Jobs versus Productivity?
The causal link from wages to labour productivity growth

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Note to the Editor: Several of the tables in the Appendix are intended as information to the referees and might be omitted in a final version.

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Abstract

Labour productivity growth determines wage growth, but there is also a causal link in the opposite direction. Our panel data analysis of 19 OECD countries (1960-2004) shows that a one-percentage point change in growth rates of real wages corresponds to 0.28 - 0.39 percentage points change in labour productivity growth. This finding casts doubt on the desirability of wage-cost saving flexibilisation of European labour markets. The later may favour job growth but impedes labour productivity growth, which is problematic with an ageing population in Europe.

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I 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 'flexibilisation' of European factor markets (notably of labour markets) would help in the realisation of higher job growth and extra welfare gains (see IMF 2007). The call for more flexible labour markets usually includes a demand for the easier firing of personnel, the realisation of greater wage flexibility (notably in the downward direction), or the reduction of minimum wages and social benefits (see e.g. OECD 1999, 2003a). 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 & Wolfers 2000).

This paper tests our hypothesis 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 would 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 Part III, this hypothesis will be tested on panel data from 19 OECD countries over the period 1960 to 2004. Our preferred hypothesis will be discussed and confronted with popular alternative hypotheses concerning the effect of wages on labour productivity. Theoretical arguments and statistical illustrations will be given in Parts I and II.

Our argument is illustrated with the aid of four figures. Figure I-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. In using Hall's & Soskice's (2001) distinction by two main groups of countries, our illustrations ignore some refinements recently proposed by Faggio & Nickell (2007). Various types of labour market institutions in the 'Liberal Market Economies' (Hall & 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 I-2 shows what most economists would expect after having seen Figure I-1: lower wage growth is related to a substantially higher growth in hours worked. Figure I-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 1990's) 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 I-1 and I-3 do not show evidence of a clear relationship between GDP growth and real wages. The logical implication of Figures I-2 and I-3 is that labour productivity growth must be appreciably lower in Anglo-Saxon countries compared to Continental Europe. Figure I-4 shows that this is indeed the case. So far, our illustrative figures are consistent with the arguments and findings by Autor et al. (2007) from very different data. The figures shed new light, however, on the job creation success of the Anglo-Saxons in figure I-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.

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 & 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.[1]

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 flexibilisation of (part of) the work force might be damaging to innovation and labour productivity growth (Kleinknecht 1994; Van Schaik 1994; Naastepad & 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 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 had mainly to do with the employment of low-productive people that otherwise would not have worked at all. 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

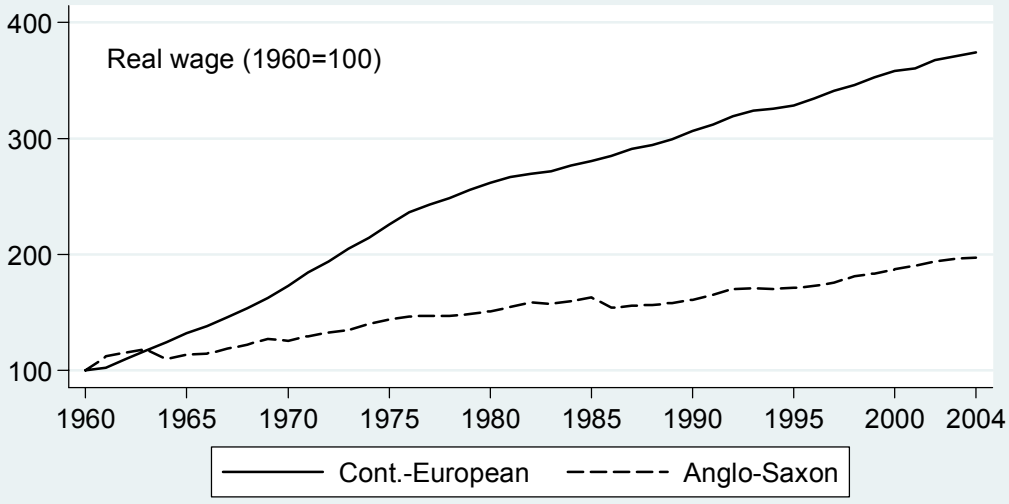
[1] One should note that the continued protection of 'insiders' does not exclude that there was a rising share of flexible 'outsiders' with non-typical working arrangements since the 1980s. Employment of the latter lead to substantial wage bill savings, which supported the policy of modest wage claims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

found this plausible, it being in line with the old neoclassical view that technological change is 'manna from heaven'. This paper will question that popular belief.

In Part II, theoretical arguments will be presented in favour of reversed causality. By means of a panel data analysis of 19 OECD countries, Part III will provide empirical evidence of a reversed causality: from wage growth to labour productivity growth. This finding has far-reaching consequences, among others for the discussion about whether 'rigid' European labour markets should indeed be made more flexible. Moreover, our estimates raise some doubt about the Verdoorn Law. This will be discussed in the concluding section.

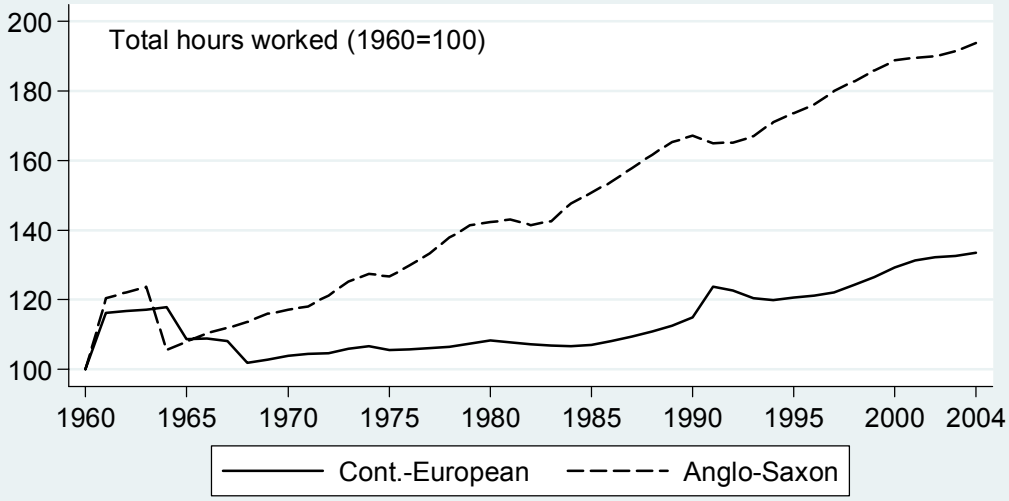
Insert Figures I-1 through I-4 here

Figure I-1: Development of real wages:
Anglo-Saxon versus Continental-European countries (1960-2004)



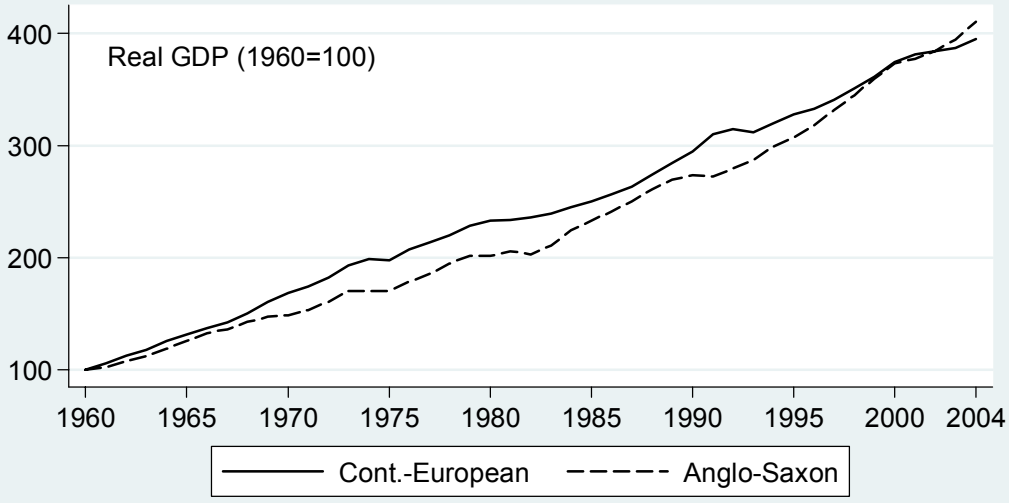
Anglo-Saxon countries: Australia, Canada, New Zealand, UK and USA;
Cont.-European countries: Austria, Belgium, Denmark, Finland, France, Germany, Italy, Netherlands, Portugal, Spain, Sweden;
Source: Database of the Groningen Growth and Development Centre (http://www.ggdc.net/).

Figure I-2: Development of total hours worked:
Anglo-Saxon versus Continental-European countries (1960-2004)



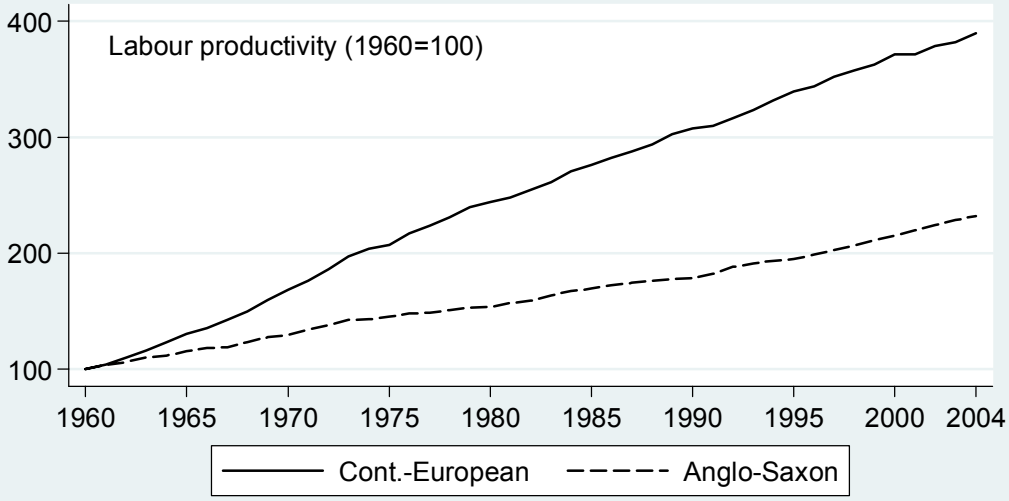
Anglo-Saxon countries: Australia, Canada, New Zealand, UK and USA;
Cont.-European countries: Austria, Belgium, Denmark, Finland, France, Germany, Italy, Netherlands, Portugal, Spain, Sweden;
Source: Database of the Groningen Growth and Development Centre (http://www.ggdc.net/).

Figure I-3: Development of real GDP:
Anglo-Saxon versus Continental-European countries (1960-2004)



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 I-4: Development of labour productivity:
Anglo-Saxon versus Continental-European countries (1960-2004)



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/).

II Theoretical arguments and further illustrations

In our opinion, there are at least five theoretical arguments in favour 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 neo-classical 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 & Tjan, 1980). 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 & Kleinknecht 2004).

(3) According to the theory of induced technological change, a higher relative wage rate increases the labour-saving bias of newly developed technology (Hicks 1932; Kennedy 1964; Ruttan 1997).

(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 monopoly 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 (1966) 'demand-pull' theory (for a recent assessment see Brouwer & Kleinknecht 1999), higher effective demand enhances innovative activity. Analogically, *Verdoorn's Law* 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.[2]

A common element in these five arguments is that they propose a positive causal relationship between real wage growth and 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[3].

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 flexibilisation of labour markets have forwarded three important 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 & Layard 1999). Second, the difficult or expensive firing

[2] Bhaduri & Marglin (1990) argue that this may be the case if an economy is 'wage-led' rather than 'profit-lead'.

[3] 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.

of redundant personnel can frustrate labour-saving innovations at the firm level (Bassanini & Ernst 2002; Scarpetta & Tressel 2004). Third, 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 (Malcomson 1997). The latter argument might indeed be relevant to countries that have de-centralized bargaining regimes. It is less likely to be relevant to rigid 'Rhineland' labour markets that rely more strongly on centralized bargaining.

In our view, the argument that rigid labour markets will hamper innovations might be less relevant for six reasons. Firstly, firms may invest in functional flexibility by means of education and training, which will facilitate the shifting of labour from old to new activities in internal labour markets. Second, in many countries, redundant personnel need not be a problem for labour-saving innovations as high percentages leave their firms voluntarily.[4] 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 (see Lorenz, 1992, 1999). Fourth, 'rigid' labour markets may be favourable to industries where a Schumpeter II ('routinized') innovation model is relevant. The latter is based on the continuous accumulation of pieces 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. Longer commitments between employees and the firm in a 'Rhineland' system (and the use of internal rather than external labour markets) may favour accumulation of knowledge and of 'tacit' knowledge, in particular. Fifth, longer commitments between firm and employee might be interpreted as an investment in trust and loyalty, which will diminish knowledge leakage to competitors; i.e. it will reduce positive externalities that lead to under-investment in R&D and training. Moreover, longer contracts may enhance employees' commitment to the firm, making them more 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. Sixth, longer-term contracts may also strengthen a firm's historical memory and favour processes of organisational learning. In addition to lower wage growth, such arguments may contribute to explain why Anglo-Saxon countries tend to experience lower productivity growth compared to 'Rhineland' countries, as shown in Table II-1.

[4] 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: 363).

Table II-1 summarises 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 Continental-European countries (excluding Portugal and Greece because of lack of data). The third column in Table II-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 numbers of working hours 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 II-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 II-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 II-1 suggests that the superior long-term employment record of the Anglo-Saxon countries is caused primarily by weaker labour productivity growth, and only 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.

III Panel data estimates

To test our hypothesis that wage growth may influence 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. The key independent variable, of course, is annual percentage growth of the real wage. We include this variable with lags in order to avoid endogeneity problems. Avoiding endogeneity requires another condition to be satisfied: there should be no serial correlation in the residuals of the regression. The absence of serial correlation is essential not only because of the 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 growth of labour productivity will cause growth of real wages) while still obtaining consistent estimators. In the Appendix (Table A1), a test is documented that does not reject the hypothesis of no serial correlation in the residuals. Nine lags are included in the regression specification in order to obtain this feature. This lag-structure seemingly is long, but, as mentioned earlier, we have theoretical reasons to expect significant effects after long lags.

We add control variables, including:

- GAP: The relative difference between the labour productivity level of a country 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 lag.
- 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 the variable is essential: high (low) labour productivity growth in the past may have caused high (low) wage growth, and will 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: 418).
- VERDOORN: The Verdoorn relationship (sometimes called the Kaldor-Verdoorn relationship) assumes a positive impact of annual GDP growth on labour productivity growth. Tentative estimates show that GDP should be included without lag as well as with a one-year lag (both are highly significant, but have different signs).
- 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 as well as for occasional outliers in the sample, we include year dummies.
- SERVICES: Following the famous Baumol argument, services may have lower productivity gains than manufacturing or agriculture. Service sector shares in total value added are therefore included as a correction variable for which we expect a negative sign.
- CAPACITY EFFECT: We add this variable 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 a variety of lags in growth of the capital/output ratio. Coefficients of the other variables (notably the wage growth variable) proved to be robust for inclusion of the capital/output ratio.

Definitions of all variables are given in the Appendix (Table A2). Detailed descriptive statistics are presented in Table A3.

It may be doubted whether the SERVICE variable should be included in the estimate. A counter-argument could be that SERVICES may be endogenous: a strategy of low wage and low labour productivity growth may favour 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. Considering such possible counter-arguments, two versions of our model are presented: the one including and the other omitting the service share variable. As will be seen, the service variable is insignificant and has only a minor impact on the other coefficients.

Regressions including (a contemporaneous and a lagged value of) the growth of the capital/output ratio are reported in Table III-1, columns (3) and (5). As can be expected, the inclusion of a capacity measure causes a loss in significance of the Verdoorn-coefficient. It is important to note, however, that the real wage coefficient is robust for its inclusion. 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 vali-

dity of the construction of the capital stock may be doubted (Robinson, 1953-54; Felipe and Fisher, 2003). Thus, including the capital/output ratio 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. It can be seen that the coefficients of the other variables (except for the Verdoorn effect) change little when including the growth of the capital/output ratio.

Table III-1: Factors that explain labour productivity growth in year t, 1960-2004. Summary of fixed-effects GLS/IV panel estimates

Independent variables:	Coefficients model 1:	Coefficients model 2:	Coefficients model 3:	Coefficients model 4 (IV):	Coefficients model 5 (IV):
Real Wage growth$_{it-1}$	0.081***	0.086***	0.074***	0.061	0.058
Real Wage growth$_{it-2}$	0.020	0.026	0.010	0.044	0.042
Real Wage growth$_{it-3}$	0.077***	0.088***	0.068***	0.074*	0.069*
Real Wage growth$_{it-4\ to\ 9}$	0.17**	0.19***	0.131*	0.093	0.079
STATE DEPENDENCY: Productivity growth$_{it-1}$	0.082**	0.069*	0.079*	0.081	0.070
STATE DEPENDENCY: Productivity growth$_{it-2}$	-0.044	-0.045	-0.033	-0.038	-0.035
STATE DEPENDENCY: Productivity growth$_{it-3}$	-0.044	-0.046	-0.034	-0.063	-0.063
STATE DEPENDENCY: Productivity growth$_{it-4\ to\ 9}$	0.046	0.020	0.084	0.139	0.15
GAP$_{it-1}$	0.037***	0.038***	0.039***	0.041***	0.042***
VERDOORN$_{it}$ (GDP growth in year t)	0.55***	0.54***	-0.031	0.66**	-0.027
VERDOORN$_{it-1}$ (GDP growth in year t-1)	-0.31***	-0.32***	0.25	-0.32***	0.36
Capacity $_{it}$ (growth of capital/output ratio in year t)	(omitted)	(omitted)	-0.65***	(omitted)	-0.79
Capacity $_{it-1}$ (growth of capital/output ratio in year t-1)	(omitted)	(omitted)	0.52***	(omitted)	0.63
COUNTRY (dummy)	yes	yes	yes	yes	yes
YEAR (dummy)	yes	yes	yes	yes	yes
SERVICES' share in total GDP	(omitted)	-.000040	(omitted)	(omitted)	(omitted)
Total effect of real wage growth on growth of labour productivity (in the long run)	0.36***	0.39***	0.31***	0.31***	0.28***
Anderson's IV-relevance test				$Chi^2(8)=23$; P-value=0.00	$Chi^2(15)=27$; P-value=0.03
Hansen J-statistic				$Chi^2(7)=6.7$; P-value=0.46	$Chi^2(7)=21$; P-value=0.11
Number of observations:	631	607	631	631	631
Log-likelihood	1929	1868	1937	(not reported)	(not reported)

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

Notes:

- Regressions (1 – 3) 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).
- Regressions (4 – 5) are estimated with Instrumental Variables (stata-command: IVreg2) for Verdoorn$_{it}$ (model 4) and Verdoorn$_{it}$ and Capacity$_{it}$ (model 5) with heteroskedastic robust standard errors. Up to nine year lags were used as instruments.
- Model 1 was tested for the appropriateness of allowing panel-specific heteroskedasticity, using a Chi^2-test (result: Chi^2 (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. All models above do not exhibit significant autocorrelation in the residuals.
- The total (long run) effect of wage growth is calculated as $\sum_{\tau=1}^{\tau=9}(b_{\text{wage growth,it-}\tau})/(1-\sum_{\tau=1}^{\tau=9}(b_{\text{labour productivity growth,it-}\tau}))$ and tested using a Chi^2-test for a non-linear model.
- Our preferred 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 significant.
- In Model 2 we loose observations as service shares in GDP are available only from 1970 onwards.
- 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. It is caused because a permanent difference starting in year y (of: say, 1) in an explanatory variable (say: x) has the (first order) effect of raising labour productivity growth with its coefficient b_x. In year y+1, we not only have the first order effect b_x, caused by the rise of x in year y+1 but also two second order effects: (1) a direct second order effect caused by the rise of x in year y (equal to the coefficient of the lagged value of x) and (2) an indirect second order effect through the growth of the lagged value of labour productivity (itself caused by the difference in x in year y) on the growth of labour productivity in year y+1. This effect equals $b_x * b_{\lambda,growth}$, where $b_{\lambda,growth}$ denotes the coefficient of the lagged value of labour productivity. In the following year (year y+2), we not only have first and second order, but also third order effects. Adding all the effects of the different orders and letting $y \to \infty$ 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. In interpreting the coefficients, a short and a long-term value will be reported.

Our inclusion of the Verdoorn effect requires explanation. First, one should be aware of qualifications in the literature. McCombie et al. (2002) state:

In the three decades since the publication of the inaugural lecture (by Lord Kaldor) there have been numerous studies estimating the Verdoorn Law using a variety of different data sets. The picture that emerges is, notwithstanding the instability of the law at the level of the advanced countries and with some time-series data sets, that the Verdoorn law estimates are particularly robust with values of the Verdoorn coefficient in the range of 0.3 to 0.6 and statistically significant (p. 106).

In our model, it was found that a double inclusion of GDP growth was appropriate. Apart from the inclusion of GDP growth in the year when labour productivity growth was measured (the most frequent specification in the literature), significance tests showed that GDP growth with a one-year lag should also be included. The immediate effect of this Verdoorn coefficient is 0.55 while the long-run effect (including the higher order effects through the lagged Verdoorn coefficient and the lags of labour productivity growth) equals 0.25. If one-year lagged GDP is omitted from the model, we find a Verdoorn coefficient with an immediate effect of 0.50 and a long-run effect of 0.37; in this

case, we have a problem with auto correlation in the residuals of our estimate. Although the long-term Verdoorn coefficient may be expected to become smaller when (extra) lags of GDP-growth are included (due to filtering out short-run capacity effects), we had expected both lags to have a positive sign. Surprisingly, lagged GDP-growth had a negative sign, perhaps caused by a high correlation with the (non-lagged) GDP-growth (the correlation exceeds 0.45). This negative sign of lagged GDP growth remains if GDP without lag is omitted from the model (which again leads us to find an auto regressive structure in the residuals).

Another explanation for the negative sign may be found through a closer look at model (3) in Table III-1. We observe that the Verdoorn-effect becomes insignificant if we add the capital/output-ratio. This suggests that the significant Verdoorn-coefficients in models 1, 2 and 4 are highly capacity driven. Looking at the coefficients of the capital/output ratio, again, we observe a switch of the sign between the contemporaneous and the lagged value of the regressor. This can be interpreted in terms of demand shocks: a positive demand shock would cause the growth of the contemporaneous capital/output ratio to decline while simultaneously causing a rise in labour productivity growth. On the other hand, it causes the growth of the lagged capital/output ratio to decline while simultaneously causing a fall in labour productivity growth, because the front of the shock hits the lagged capital/output ratio while the shock wears off for the current labour productivity. Hence the negative sign of the contemporaneous capital/output ratio and the positive sign of the lagged value.

Another potential caveat in estimating the Verdoorn relation is that it is possibly endogenous to labour productivity. Hence, models (4) and (5) use lagged values as instruments to correct for this[5]. As can be observed, some significance is lost due to instrumentation, but the overall outcome of the regression remains unaltered.

The Verdoorn relationship certainly merits closer investigation in future studies. It is particularly worrying that after inclusion of a better correction for fluctuations in capacity utilisation (by including the capital output ratio in models 3 and 5), the Verdoorn effect becomes insignificant. This may feed speculations that at least part of the supportive evidence of Verdoorn effects in the literature (see recently McCombie et al., 2002) may have been driven by fluctuations in capacity utilisation. For the purpose of the present study, the Verdoorn relation is used simply as a control variable. We trust that the version documented in the table is the most plausible one. Fortunately, whichever version

[5] Following this line of reasoning, one can suggest instrumenting the contemporaneous growth of real wages, too. However, the Anderson statistic indicates that, in this case, the instruments are too weak to obtain consistent estimators.

of a Verdoorn specification was used, all other variables (and notably the coefficient of wage growth) remained robust.

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.

Furthermore, our estimates suggest that there is some evidence of state dependency in labour productivity growth. Labour productivity growth one year delayed ($year_{t-1}$) has a significantly positive impact on labour productivity in $year_t$. Labour productivity growth with more lags (2-9 years) is insignificant. Although short-lagged labour productivity growth has a significant positive effect on current productivity growth, one might perceive it as remarkable that the long-run, cumulative, effect of lagged labour productivity growth on the current growth of labour productivity is negligible. An F-test on whether the cumulative effect is significantly different from zero could not reject the null-hypothesis (p-value = 0.4). This shows that, in the long run, labour productivity growth is no self-propelling force.

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 - 0.36% reduction of labour productivity growth. If the service variable is included, the long-term effect of wage growth increases slightly (to 0.39); if the capital/output ratio is included, it reduces slightly (0.28 - 0.31). We interpret these results in the light of the theoretical arguments discussed in section II.

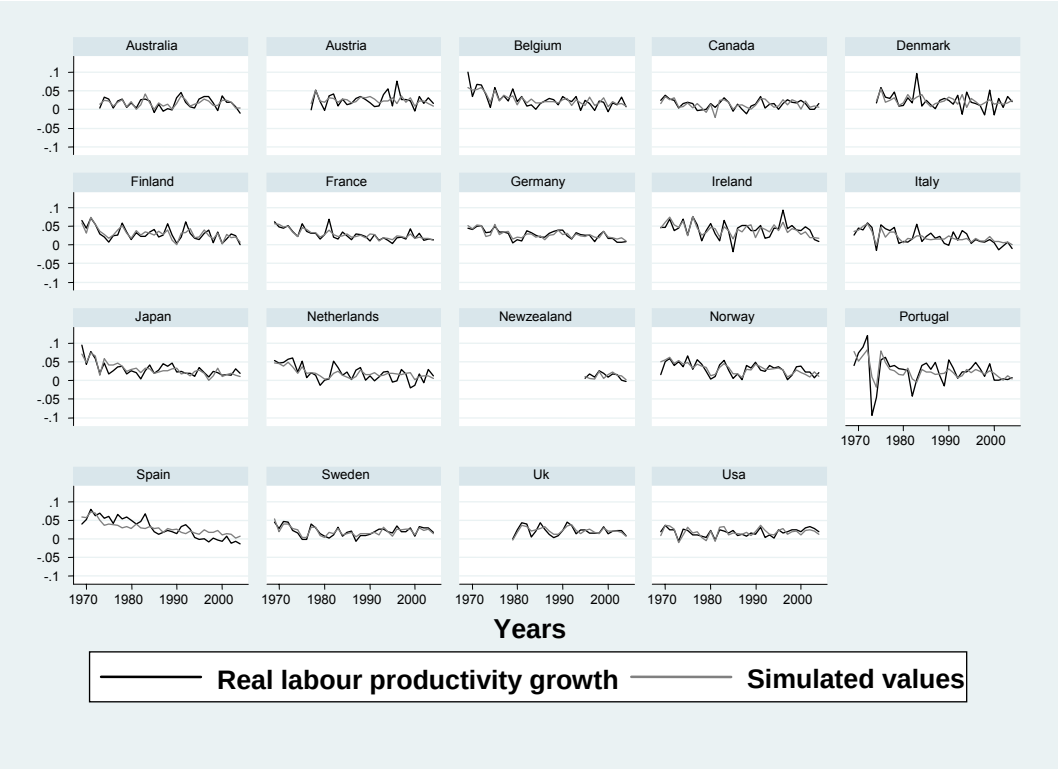
There is one competing hypothesis for explanation of our results: the *growth in low-productive jobs hypothesis*. According to our arguments, real wages cause changes in labour productivity because they not only influence labour productivity of newly created jobs but, more importantly, they change labour productivity growth of existing jobs. This interpretation contradicts the view expressed by the OECD (2003b). 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, decentralisation 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.). 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 I-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. Thirdly, the OECD argument suggests that there are many new jobs in low-productive services. In our estimates, we have explicitly controlled for a shift from manufacturing to services, finding that this has only minor effects on our outcomes. Finally, from a normative viewpoint, it may be asked whether it is wise to have people locked into 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 might be 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 III-1 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 III/1:
Comparison between observed labour productivity growth and simulated labour productivity growth



VI Conclusions

At first sight, Figures I-1 and I-2 seem to confirm what everyone would expect: modest wage growth in flexible Anglo-Saxon economies leads to a substantial growth in labour input. This seems to confirm the neoclassical belief of a trade-off between wages and employment. However, Figure I-3 shows that – contrary to popular belief – high Anglo-Saxon job growth can hardly be attributed to enhanced GDP-growth. Figure I-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.

We discussed a competing explanation of this effect, i.e. the *growth in low-productive jobs* hypothesis as proposed by the OECD (2003b). 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. There is of course evidence of a higher GDP growth in Anglo-Saxon countries in recent years, 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.[6] Figure I-3 shows that, in the long run (1960s to the present), GDP growth in the Anglo-Saxon countries is not higher than in Europe. We conclude that lower wage growth reduces labour productivity growth also in existing jobs and that this is a major cause behind the higher growth of labour hours in the Anglo-Saxon countries (Figure I-2).

Table II-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.

[6] 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 in the US, similar effects may apply to the US economy.

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 & Pyka 2002). We see four reasons for doubt.

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: 437) that shorter working hours would reduce unemployment, Table II-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 employment 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 (minus) 0.03. In spite of the negative employment elasticity of combined with high 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 and whether people chose for more GDP or for more free time is not in itself 'good' or 'bad'; it simply depends on preferences.

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 realize 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 II-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 estimates raise some doubt about the realism of the Verdoorn Law. Several chapters in McCombie et al. (2002) provide evidence in favour 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 favour of Schmooklerian 'demand-pull' effects for product innovation (Brouwer & Kleinknecht 1999) and of Verdoorn effects for labour productivity growth were indeed valid, this would imply that neglect of demand in economic policy might weaken innovation and productivity growth in Europe. Given the role of innovation and productivity for exports (Hughes 1988; Carlin et al. 2001; Kleinknecht & 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.

IV Literature

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Appendix

Table AI: Coefficients of auto regressions of the residuals of Table III/1, 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 (…)

A2 Description of data

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: $x_{growth} = (x_{t+1} - x_t)/\text{average}\ (x_{t+1};x_t)$

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 includes remuneration for the self-employed. They are obtained from the Eurostat-Ameco database. Labour productivity is described above.

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

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

SERVICES = the share of value added in banks, insurance, real estate and other business services relative to total value added in all sectors of the economy, as obtained from OECD. This series runs from 1970–2004.

CAPACITY EFFECT = 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 Euro's.

A3 Country-wise descriptive tables of the data

country	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
GDP growth	45	0.04	0.02	0.00	0.07
Gap	42	0.29	0.04	0.21	0.35
Services (%)	34	21.77	5.26	14.34	29.24

country	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
GDP growth	45	0.03	0.02	0.00	0.07
Gap	38	0.26	0.08	0.16	0.53
Services (%)	35	16.06	4.52	8.49	22.56

country	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
GDP growth	45	0.03	0.02	-0.01	0.07
Gap	45	0.19	0.11	0.05	0.46

Services (%)	35	21.57	5.48	11.77	29.00

country	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
GDP growth	45	0.04	0.02	-0.03	0.07
Gap	45	0.23	0.08	0.11	0.37
Services (%)	32	20.98	3.22	16.22	25.84

country	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
GDP growth	45	0.03	0.02	-0.01	0.09
Gap	41	0.28	0.05	0.20	0.40
Services (%)	35	19.95	2.56	14.82	24.00

country	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
GDP growth	45	0.03	0.03	-0.07	0.09
Gap	45	0.38	0.09	0.27	0.55

Services (%)	35	15.99	3.00	11.95	20.96

country	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
GDP growth	45	0.03	0.02	-0.01	0.07
Gap	45	0.16	0.11	0.03	0.39
Services (%)	35	25.57	3.56	19.81	30.95

country	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
GDP growth	45	0.03	0.02	-0.01	0.07
Gap	45	0.21	0.08	0.08	0.41
Services (%)	35	21.37	5.28	12.85	29.14

country	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
GDP growth	45	0.05	0.03	0.00	0.11
Gap	45	0.43	0.15	0.15	0.64
Services (%)	34	15.54	3.28	9.82	21.85

country	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
GDP growth	45	0.03	0.02	-0.02	0.08
Gap	45	0.23	0.09	0.14	0.49
Services (%)	35	19.96	4.42	13.80	27.67

country	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
GDP growth	45	0.04	0.04	-0.01	0.12
Gap	45	0.47	0.10	0.36	0.73
Services (%)	34	20.83	3.48	15.55	27.73

country	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
GDP growth	45	0.03	0.02	-0.01	0.08
Gap	45	0.07	0.08	0.00	0.22
Services (%)	35	19.37	4.82	12.20	26.89

country	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
GDP growth	45	0.03	0.03	-0.05	0.10
Gap	45	0.39	0.09	0.24	0.51
Services (%)	31	20.65	5.50	13.63	28.11

country	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
GDP growth	45	0.04	0.02	0.00	0.07
Gap	45	0.13	0.13	0.00	0.36
Services (%)	35	16.76	1.99	13.75	19.53

country	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
GDP growth	45	0.04	0.03	-0.04	0.11
Gap	45	0.61	0.05	0.54	0.74
Services (%)	35	15.70	2.66	12.42	19.33

country	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
GDP growth	45	0.05	0.03	-0.01	0.12
Gap	45	0.39	0.14	0.21	0.69
Services (%)	35	17.17	2.31	13.28	20.93

country	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
GDP growth	45	0.03	0.02	-0.02	0.07
Gap	45	0.26	0.05	0.17	0.35
Services (%)	35	19.65	3.47	14.78	24.34

country	United Kingdom				
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
GDP growth	45	0.02	0.02	-0.02	0.07
Gap	45	0.30	0.04	0.24	0.37
Services (%)	35	21.27	4.54	15.34	30.25

country	United States of America				
Variable	#	Mean	Std. dev.	Min	Max

	observations				
Labour prod. growth	45	0.02	0.01	-0.01	0.04
Real wage growth	45	0.02	0.01	-0.01	0.04
GDP growth	45	0.03	0.02	-0.02	0.07
Gap	45	0.11	0.08	0.00	0.23
Services (%)	34	23.46	4.99	17.45	32.16

Table A4
Full details of fixed effects GLS panel estimates of Model 1 as summarized in Table III/1 in current text

	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	0.2	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	0.022
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	0.047
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
VERDOORN$_{it}$ (GDP growth in same year)	0.55	17.4	0
VERDOORN$_{it-1}$ (GDP growth one year delayed)	-0.31	-8.44	0
COUNTRY (dummy)	Yes		
YEAR (dummy)	Yes		
SERVICES' share in total GDP	Not included		

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).