Productivity-Participation Trade-Off: Europe versus Anglo-Saxon countries

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Abstract

This paper has established the existence of a trade-off between productivity and participation. This is however only short-term phenomena and vanishes in 3 to 5 years. Furthermore, we found that for the period 1970-1995 time patterns in the trade-off are similar between Europe and Anglo-Saxon countries (read: USA). However, after 1995, the time patterns have become highly different, as there continues to be a trade-of in the US, but no longer in Europe. The main reason for this is the difference in skill composition of the newly hired workers compared to the existing workforce. In Europe the surge in part-time labour of entering females added to this problem.
JEL: F2, J2, O4, R11

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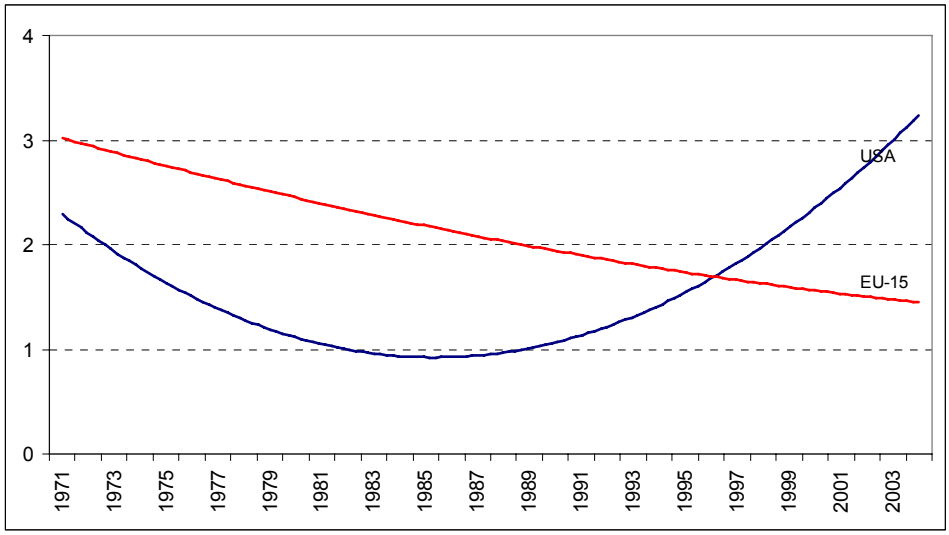
1. Introduction

One of the major policy issues in the past decade in the industrialised world has been how to offset the opposite development in the growth rates of labour productivity in Europe and the USA. These divergent labour productivity growth paths are shown in figure 1. Labour productivity growth in Europe has been on a declining growth path throughout the past three decades. The US productivity growth path declined until halfway the 1980's after which it started to rise and cross European growth rates halfway the 1990's. This is called the productivity growth gap between Europe and the USA.

Figure 1 – Quadratic trend in labour productivity growth rates, USA and EU-15

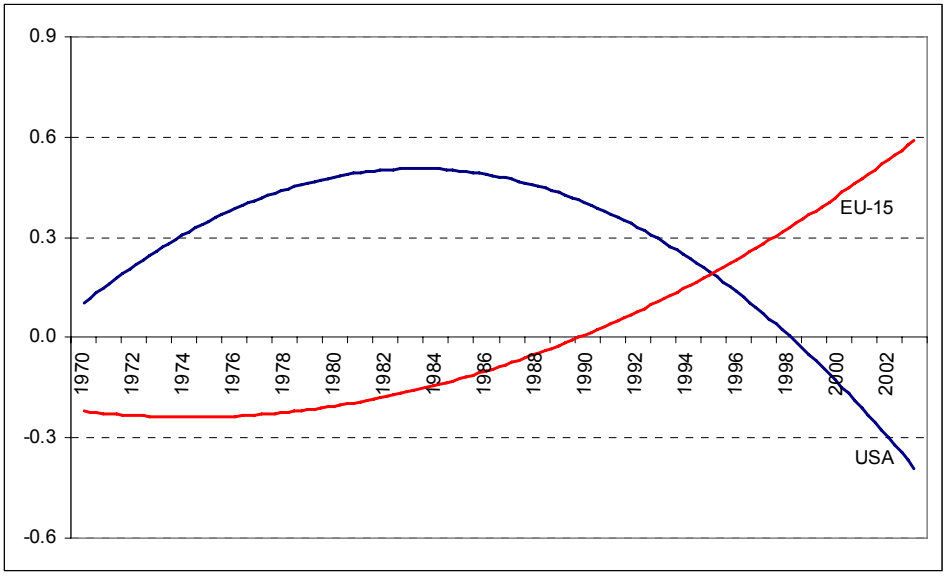


Source: EUKLEMS data base (www.euklems.net)

Many studies have been carried out aiming to explain this phenomenon. Some stress the intensity with which information and communication technology (ICT) is used (Jorgenson et al 2002, van Ark et al. 2002, Daveri 2004, Bloom et al. 2006). Differences in management and organization of firms is also considered to be important (Besnahan et al. 2003, Bloom et al. 2006) and differences in time and pace of structural reforms to product and labour markets (Nicoletti and Scarpetta 2003, Gust and Marquez 2004).

This paper studies differences in the effect of changes in the growth rate of labour participation on the productivity gap. Figure 2 shows trend paths of net labour participation growth in Europe and the US between 1970 and 2004. Net participation is defined as the ratio of employed labour force and population between 15 and 64. Between 1970 and 1990 net labour participation growth in Europe was on average declining, after which it took off on a rising growth path. In the US the opposite occurred, where from the second half of the 1980's participation growth slowed down. At the end of the century participation even decreased. Hence, US participation came on a much slower growth path than before, while in Europe this participation growth path increased. From the second half of the 1990's there is evidence of a participation growth gap between Europe and the USA. So this second part of the 1990's is not only a watershed in terms of the rise in US productivity growth (compared to Europe), but also in terms of a fall in participation growth (compared to Europe). Is there a productivity-participation trade-off?

Figure 2 – Quadratic trend in net labour participation growth rates, USA and EU-15



Source: OECD, GGDC

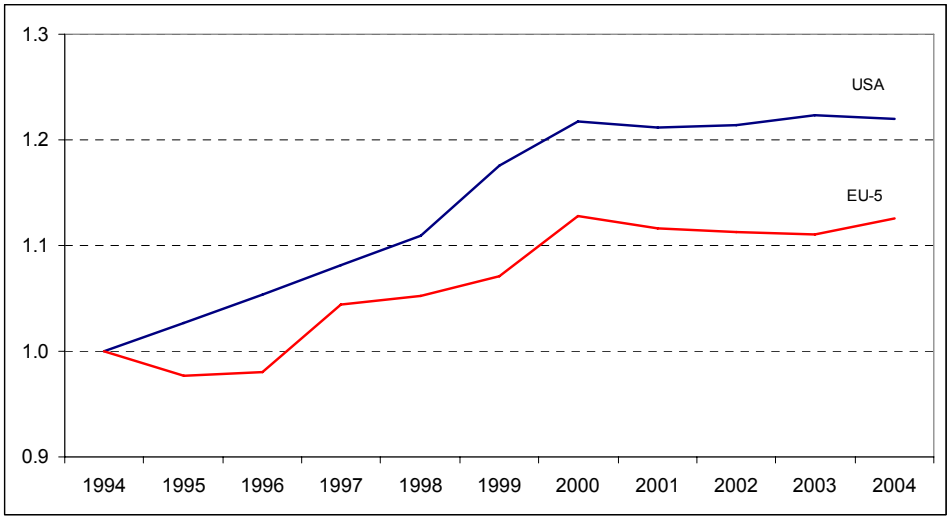
The relation between participation and productivity has not been unnoticed. The past decade European participation increased because of a strong rise in female labour participation compared to the US. Male participation rates slightly fell. The strong cyclical upsurge of the late 1990's and earlier labour market reforms in European countries beginning to take effect, implied that much more unemployed found a job there than in earlier recovery periods, particularly long term unemployed. This caused an influx of less educated, lower skilled employed persons in Europe, which can possibly explain the existence of a productivity-participation trade-off. Low skilled workers hold relatively simple jobs with a low output per hour worked, i.e. a low productivity. See also Beaudry and Collard (2003), Cavelaars (2004), Cette (2004), Belorgey et al. (2004), McGuckin and van Ark (2005), Dew-Becker and Gordon (2006).

Figure 3 provides empirical support of this premise. It shows the change in the ratio of high to low educated workers for the period 1994-2004 in the US and five major European countries.[1] This ratio increased between 1994 and 2000, so relatively more high than low educated persons were employed in both Europe and US. After 2000 it stabilises in both regions, so as of then the development in high and low educated workers was about equal. Figure 3 also shows that over the whole period the ratio increased stronger in the US then in Europe, hence in Europe relatively more lower educated found employment than in the US. Since lower educated have lower productivity than higher educated, this corroborates Europe's productivity slowdown in that period.

On the other hand, a lasting negative effect of participation on productivity is very unlikely, because in the long run productivity has been increasing and so has employment in the industrialised world. Productivity, employment and wealth (per capita income) are all driven by strong positive trends in technological progress, structural change and population growth. So theoretically speaking, any observed trade-off between productivity and participation, will only be a short-term phenomenon.

[1] These five countries, Germany, France, UK, Italy and The Netherlands, comprise three quarters of the European Union's labour force

Figure 3 – Ratio of high to low educated employed (normalised to 1 in 1994) in USA and Europe



Source: Eurostat, BLS, EUKLEMS-data base

These arguments imply two questions that will be addressed in this paper. First, what is the effect of an increase in labour participation on productivity. In other words, is there a productivity-participation trade-off, as discussed above. And second, how can differences in trade-off between Europe and the US be interpreted. We find that, in particular for the period after 1995, the time pattern of the trade-off between productivity and participation is highly different in European compared to Anglo-Saxon countries, who stand for the USA. These trade-offs are strictly a short run phenomenon; after 3-5 years the effects have vanished. The differences in response to a participation shock are indeed for a large part related to differences in skill composition of the newly hired workers and to a lesser extent to differences in hours worked in Europe and the US.

This paper is organised as follows. Section 2 shows how this paper is embedded in the literature. Section 3 gives a set up the methodology we use to study the above phenomena, based on an impulse response analysis of a system of three equations. Section 4 shows the results of this analysis. Section 5 discusses the differences in response between US and Europe and between 1970-2004 and 1995-2004 and interprets them in the light of the productivity gap between Europe and the US. Section 6 gives an interpretation of these results and finally section 7 concludes.

2. Related literature

Theoretically speaking, when net participation growth is associated with employment growth, the productivity-participation trade-off follows directly from the neoclassical production function.[2] When there are decreasing returns to labour, any increase in employment (i.e. participation) reduces capital intensity, which in its turn will lower output per worker (productivity). A related argument is that high growth rates of labour make it less possible to take advantage of the arrival of new technologies (Beaudry and Collard, 2003). These new technologies are the main cause for productivity growth. Another theoretical explanation for a productivity-participation trade-off builds on the skill heterogeneity of workers. Skills are not homogeneously distributed among workers; marginal workers

[2] Assuming a rise in labour participation is usually a rise in employment. A fall in the (non-employed) population would also raise participation, but that is an unlikely scenario in reality.

have a lower skill level that already employed workers. A rise in labour participation implies therefore that lower skilled worker may enter the labour market and hence giving a lower productivity.

Beaudry and Collard (2003) define productivity growth as real GDP growth minus the rate of growth of the employed labour force. Productivity growth is related to employment growth in a number of regressions. They find an elasticity of roughly -0.9. This productivity-employment trade-off is shown to be confined to the period 1978-1995, but not for the 1960's and early 70's. Using a similar definition and data set, Cavelaars (2004) shows just the opposite with a distinct productivity-employment trade-off in the period 1961-1980, but not in the subsequent period of 1981-2000.[3] He finds an elasticity of -0.6, so a 1%-point rise in employment growth gives a fall in productivity growth of 0.6%-point. He also find a positive impact of the change in hours worked on productivity growth (also confined to the period 1961-1981). Both studies look at growth equations only, thereby focusing on long-term effects. Notice, however, that neither study investigates a genuine productivity-participation trade-off.

Gust and Marquez (2004) do relate labour productivity growth to the change in labour participation among others, where productivity growth is real value added growth minus labour input growth and labour input is in labour years.[4] They find a productivity-participation trade-off with an estimated elasticity of -0.8. Hence a 1% rise in the change in participation leads to a fall in productivity growth of 0.8%. They also pay no attention to the duration op the trade-off.

Belorgey et al. (2004) and Cette (2004) also notice productivity-participation trade-offs. Estimating a productivity growth equation, Belorgey et al. find a short-term negative elasticity of -0.3 for participation growth, i.e. a 1%-point rise in the growth rate of participation implies a fall in productivity growth of -0.3%-point. Labour productivity is measured as GDP over employment, instead of GDP per hour. Given the autoregressive specification Belorgey et al. use, this value leads to a long run equilibrium elasticity of -0.4. In other words, they do find a long run productivity-participation trade-off. Likewise, Belorgey et al. find a positive short-term elasticity for the growth rate of working hours on productivity growth of 0.4. The long run elasticity that follows is 0.5. A rise in working hours raises output per worker less than proportional. Notice that a rise in working hours not necessarily means a rise in labour intensity, when employment and working hours growth at the same rate. So the existence of a long run productivity-labour intensity trade-off is not corroborated.

McGuckin and Ark (2005) also study the trade-off in a number of simple regression exercises, relating productivity growth to not just contemporaneous, but also to various lags in overlapping time spans of participation growth[5]. Where other studies only look at one-year effects, theirs shows lagged effects. They find a negative contemporaneous effect, of about -0.2 that vanishes as the number of lags increase, i.e. as time moves on. So in this case the productivity-participation trade-off is just a short run phenomenon. McGuckin and van Ark go on to argue that the relation between growth of labour intensity and productivity growth is hard to interpret, because it is closely related to per capita growth, which in turn is determined by productivity growth.

[3] These opposite results are strange considering that both use similar country-comparative data sets from OECD and from the Penn World Tables on a similar group of (industrialised) countries, comparable sample periods and definitions.

[4] This means that employment is adjusted for differences in hours work.

[5] Overlapping time spans, are e.g. years 1-3, 2-4, 3-5, 4-6, to define growth periods for participation in the regression. Corresponding non-overlaping time spans would be years 1-3, 4-6, 7-9 etc.

Dew-Becker and Gordon (2006) argue that changes in the hours work trend are a major cause of the productivity gap. They argue that the US-European productivity gap is not so much an ICT-related phenomenon, but is much more related to differences in hours worked. Before 1995 labour became more expensive in European countries by reducing hours worked per worker. This reduction represents preferences of the workers or policies to keep up European welfare states and fight high European unemployment. After 1995 employment in terms of the total number of hours worked started to increase at a higher pace than in the USA, causing a slower rate of productivity growth

The main difference between our analysis and the above studies is that in our analysis labour productivity, labour participation, labour intensity and per capita income (wealth) will mutually affect each other, whereas the previous work was based on univariate relations between productivity and employment (participation) or between productivity and hours worked (labour intensity). This means that relations not taken into account in previous investigations, may now be brought to light.

3. Methodology

The method we use to analyse the labour productivity gap between Europe and the US starts from the identity

$$\left(\frac{Y}{P}\right)=\left(\frac{Y}{H}\right)\cdot\left(\frac{H}{E}\right)\cdot\left(\frac{E}{P_{15-64}}\right)\left(\frac{P_{15-64}}{P}\right) \tag{1}$$

where Y is real GDP, P is population, H is hours work, E is the number of employed persons and P_{15-64} is the population of a working age, i.e. between 15 an 64 years old. The left hand side of (1) is per capita income, or wealth, which equals labour productivity (GDP per hour) times labour intensity (hours worked per employed person) times net participation times the age structure of the population. It is easy to see that (1) can be rewritten as

$$\left(\frac{Y}{H}\right)=\frac{\left(\frac{Y}{P}\right)}{\left(\frac{H}{E}\right)\cdot\left(\frac{E}{P_{15-64}}\right)\cdot\left(\frac{P_{15-64}}{P}\right)} \tag{2}$$

Rewriting equation (2) in terms of growth as

$$\Delta\log\left(\frac{Y}{H}\right)=\Delta\log\left(\frac{Y}{P}\right)-\Delta\log\left(\frac{H}{E}\right)-\Delta\log\left(\frac{E}{P_{15-64}}\right)-\Delta\log\left(\frac{P_{15-64}}{P}\right) \tag{3}$$

This identity cannot be estimated in order to assess the effect of a change in either right hand side variable to labour productivity growth. At least one variable has to be omitted to estimate (3), where the estimated residual represents this omitted variable.

If we take per capita income as the omitted variable, equation (2) points out that the response of labour productivity to an adverse shock in labour participation (i.e. a rise in employment E,

assuming a constant population $P_{15\text{-}64}$)[6] depends on the response of labour intensity (H/E) and on the response of the age structure to this shock. We take it that the latter variable is exogenous and is hardy affected by changes in participation, so we focus on the first response. There are three possibilities, assuming a positive 1%-point participation shock. Fist, the new employed persons ΔE work just as many hours per worker as the existing workforce, i.e. have the same labour intensity. When output of these additional workers is lower than the existing ones, there is a drop in labour productivity and hence a productivity-participation trade-off. The residual (wealth) effect depends on the strength of this trade-off. For example, a linear trade-off, i.e. a 1%-point fall in one variable implies a rise of 1%-point in the other, would in this case have a zero residual effect. Second, assume the newly employed persons have a lower labour intensity compared to the existing workforce, as well as, like before, a lower output. Given the same trade-off strength this implies a smaller fall in productivity than in the first case and hence higher wealth effect. Third, they have a lower output and a higher labour intensity than the existing workforce. Given again the same trade-off relation, this leads to a deeper fall in productivity than in the first case and hence a smaller increase in wealth.

How should we interpret this trade-off between productivity and participation and what are the compensating adjustments? Basically it suggests that new entrants into employment have lower productivity. Nevertheless, in the end these workers catch up with the rest of the workforce after a period of skills development. So the long run effect of a participation shock on productivity is positive, because they are both driven by strong positive trends in level and duration of education, technological progress, structural change and population growth.

Given equation (3) we can easily relate labour productivity growth, labour intensity growth, labour participation growth and growth of the population of working age in a mutual dependent system of equations as

$$\Delta lp_t = \alpha_{1,0} + \sum_{i=1} \alpha_{1,i} \Delta lp_{t-i} + \sum_{j=1} \beta_{1,j} \Delta h_{t-j} + \sum_{k=0} \gamma_{1,k} \Delta p_{t-k} + \sum_{l=1} \delta_{1,l} \Delta pp_{t-l} + \varepsilon_{1,t} \quad (4)$$

$$\Delta h_t = \alpha_{2,0} + \sum_{i=1} \beta_{2,i} \Delta h_{t-i} + \sum_{j=1} \alpha_{2,j} \Delta lp_{t-j} + \sum_{k=0} \gamma_{2,k} \Delta p_{t-k} + \sum_{l=1} \delta_{2,l} \Delta pp_{t-l} + \varepsilon_{2,t} \quad (5)$$

$$\Delta p_t = \alpha_{3,0} + \sum_{i=1} \gamma_{3,i} \Delta p_{t-i} + \sum_{j=1} \alpha_{3,j} \Delta lp_{t-j} + \sum_{k=1} \beta_{3,k} \Delta h_{t-k} + \sum_{l=1} \delta_{3,l} \Delta pp_{t-l} + \varepsilon_{3,t} \quad (6)$$

$$\Delta pp_t = \alpha_{4,0} + \sum_{i=1} \delta_{4,i} \Delta pp_{t-i} + \sum_{j=1} \alpha_{4,j} \Delta lp_{t-j} + \sum_{k=1} \beta_{4,k} \Delta h_{t-k} + \sum_{l=1} \gamma_{4,l} \Delta pp_{t-l} + \varepsilon_{4,t} \quad (7)$$

where the lower case variables refer to region-specific relative to group aggregates, e.g. European countries relative to Europe as a whole. We investigate country-specific shocks relative to this aggregate group. Single countries cannot be studied due to lack of sufficiently long time series.

$$lp_i = \log\left(\frac{Y_i}{H_i}\right) - \log\left(\frac{Y_{all}}{H_{all}}\right)$$

[6] A fall in (non-employed) population of working age given employment could also lead to a rise in participation but in reality this is highly unlikely.

$$h_i = \log\left(\frac{H_i}{E_i}\right) - \log\left(\frac{H_{all}}{E_{all}}\right)$$

$$p_i = \log\left(\frac{E_i}{P_{15-64,i}}\right) - \log\left(\frac{E_{all}}{P_{15-5-64,all}}\right)$$

$$pp_i = \log\left(\frac{P_{15-64,i}}{P_i}\right) - \log\left(\frac{P_{15-64,all}}{P_{all}}\right)$$

Where subscript *i* refers the country and subscript *all* to the sum of all countries *i* in the group. Leaving out per capita income growth from equation (3) implies it will act as residual for the equations of the system (4)-(7). It is also important to note that (4)-(7) is not a VAR in the strict sense of the word. We assume that labour participation growth exerts contemporaneous influence on labour productivity and on labour intensity. When we want to assess the effects of a participation shock, this implies there is an immediate effect on productivity growth and labour intensity. The effect of this change in labour intensity does work through on productivity, but with a lag. The fact that labour intensity explains labour productivity only lagged is important to evade endogeneity, since hours worked (*H*) are in both productivity and intensity. For participation this is less of a problem, so it can appear contemporaneous.

We allow for two lags in each variable in each equation. Our approach to estimating this system is to pool countries together according to the group or region they are in and add country fixed effects in each equation. This gives an impression of both commonalities and differences across countries. The time dimension is too small to allow reliable estimation of (4)-(7) for each individual country. A comparison between the USA and European countries is therefore not possible. To evade this problem we will compare the EU-15 countries to a group of countries similar to the USA we will call the non-EU Anglo-Saxon countries, consisting of the USA plus Australia, Canada and New Zealand. The productivity growth pattern for these countries compares well to that of the USA, as opposed to that for Europe, as is shown in table 1.

Table 1. Average annual labour productivity growth, Anglo-Saxon countries versus Europe.

	Australia	Canada	New Zealand	USA	Anglo-Saxon countries	Europe (EU-15)
1971-2004	0.8	0.6	0.3	0.7	0.7	1.1
1971-1994	0.7	0.5	0.2	0.6	0.6	1.2
1995-2004	0.9	0.7	0.5	1.0	0.9	0.7
1995-2004 relative to 1970-1994	1.3	1.4	2.5	1.7	1.5	0.6

Source: GGDC Total Economy Database

System (4)-(7) will be used to conduct an impulse response analysis. A shock to the growth rate of labour participation will be modelled as a one period 1 %-point innovation to equation (6) and the response of that shock to growth of productivity and labour intensity result from the entire system. Estimation is done using GLS based on cross-section (country) weights and inclusion of country fixed effect. Weighted least squares take account of possible heteroscedasticity. The estimation results we find are subsequently used to obtain responses of the entire system to a shock in the growth rate of labour participation. We are particularly interested in the effects on labour productivity, emphasising differences between the USA and Europe and between the entire sample 1970-2004 and sub-period 1995-2004.

4. Impulse responses for EU-15 and non-EU Anglo-Saxon countries

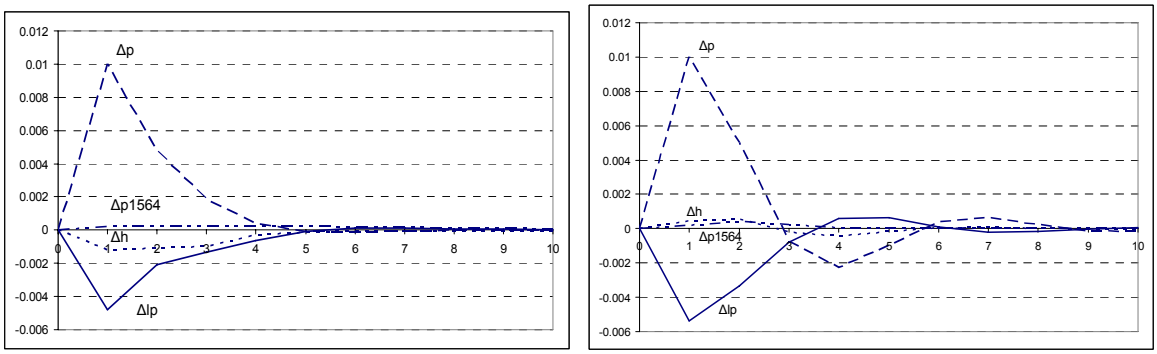
Labour participation shock, 1970-2004

We estimate the system (4)-(7) with two lags in each variable for the EU-15 countries and the entire sample period. These estimated models are used to assess the effects of a 1%-point shock to the growth rate of labour participation, i.e. in equation (6). This shock will work its way through the system and comparison with the baseline projection yields the response functions for labour productivity growth, labour intensity growth and population growth in figure 4. It shows that a 1%-point participation shock depresses productivity growth in the EU-15 with roughly 0.5 %-points. Hence there is a clear trade-off between productivity and participation. This shock takes about five years to die out and there is no apparent effect on the growth rates of labour intensity and the share of the population of working age.

Figure 5 shows the impulse response functions for the four Anglo-Saxon countries outside the EU (USA, Canada, Australia, New Zealand), based on a corresponding specification. We find that for this period and this group of countries the responses are quite similar to those of figure 4. The initial response to a 1%-point participation growth impulse is a drop in productivity growth of 0.5%-points and there is virtually no response of the growth rates of labour intensity and population share. The most striking difference is the pattern and timing at which the shock is absorbed by the system. For the EU-15 countries it takes 5 years for the impulse to die out. In the Anglo-Saxon countries (read: US) the impulse reaches the X-axis after 3 years, but there is much more tendency of the response to overshoot.

Figure 4/5. Response functions to a 1%-point impulse in growth of labour participation, based on system (4)-(7) estimated over 1971-2004.

EU-15 countries **Anglo-Saxon countries**

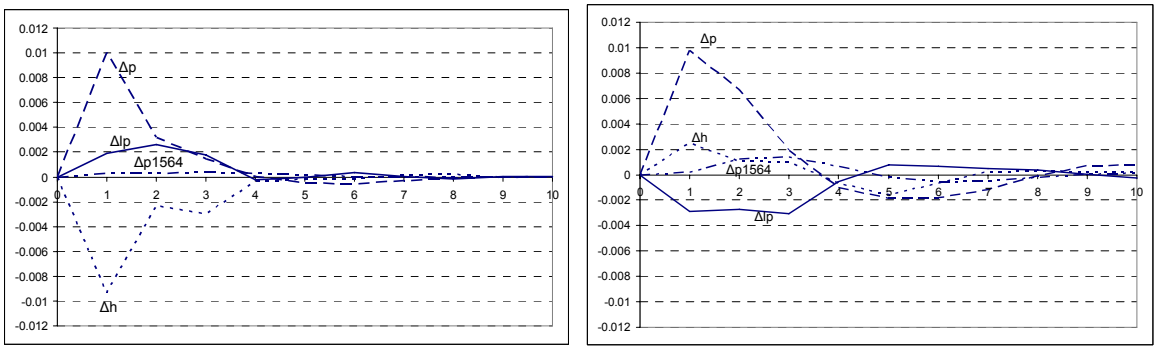


Labour participation shock, 1995-2004

Figures 6 and 7 present the same impulse response function for the same groups of countries, based on system estimation over the sample 1995-2004. This period is chosen because of the fact that according to figures 1 and 2 both the productivity gap and the participation gap opened up between Europe and the US. We will now not only investigate differences in response between the two blocks of countries, but also differences in response for the period after 1995 compared to the entire period.

Figure 6/7. Response functions to a 1%-point impulse in growth of labour participation, based on system (4)-(7) estimated over 1995-2004.

EU-15 countries **Anglo-Saxon countries**



As opposed to the similarity in response of figures 4 and 5, we now find very large differences between Europe and the Anglo-Saxon countries. In Europe the participation shock now has a strong, negative effect on labour intensity and a slightly positive effect on productivity. This implies the new workers work much less hours than existing workers, but do generate positive output. In other words, the negative response of labour intensity clearly positively affects productivity growth and offsets any productivity-participation trade-off. The response of the population share of 15-64 is again about zero. The participation shock is absorbed after four years. Compared to figure 4, this is an increase of adjustment of one year.

In the Anglo-Saxon countries the story is completely different. Here the productivity-participation trade-off still exits, be it less strong as the one of figure 5. On the other hand, figure 7 now shows a small positive labour intensity effect. This implies new workers work more hours than existing ones. Compared to figure 5, the labour intensity effect has become much stronger and the adjustment time after which the shock is absorbed has increased from three to four years. Just like before, the tendency of the responses to overshoot remains present in this case as well. Finally the population effect is as before very small.

5. Interpreting the results

The main empirical findings can be summarised as follows. For the full sample, we find a short term productivity-participation trade-off of approximately -0.5. After 3-5 years the effects of this shock have died out. This finding corroborates McGuckin and van Ark (2005) that a lasting trade-off is not feasible given the positive relations between productivity, participation and wealth in the long run, which are driven by technical progress, structural change and population growth.

This short term trade-off corroborates the existence of decreasing marginal return to labour and the existence of difference in work time preference or skill diversity among workers. Differences in the timing of 'short-term' between European and Anglo-Saxon countries depend on the flexibility of labour markets and on the nature and sources of adjustment to a participation shock. The 'shorter' the short-term, the faster adjustments are made to shocks and the sooner long run equilibriums are restored.

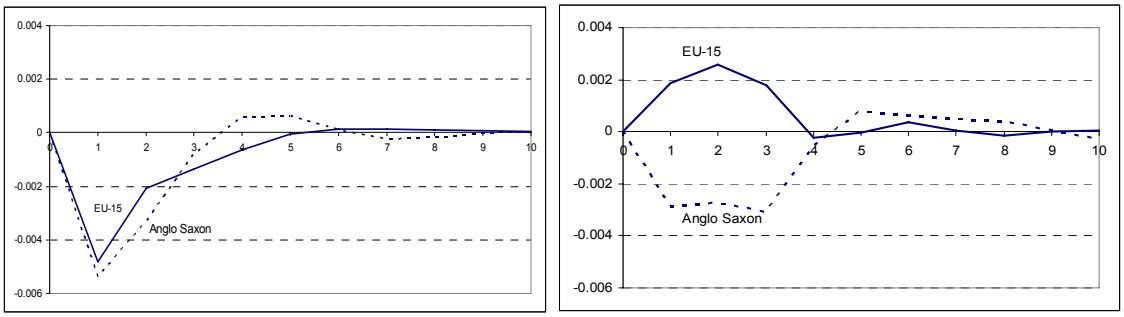
We do find that these adjustments go faster in Anglo-Saxon countries than in Europe, a sign that markets are less rigid than in Europe. However, in the Anglo-Saxon countries markets overreact to a shock, while European countries have smooth be it slow adjustment. While faster adjustment is a sign of more flexibility, overshooting is disruptive as it means that adjustment in a particular dimension is too strong. This cancels out the lead of the Anglo-Saxon labour market adjustment. In fact it means that shocks lead to much more turmoil in the US than in Europe.

The size of these short-term trade-offs is next considered in detail. Figures 8 and 9 single out the responses of labour productivity growth to the participation shock from figures 4-7. Figure 8 shows virtually no difference in response of labour productivity growth when the full sample 1970-2004 is used for estimation and response analysis. Both areas react to the shock with a 0.5%-point fall in productivity growth. The two groups of countries do react differently for the model based on 1995-2004, as figure 9 shows.

Figure 9 still shows a short-term production-participation trade-off for the Anglo-Saxon countries, but with -0.3 it only half as large as the one based on the model of the entire sample period. For Europe, on the other hand, we find that participation and productivity go hand in hand, as a 1%-point participation shock now raises productivity growth by 0.3%-points. Figure 11 below shows where this change in response comes from.

Figure 8/9. Difference in response of labour productivity growth between the EU-15 and Anglo-Saxon countries to a 1%-point shock in the participation growth rate.

1971-2004 **1995-2004**

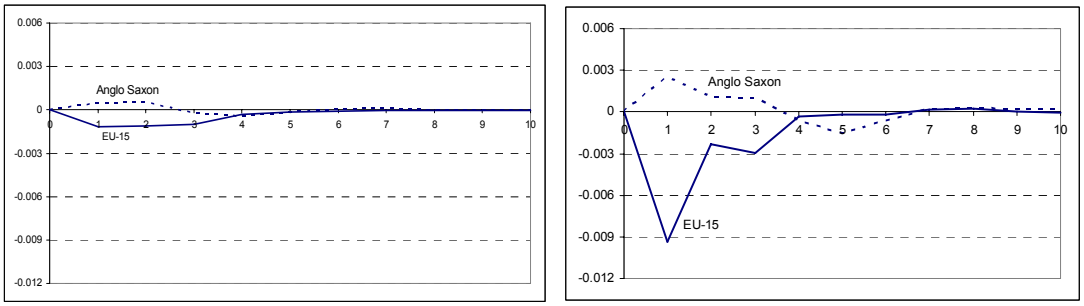


In figures 10 and 11 the response of labour intensity growth to the participation shock is singled out for both periods. When the entire sample period is used for estimation and impulse response analysis, we find virtually no response of labour intensity in figure 10. Hence the number of hours worked per newly employed, who come in as a result of the participation shock, is about the same as for the existing work force in both regions. Figure 11, pertaining to the period 1995-2004, does show large differences in response. In the Anglo-Saxon countries there is a small positive labour intensity effect,

implying that newly hired workers actually work more hours than the existing ones. In Europe on the other hand, we find a deep trade-off of -0.9. This means new workers in Europe hired in the period 1995-2004, work far less hours then the existing work force. For both regions, we find that when the shock ends, so does (eventually) the response of labour intensity growth. Hence labour intensity returns to its equilibrium level in both regions.

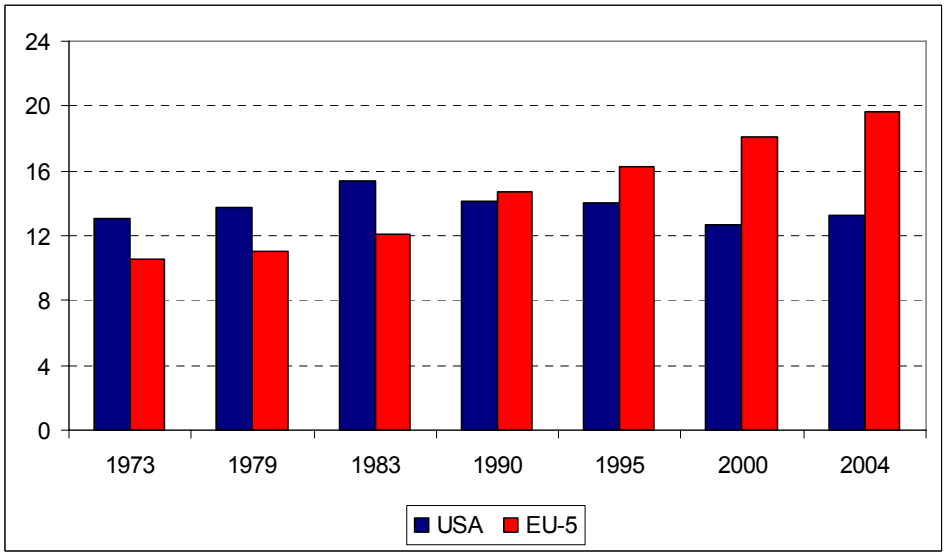
Figure 10/11. Difference in response of labour intensity growth between the EU-15 and Anglo-Saxon countries to a 1%-point shock in the participation growth rate.

1971-2004 **1995-2004**



These new workers in Europe have primarily been women, causing the upward trend in the European growth of labour participation of figure 2. European female workers work more often on a part-time job than their US counterparts. The trend in total part-time employment has been rising in Europe the past three decades, as opposed to the USA. Figure 12 shows that growth in US part-time employment has reversed halfway the 1980's. The share of part-time employment in Europe on the other hand has doubled from about 10% in 1973 to 20% in 2004.[7]

Figure 12. Share of part-time employment in Europe and USA



Source: own calculation based on OECD, EUKLEMS, EUROSTAT

[7] Europe again comprising five major European countries: Germany, France, UK, Italy and The Netherlands (footnote 1).

This growth of part-time employment in Europe is to a large extent caused by females. Table 2 gives the contribution of part-time employment growth by females over the past fifteen years. In Europe female workers have contributed about 80% to the overall growth rate of part-time work, i.e. 4 out of the 5%-points between 1990-2004. In the US females contributed about two thirds to the falling rate of part-time employment, i.e. -0.6 out of the -0.9%-points between 1990-2004.

Table 2. Growth of part-time employment and female contribution to that growth

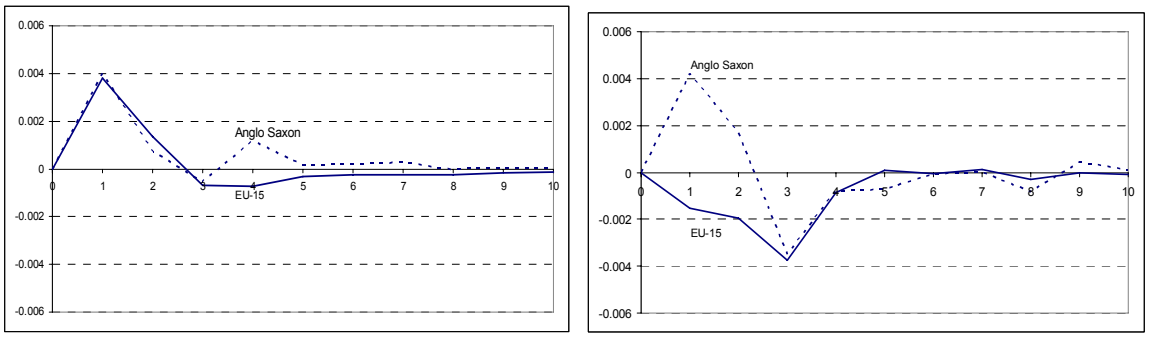
	Growth rate of part-time employment share (%-point)			Contribution to growth of female part-timers (%)		
	1990-1995	1995-2000	2000-2004	1990-1995	1995-2000	2000-2004
USA	-0.14	-1.36	0.60	66.5	66.2	66.0
EU-5	1.59	1.82	1.55	79.9	79.3	80.6

Source: own calculation based on OECD, EUKLEMS, EUROSTAT

The final question then is which effect the participation shock has had on per capita income growth, or growth of wealth. To this end the residuals of the responses, i.e. that part of the response that is left after the productivity, labour intensity and population by age responses are subtracted from the initial shock is next considered. Figure 13 and 14 show the differences in response of wealth. When the entire sample is used for model estimation both regions have very similar response patterns: a 1%-point shock in participation growth leads to a 0.4 %-point rise in per capita growth. In both cases it takes about 3-5 years for the shock to be absorbed. When the period after 1995 is used, we find that the US response of welfare growth is positive, again with a 0.4 elasticity, whereas in Europe it now has a negative response. Despite the positive productivity effect in Europe (figure 9) a positive welfare effect is frustrated by a strong negative labour intensity response. The response of the share of the population of working age is negligible in both periods in the two regions.

Figure 13/14. Difference in response of per capita income growth between the EU-15 and Anglo-Saxon countries to a 1%-point shock in the participation growth rate.

1971-2004 **1995-2004**



6. Regression analysis

This impulse response analysis shows there are two major phenomena that can account for the reaction in productivity to a participation shock. The common short term trade-off is explained by the skill composition of the newly entered workers. The positive relation between productivity and participation found in Europe after 1995 is related to the hours worked of the newly employed.

Which one of these effects can account of the productivity gap? This issue is addressed in a simple regression analysis where the US-EU productivity gap (figure 1), is explained by the gap in growth of skill composition (figure 3) and the gap in changes in part-time employment (figure 12). The latter is further differentiated by gender. So we estimate

$$\left[\left(\frac{\dot{y}}{h}\right)_{US}-\left(\frac{\dot{y}}{h}\right)_{EU}\right]=\mu+\alpha\left[\left(\frac{\dot{emp}_{high}}{emp_{low}}\right)_{US}-\left(\frac{\dot{emp}_{high}}{emp_{low}}\right)_{EU}\right]+\beta\left(\Delta pt_{m,US}-\Delta pt_{m,EU}\right)+$$
$$+\gamma\left(\Delta pt_{f,US}-\Delta pt_{f,EU}\right) \qquad (8)$$

where the first explanatory variable represents differences in the development of employment by educational attainment. In figure 3 we found that the ratio of high to low employed rises stronger in the US than in Europe, so this term is positive. The second and third term represent the growth of the share of part-time employment for male and female workers respectively. The data on productivity growth are from the EUKLEMS database. Data on the skill composition is drawn from various sources of Eurostat, the US Bureau of Labor Statistics (BLS) and the EUKLEMS database. The share of part-time workers by gender is from the OECD. The sample period is relatively short, 1994-2004, because of the limited availability of skill composition data. The other variables have a slightly longer time span. Table 3 shows the estimation results of (8). The explanatory variables are hampered by high multicollinearity, particularly between the skill composition variable and both part-time variables.

Table 3. Explaining the US-EU productivity gap: estimation of equation (8), 1992-2004

	Eq. (8)					
Intercept	-2.85	-3.09	-1.72	-1.85	0.71	1.13
	(-2.25)	(-3.43)	(-1.41)	(-4.28)	(1.44)	(4.62)
US-EU gap in						
growth of ratio high to low educated workers	40.5	42.5	31.1	32.2		
	(3.15)	(4.51)	(2.50)	(5.67)		
growth of male share of part-time work	-1.72	-1.66			1.50	
	(-1.43)	(-1.57)			(1.18)	
growth of female share of part-time work	0.19		0.10			1.28
	(0.22)		(0.11)			(2.43)
Adjusted R^2	0.35	0.43	0.37	0.44	-0.01	0.17
N	11	11	11	11	13	13
DW	2.51	2.54	2.66	2.67	1.62	1.66
t-values based on Newey-West consistent standard errors are between parentheses						

Nevertheless the estimated coefficients are still unbiased. We find the skill composition explains about 85% of the explained variation of equation (8), while the growth of female part-time employment accounts for 11% and that of male workers yields 4%. Indeed we find that a large part of the productivity gap is due to the inflow of relatively low skilled new workers in Europe compared to the USA. But also part-time employment, particularly of women who entered the European labour market, has had a substantial contribution.

Note that equation (8) is not meant to explain the entire productivity gap, but merely provide a further interpretation for the response of a participation shock. This equation covers about 40% of the explained variability of the productivity gap. This means that 60% is still not accounted for and can be explained by the usual explanatory variables like differences in ICT-use, technological and organisational innovation and regulatory burden. Table 3 also shows estimations of models in which explanatory variables are omitted. The switching of signs is a clear indication of multicollinearity. In the end both the gap of skill composition variable and the gap in growth of female part-time employment have a significant effect on the European-US productivity gap.

These results corroborate the impulse response functions of figures 9 and 11. In fact the by far dominant difference in response to a shock in participation growth between Europe and the US of the post-1995 period is that of labour intensity in figure 11. This labour intensity growth response also governs the difference in response of labour productivity growth in figure 9 and hence growth of wealth of figure 14. For the US there continues to exist a productivity-participation trade-off, while for Europe the two go hand in hand. Hence, for the USA differences in the skill composition of new and existing workers have played a role. For Europe, there is the rise in inflow of women working part-time. Whether the skill composition could become dominant in Europe, as the regression results show, depends on the GDP generated per new worker. Only if these new female workers worked far less hours than the existing workers, then a lower GDP, i.e. a lower skill or education level of these new workers, could raise the overall labour productivity growth (as in figure 9) and still render a negative per capita income growth (figure 14). So indeed also in Europe the impulse responses can be interpreted as an effect of skill composition only when many low skilled, less educated, new workers moved in, working relatively few hours.

7. Concluding remarks

This paper has established the existence of a trade-off between productivity and participation. This is however only a short-term phenomenon and vanishes in 3 to 5 years. Furthermore, we found that for the period 1970-2004 time patterns in the trade-off are similar between Europe and Anglo-Saxon countries (read: USA). However, after 1995, the time patterns have become highly different, as there continues to be a trade-of in the US, but no longer in Europe. The main reason for this is the difference in skill composition of the newly hired workers compared to the existing workforce. In Europe the surge in part-time labour of entering females added to this problem.

From a policy perspective this study raises a number of issues. First, the existence of only a short-term trade-off implies it is not wise to try and tackle short-term job loss. Second, bringing new workers to the labour market can lead to slower productivity growth, but the gain in jobs is more than sufficient to offset the productivity declines, so that GDP increases and so does per capita income. Only when this is accompanied by a fall in working time of these new workers, a fall in GDP may result causing a fall of per capita income. Hence stimulating part-time work, as it happened in Europe, can only raise welfare when it is accompanied by a rise in training and education. Third, the weak

effect of the population of working age on all accounts, makes it doubtful whether extending the working life of existing workers will lead to a rise in per capita income. This means policy should be directed at encouraging entry of new workers from either unemployment or outside the labour force through various incentives. More generally, as productivity and changing demand reduces demand for workers in their current jobs, policies should focus on facilitating shifts to new jobs. This may require training or moves to areas where jobs are more in demand or where unused labour potential can be integrated into the labour force.

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