0.016	0.011	0.000	0.037
Real wage growth	36	0.020	0.013	0.003	0.047
GDP growth	44	0.020	0.014	-0.009	0.051
Catchup	46	-0.196	0.079	-0.372	-0.082
Wage share	41	0.589	0.030	0.535	0.636
Services	16	0.590	0.027	0.543	0.627

Uk

Variable	# observations	Mean	Std. dev.	Min	Max
Labour prod. growth	44	0.027	0.007	0.013	0.042
Real wage growth	36	0.025	0.011	0.006	0.049
GDP growth	44	0.024	0.008	0.007	0.040
Catchup	46	-0.347	0.129	-0.571	-0.213
Wage share	41	0.576	0.029	0.530	0.652
Services	26	0.616	0.067	0.487	0.724

Usa

Variable	# observations	Mean	Std. dev.	Min	Max
Labour prod. growth	44	0.018	0.006	0.008	0.031
Real wage growth	36	0.017	0.010	-0.004	0.037
GDP growth	44	0.032	0.009	0.016	0.056
Catchup	46	-0.019	0.030	-0.081	0.000
Wage share	41	0.596	0.016	0.566	0.622
Services	43	0.588	0.069	0.478	0.696

Table 10.6. Results of Arellano-Bond regressions explaining the growth of labour productivity ($\hat{\lambda}$), on 5-year averaged values for 20 OECD countries from the 1960s to the 2000s, using instruments based on the third lag of potentially endogenous regressors

Independents		(I)	(II)	(III)	(IV)	(V)
$\hat{w}$		0.42*/*	0.38/*	0.44*/**	0.36*/**	0.40*/*
	P_1,5,10	0,2,3	0,2,4	1,3,4	1,3,3	0,1,4
ws		0.22**/**	0.18/*	0.22*/***	0.19**/***	0.21**/**
	P_1,5,10	2,4,4	0,2,3	3,4,4	4,4,4	1,4,4
Catchup		-0.05**/**	-0.05**/***	-0.06**/**	-0.07**/***	-0.05**/**
	P_1,5,10	2,4,5	1,4,5	1,5,5	1,5,5	1,4,5
Verdoorn ($\hat{Y}$)		0.23/	0.15/		0.16/	0.24/
	P_1,5,10	0,0,1	0,0,1		1,1,1	0,0,1
$\hat{\lambda}_{-1}$ (a)			-0.15/			
	P_1,5,10		0,0,1			
Services					-0.05/	
	P_1,5,10				0,0,0	
Germany						-0.02/*
	P_1,5,10					1,2,3
Sargan		$\overline{P}$ =0.53; $P_{\bar{z}}$ =0.53	$\overline{P}$ =0.49; $P_{\bar{z}}$ =0.44	$\overline{P}$ =0.34; $P_{\bar{z}}$ =0.32	$\overline{P}$ =0.45; $P_{\bar{z}}$ =0.38	$\overline{P}$ =0.50; $P_{\bar{z}}$ =0.5
	P_1,5,10	0,0,0	0,0,1	0,0,0	0,0,1	0,0,0
Hansen		$\overline{P}$ =0.40; $P_{\bar{z}}$ =0.37	$\overline{P}$ =0.81; $P_{\bar{z}}$ =0.82	$\overline{P}$ =0.28; $P_{\bar{z}}$ =0.25	$\overline{P}$ =0.45; $P_{\bar{z}}$ =0.4	$\overline{P}$ =0.50; $P_{\bar{z}}$ =0.4
	P_1,5,10	0,0,0	0,0,0	0,0,0	0,0,0	0,0,0
Ar2		$\overline{P}$ =0.49; $P_{\bar{z}}$ =0.46	$\overline{P}$ =0.60; $P_{\bar{z}}$ =0.52	$\overline{P}$ =0.27; $P_{\bar{z}}$ =0.25	$\overline{P}$ =0.31; $P_{\bar{z}}$ =0.22	$\overline{P}$ =0.46; $P_{\bar{z}}$ =0.4
	P_1,5,10	0,0,0	0,0,0	0,0,0	0,0,1	0,0,0

Notes:
*,**,*** denote average significance of 10%, 5%, 1% respectively. Stars on the left side of "/" display the significance based on the average P value. Stars on the right side denote the significance based on the average z value (t-distributed). P values are calculated based on standard errors that are robust to general heteroskedasticity and autocorrelation. Numbers indicating P_1,5,10 denote the count of a 1%, 5%, 10% significant result out of the 5 rolling regressions. $\overline{P}$ denotes the significance level based on the average p-value; $P_{\bar{z}}$ denotes the significane level based on the average z-value.
All regressions are estimated with a Fixed Effects Arellano Bond procedure that uses available lags to instrument the possibly endogenous regressors ($\hat{w}$ and $\hat{Y}$). Stata routine: Xtabond2 (Roodman 2009) with options noleveleq small robust. *Services* denotes the share of services; *Germany* denotes a dummy for the unification of Germany. Fixed time effects are included in all the regressions. *Sargan* and *Hansen* denote the respective overidentification tests for validity of the instruments. The Sargan-test is not vulnerable for overfitting, but it is not robust. The Hansen test is robust, but vulnerable for overfitting. The *Ar2* is the Arellano-Bond test for presence of second order autocorrelation in the residuals of the regression.
(a) Instruments of the lagged dependent are based on lag 2 of the dependent. Overfitting bias is a problem with this regression.

Table 10.7. Results of Arellano-Bond regressions explaining the growth of labour productivity ($\hat{\lambda}$), on 5-year averaged values for 20 OECD countries from the 1960s to the 2000s, employing a two-step feasible generalised least squares estimator

Independents		(I)	(II)	(III)	(IV)	(V)
$\hat{w}$		0.43$^{*/**}$	0.30$^{/}$	0.39$^{/**}$	0.40$^{/*}$	0.39$^{*/*}$
	P_1,5,10	2,2,3	0,2,2	1,3,3	1,2,3	0,2,3
ws		0.23$^{**/***}$	0.16$^{/*}$	0.22$^{**/***}$	0.23$^{**/**}$	0.21$^{**/***}$
	P_1,5,10	3,4,5	0,4,4	3,4,5	3,4,4	3,5,5
Catchup		-0.06$^{*/**}$	-0.07$^{***/***}$	-0.07$^{**/***}$	-0.07$^{*/**}$	-0.05$^{/*}$
	P_1,5,10	1,3,3	3,5,5	1,3,4	1,3,4	0,2,2
Verdoorn ($\hat{Y}$)		0.11$^{/}$	0.09$^{/}$		0.08$^{/}$	0.17$^{/}$
	P_1,5,10	0,0,0	0,0,0		0,0,0	0,0,1
$\hat{\lambda}_{-1}$ $^{(a)}$			-0.08$^{/}$			
	P_1,5,10		0,0,0			
Services					-0.04$^{/}$	
	P_1,5,10				0,0,1	
Germany						-0.02$^{/*}$
	P_1,5,10					1,1,2
Sargan		$\overline{P}$ =0.48; $P_{\bar{z}}$=0.45	$\overline{P}$ =0.55; $P_{\bar{z}}$=0.51	$\overline{P}$ =0.47; $P_{\bar{z}}$=0.45	$\overline{P}$ =0.68; $P_{\bar{z}}$=0.68	$\overline{P}$ =0.55; $P_{\bar{z}}$=0.54
	P_1,5,10	0,0,0	0,0,1	0,0,0	0,0,0	0,0,0
Hansen		$\overline{P}$ =0.45; $P_{\bar{z}}$=0.45	$\overline{P}$ =0.82; $P_{\bar{z}}$=0.83	$\overline{P}$ =0.46; $P_{\bar{z}}$=0.46	$\overline{P}$ =0.54; $P_{\bar{z}}$=0.54	$\overline{P}$ =0.42; $P_{\bar{z}}$=0.42
	P_1,5,10	0,0,0	0,0,0	0,0,0	0,0,0	0,0,0
Ar2		$\overline{P}$ =0.59; $P_{\bar{z}}$=0.57	$\overline{P}$ =0.60; $P_{\bar{z}}$=0.63	$\overline{P}$ =0.46; $P_{\bar{z}}$=0.40	$\overline{P}$ =0.48; $P_{\bar{z}}$=0.44	$\overline{P}$ =0.54; $P_{\bar{z}}$=0.52
	P_1,5,10	0,0,0	0,0,0	0,0,1	0,0,0	0,0,0

Notes:
*,**,*** denote average significance of 10%, 5%, 1% respectively. Stars on the left side of "/" display the significance based on the average P value. Stars on the right side denote the significance based on the average z value (t-distributed). P values are calculated based on standard errors that are robust to general heteroskedasticity and autocorrelation. Numbers indicating P_1,5,10 denote the count of a 1%, 5%, 10% significant result out of the 5 rolling regressions. $\overline{P}$ denotes the significance level based on the average p-value; $P_{\bar{z}}$ denotes the significane level based on the average z-value.
All regressions are estimated with a Fixed Effects Arellano Bond procedure that uses available lags to instrument the possibly endogenous regressors ($\hat{w}$ and $\hat{Y}$). Stata routine: Xtabond2 (Roodman 2009) with options noleveleq small robust twostep. *Services* denotes the share of services; *Germany* denotes a dummy for the unification of Germany. Fixed time effects are included in all the regressions. *Sargan* and *Hansen* denote the respective overidentification tests for validity of the instruments. The Sargan-test is not vulnerable for overfitting, but it is not robust. The Hansen test is robust, but vulnerable for overfitting. The *Ar2* is the Arellano-Bond test for presence of second order autocorrelation in the residuals of the regression.
(a) Instruments of the lagged dependent are based on lag 2 of the dependent. Overfitting bias is a problem with this regression.

11. Nederlandstalige samenvatting (Summary, in Dutch)

Labour market flexibility, productivity and employment
Arbeidsmarktflexibiliteit, productiviteit en werkgelegenheid

Ir. Robert Vergeer

Europa lijdt aan een 'rigide' arbeidsmarkt. Daardoor blijft Europa achter bij de Angelsaksische landen. Want daar is het makkelijker om mensen te ontslaan, spelen vakbonden een kleinere rol en zijn de werkloosheidsuitkeringen lager. Dus is de economie flexibeler. Europa is daardoor minder innovatief, minder productief en heeft een hogere werkloosheid dan landen met een 'flexibele' arbeidsmarkt.

Dat is in een notendop de neoklassieke analyse van het 'achterblijvende' Europa. Die analyse vormt het wetenschappelijke fundament onder de politieke roep om hervormingen van de arbeidsmarkt. Die roep wordt nog sterker nu de opgelopen staatsschuld en de opkomende vergrijzing het sociale stelsel onbetaalbaar dreigen te maken. Tijdens de verkiezingscampagne in Nederland is dit verkondigd door politici van verschillende politieke partijen. Ook het IMF, de OESO en de EU verkondigen deze boodschap.

Met het woord hervormen, wordt een pakket van maatregelen bedoeld dat de bescherming van werkenden tegen ontslag en de gevolgen daarvan moet afbreken. Het gaat dan om het verminderen van de ontslagbescherming, het verlagen van uitkeringen en het verkleinen van de rol van vakbonden. Kortom: ons sociale stelsel moet op de helling. Dat zou een verlies aan inkomen en zekerheid betekenen dat vooral terecht komt bij de mensen aan de onderkant van het loongebouw.

Voordat er begonnen wordt met het afbouwen van ons sociale stelsel, lijkt het verstandig om de volgende vraag te stellen: hoe sterk is de wetenschappelijke onderbouwing van de voordelen die met de hervormingen worden beoogd? Die vraag staat centraal in dit proefschrift. Er is toegespitst op twee elementen: wat is het effect van een flexibele arbeidsmarkt op de werkloosheid? En: wat is het effect van een flexibele arbeidsmarkt op de arbeidsproductiviteit?

De theoretische onderbouwing van de stelling dat flexibele arbeidsmarkten zorgen voor minder werkloosheid, is de NAIRU-theorie[57]. Volgens deze theorie heeft de economie in ieder land een evenwichtswerkloosheid. De evenwichtswerkloosheid is het werkloosheidspercentage dat de economie gemiddeld heeft. Als de werkloosheid heel laag is, dan ontstaat er prijsinflatie omdat de werkenden, via hun vakbond, hoge looneisen kunnen stellen. Die prijsinflatie leidt tot een krimp van de economie, aldus de NAIRU-theorie, en dus tot een hogere werkloosheid. De werkloosheid bereikt zo vanzelf de evenwichtswaarde. Op die evenwichtswaarde is er geen extra prijsinflatie meer en blijft de werkloosheid stabiel. Volgens de theorie fluctueert de werkloosheid dus rond de evenwichtswaarde.

[57] NAIRU staat voor Non Accelerating Inflation Rate of Unemployment.

Die evenwichtswaarde schuift omhoog wanneer de arbeidsmarkt minder flexibel wordt. Meer ontslagbescherming, machtigere vakbonden en hogere uitkeringen hebben allemaal als effect dat er hogere looneisen gesteld kunnen worden. Daardoor ontstaat een hogere prijsinflatie. De ruimte van vakbonden om hoge looneisen te stellen kan alleen beperkt worden met een hogere werkloosheid. Dat is de crux van de NAIRU-theorie: als de arbeidsmarkt minder flexibel is, wordt de evenwichtswerkloosheid hoger. De enige manier om de werkloosheid te verlagen, is dus het afbreken van de sociale zekerheid. Hoe plausibel is deze theorie eigenlijk?

Andere auteurs laten zien dat de prijsinflatie niet alleen afhankelijk is van de arbeidsmarkt, maar ook van bijvoorbeeld de arbeidsproductiviteit. Er is immers ruimte voor loonstijging als er per werknemer meer wordt geproduceerd, want dan dalen de loonkosten per product. Eén van de bevindingen in dit proefschrift is dat flexibele arbeidsmarkten schadelijk zijn voor de arbeidsproductiviteit. Het negatieve effect van deze dalende arbeidsproductiviteit op de economische ontwikkelingen is groter dan het positieve effect van een loonsverlaging die een flexibele arbeidsmarkt tot gevolg kan hebben. Dan leidt een flexibele arbeidsmarkt juist tot prijsinflatie, omdat de loondaling meer dan teniet wordt gedaan door de daling van de arbeidsproductiviteit. De conclusie is dat een flexibele arbeidsmarkt ook juist een verhoging (in plaats van een verlaging) van de evenwichtswerkloosheid kan veroorzaken.

In dit proefschrift wordt verder betoogd dat de NAIRU-theorie mank gaat aan een cirkelredenering. Want waarom zou de werkloosheid onder invloed van de prijsinflatie altijd precies teruggaan naar die ene evenwichtswerkloosheid? In het model dat zorgt dat de werkloosheid stijgt als de prijsinflatie toeneemt, zit de aanname van die ene evenwichtswerkloosheid. Maar als je die aanname niet zou doen, dan kan de werkloosheid ook op allerlei andere niveaus blijven steken. Kortom: de NAIRU-theorie bijt zichzelf in de staart.

In dit proefschrift is ook het empirisch bewijs dat de NAIRU-theorie ondersteunt onder de loep genomen. Daarbij is gekeken naar de resultaten van econometrisch (statistisch) onderzoek waarin wordt onderbouwd dat een flexibele arbeidsmarkt zorgt voor een lage werkloosheid. Het gaat dan om veel geciteerd onderzoek en om onderzoek dat door internationale organen als IMF en OESO is gedaan. De conclusie is dat de onderzoeksresultaten niet robuust zijn. Dat betekent dat kleine, schijnbaar onschuldige, veranderingen in de onderzoeksopzet ervoor kunnen zorgen dat de resultaten van het onderzoek geheel omdraaien. De uitkomsten van twee bijna gelijkwaardige studies in hetzelfde IMF-onderzoek spreken elkaar bijvoorbeeld tegen. In een aantal andere empirische onderzoeken die de NAIRU-hypothese onderbouwen, wordt de flexibiliteit van de arbeidsmarkt vergeleken met het verloop van de werkloosheid over de jaren. Andere auteurs laten zien dat de resultaten onderuit gaan als gegevens uit recentere jaren aan de database worden toegevoegd. In dit proefschrift wordt verder gedemonstreerd dat de resultaten van een invloedrijk empirisch onderzoek dat de NAIRU-hypothese ondersteunt, sterk afhangen van hoe precies het historische verloop van de werkloosheid in het model wordt meegenomen. Kortom: de econometrische ondersteuning van de NAIRU-hypothese is niet robuust en daarmee weinig overtuigend.

Dan kom ik aan de tweede vraag: wat is het effect van flexibele arbeidsmarkten op de productiviteit? Ook hier is in dit proefschrift een theoretische en een econometrische analyse van gemaakt.

In eerste instantie zou je verwachten dat de neoklassieke theorie argumenten aandraagt ter ondersteuning van de hypothese dat flexibele arbeidsmarkten de productiviteit bevorderen. Flexibele arbeidsmarkten zorgen er immers voor dat bedrijven makkelijker kunnen experimenteren met technologie, dat de concurrentie onder werknemers groter is waardoor ze beter hun best gaan doen en dat werkgevers en werknemers eerder de meest productieve match tussen baan en werknemer kunnen en moeten zoeken. Aan de andere kant blijkt de neoklassieke theorie ook een scala aan argumenten aan te dragen die pleiten voor het tegenovergestelde: namelijk dat flexibele arbeidsmarkten juist de productiviteit afremmen. Ik noem er in deze samenvatting twee: ten eerste lekt kennis eerder weg in flexibele arbeidsmarkten en ten tweede is de winst voor werkgevers van een verhoging van de arbeidsproductiviteit lager.

Het eerste argument begint met de notie dat een verhoging van de productiviteit voor een belangrijk deel afhankelijk is van de kennis die werknemers hebben van het productieproces en het product. Die kennis kan gemakkelijk weglekken uit de organisatie, bijvoorbeeld als iemand de organisatie verlaat. Als die kennis snel weglekt, wordt het voor de ondernemer minder aantrekkelijk om te investeren in de opbouw ervan. Hoe flexibeler de arbeidsmarkt, hoe sneller die kennis weglekt en hoe minder er dus geïnvesteerd wordt in de opbouw van productiviteitsverhogende kennis.

Het tweede argument binnen de neoklassieke theorie komt voort uit de notie dat ondernemers eerder zullen investeren in nieuwe technologie die de (arbeids)productiviteit verhoogt, als de arbeidskosten hoger zijn. Dan levert het ze immers meer geld op. Flexibele arbeidsmarkten gaan vaak juist gepaard met lagere lonen, bijvoorbeeld doordat vakbonden afwezig zijn of werknemers minder ontslagbescherming hebben. Binnen dit neoklassieke argument leiden flexibele arbeidsmarkten dus tot lagere lonen, en lagere lonen tot minder productiviteitsgroei. Flexibele arbeidsmarkten zijn dan niet bevorderlijk, maar juist schadelijk voor de productiviteit.

In dit proefschrift wordt verder betoogd dat de neoklassieke theorie van de arbeidsmarkt een te beperkt concept is om productiviteitsontwikkelingen mee te analyseren. Bij arbeid gaat het inherent om een min of meer duurzame relatie tussen een werkgever en een werknemer. In die relatie is sprake van hiërarchie: de werkgever bepaalt wat de werknemer moet doen. Dit ligt vast in het arbeidscontract. Maar die hiërarchie wordt ingeperkt doordat de werkgever niet een volledig zicht heeft op hetgeen de werknemer allemaal doet. Bovendien vragen veel banen om professionele autonomie. Productiviteitswinsten kunnen dan geanalyseerd worden als voortkomend uit deze arbeidsrelatie. In deze relatie *kunnen* werknemers alleen bijdragen aan productiviteitsverhoging als ze kunnen meepraten. Ze *willen* alleen bijdragen als ze niet bedreigd worden met ontslag als de productiviteit omhoog gaat, en als ze delen in de productiviteitswinsten. Dat staat op gespannen voet met een flexibele arbeidsmarkt omdat daarin de ontslagdreiging groter is en de lonen lager liggen. Kortom, gemotiveerde werknemers werken harder en slimmer.

Uit een vergelijking van empirisch onderzoek blijkt dan ook dat een stevig ontslagrecht eerder een positief dan een negatief effect heeft op de productiviteit.

Ten slotte wordt empirisch onderzoek gepresenteerd naar het effect van loonmatiging (loonverlaging) op de productiviteit. Uit de in dit proefschrift uitgevoerde analyse van de data blijkt enerzijds dat loonmatiging inderdaad vaak samengaat met flexibele arbeidsmarkten. Nederland is hierin een uitzondering, omdat ons land gekenmerkt wordt door een behoorlijk stevige ontslagbescherming en een redelijk sociaal stelsel, terwijl de vakbonden hier sinds 1982 akkoord zijn met matiging van de lonen. Anderzijds wijzen de resultaten van het onderzoek erop dat loonmatiging schadelijk is voor de productiviteitsontwikkeling.

Wat is nu de centrale boodschap van dit proefschrift? Kort samengevat luidt die dat het standaard, neoklassieke, economische model kampt met problemen. De theoretische onderbouwing van de hypothese dat hervormingen van de arbeidsmarkt de werkloosheid omlaag brengen, is incompleet. Bovendien is hij gestoeld op een cirkelredenering. De empirische onderbouwing is geen solide bouwwerk, maar eerder een kaartenhuis. Als je er zachtjes tegenaan blaast, stort hij in. Bovendien zijn er theoretische en empirische aanwijzingen dat de hervormingen schadelijk zijn voor de productiviteitsontwikkeling.

Belangrijk is ook dat deze hervormingen gepaard gaat met een polarisatie in de inkomensverdeling. Met andere woorden: de onzekerheid over het inkomensverlies en die verliezen zelf worden neergelegd bij de mensen die aan de onderkant van de inkomensverdeling staan. Het lijkt mij dat de afbraak van het sociale stelsel alleen te rechtvaardigen is als we er zeker van zijn dat er uiteindelijk positieve gevolgen zijn qua werkloosheid en/of productiviteit. Als dit proefschrift iets laat zien, dan is het dat een overtuigende wetenschappelijke onderbouwing hiervoor ontbreekt.

Vanwege de vergrijzing moeten we straks met minder mensen meer dingen doen. Dan is het belangrijk om productiever te worden. De boodschap uit dit proefschrift? Flexibilisering is de verkeerde route. Wat we daarentegen nodig hebben is juist een beetje meer 'regulering' van de arbeidsmarkt.

Labour market flexibility, productivity and employment

Robert Vergeer

For over 50 years, mainstream economists have put forward that we need to make labour markets more flexible. This PhD thesis challenges the mainstream economist's belief in the benefits of labour market reforms. These reforms are supposed to bring down unemployment and to promote productivity growth. However, the theoretical structure behind the claim that reforms bring down unemployment, seems not to be as solid as one may expect. Moreover, empirical evidence that supports this claim turns out to be fragile. Small and seemingly innocent changes to the empirical research set-up can turn the results upside down. With regard to productivity, it turns out that the effect of labour market reforms is indeterminate. The weight of the evidence even seems to point to a favourable effect of labour market regulation.

This study takes the reader along a critical examination of main stream theoretical and empirical evidence, focussing on the question: do we really need to reform labour markets?

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