Estimating Labour Market Performance in Twenty-Three OECD Countries, 1980-2009

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The purpose of this study is to estimate the relationship between various macroeconomic variables such as output and labour for the 1980-2009 period. In order to indicate the main components of economic growth, I firstly use an alternative growth accounting method, where physical capital accumulation, technological changes and several (un)employment rates are also taken into account. Thus, analysing time series panel data of the USA, the EU-15 and some OECD countries with the rolling regression method, this paper concludes that the link between labour and output has obviously and temporarily changed after the mid-1990s. Hence, results suggested that an increase in output gaps caused a lesser changes in (un)employment rates, which could determine the increasing role of other economic factors i.e. technology, the labour market and political institutions etc.

Key words: *Growth Accounting, Okun's law, (Un)employment rates*
JEL Classification: *C23, E32, E24.*

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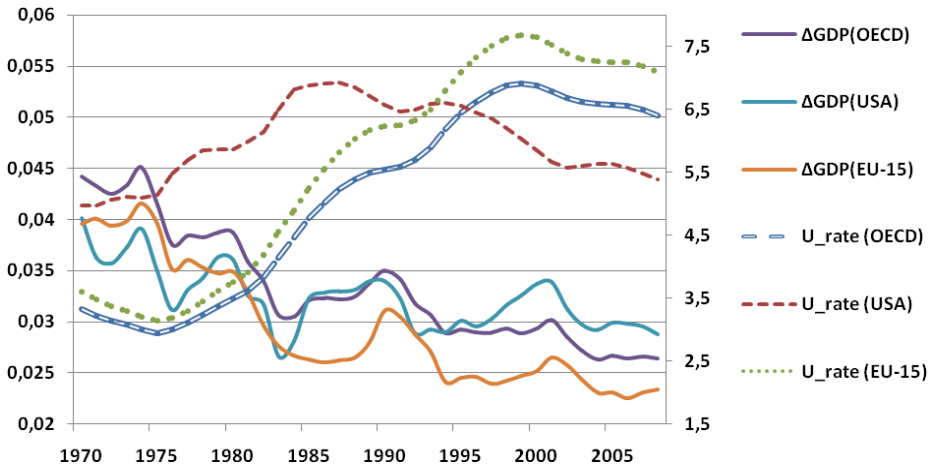
Introduction: the changing macroeconomic environment

Over the last two centuries the developed world has experienced steady and relatively stable economic growth, contributing to a constant improvement in people's living standards. However, employment has usually only been the primary focus of empirical studies in the last decades of 20th century. So the year 1984 is identified in macroeconomics as an important year, as a start of what McConnell and Perez-Quiroz, (2000), Stock and Watson, (2002) called the 'Great Moderation'. The original term comes from the features of the moderate economic activity in the USA, which suddenly and dramatically became less volatile. Nevertheless, this phenomenon has also persisted in other EU-15 and OECD[1] countries to this day. See the tendencies of real GDP and unemployment rates in [Figure 1.].

Figure 1. Changes in economic growth (ΔGDP) and unemployment rates (U_rate) (see right axis), 1970-2009



Source: own calculation based on AMECO Database.
Notes: the GDP is in 2000 constant prices

[1]Australia, Canada, Iceland, Japan, New-Zealand, Norway, South-Korea, Switzerland.

Serious debates have occurred, attempting to explain the increased output stability and declining economic volatility, but essentially no clear theoretical consensus has yet emerged. The most common explanations of Summers (2005), which provide a broad overview of this literature include improved *macroeconomic policies*, *structural changes* and simply a "*good luck*" hypothesis. The first category of these explanations focuses on the arguably improved performance of monetary policies. As Blanchard and Simon (2001), and Willis (2003) concluded the idea is that better monetary policy may have contributed to reduced variability in inflation and increased economic stability both in the United States and other industrial countries. Using a formal econometric model Kim, Nelson and Piger (2003) also found structural breaks in the persistence of inflation and changes in output volatility at about the same time. Explanations also suggest that structural features (i.e. technology, business practices, and other institutions) of the economy have an improved ability to absorb shocks. McCarthy and Zakrajsek (2003) have argued that the improved management of business inventories has reduced the amplitude of fluctuations, which in earlier decades also played an important role. However, the more sophisticated financial markets, market deregulation in many industries, the employment shift from manufacturing toward services and increased openness to trade and international capital flows may have increased macroeconomic flexibility and stability [Kahn–McConnell–Perez-Quiros, 2002]. The third relevant approach pointed out that the Great Moderation did not result primarily from structural changes or better policymaking but occurred because the shocks of last decades became smaller and more infrequent. Several distinct empirical studies have supported this 'good-luck' hypothesis [Shaghil et al., 2004].

Meanwhile, the unemployment rates [in Figure 1.] do not show similar movements to economic growth tendencies. Until the end of the 1990s unemployment in Europe was lower than in the USA. For the

European Union, as a whole, the aggregate unemployment rate level remained at over 7%. But high unemployment, as Blanchard (2005) concludes, is not only a 'European' trait. Attempting to explain the evolution of 'Eurosceloris' over the last three decades he confronts the following stylized facts. (1) The average European unemployment rate hid large cross-country differences, because in a number of smaller countries, notably Ireland and the Netherlands, unemployment was below 5% from the early 1980s. (2) Secondly, in Europe, at a given unemployment rate the period of unemployment and job turnover were substantially longer and lower than in the USA. (3) In the 1970s, the high rate of productivity that had characterized the earlier post-war period came to an end, which could have led to lower capital accumulation and employment growth with higher unemployment. (4) All in all, he concluded that the evolution of unemployment has been very different across countries thanks to the heterogeneity of labour market institutions. The higher social protection, the more generous unemployment insurance with higher benefits and the administrative components of employment protection systems, provided by the European welfare states, obviously resulted in higher unemployment rates.

The primary aim of this paper is to contribute to a better understanding of the interaction between economic growth and labour. So this paper is structured as follows. In section (2), I develop an alternative growth accounting method to factorize the components of output growth based on this concept. In Section (3), I provided a coherent empirical approach for the temporary variations in (un)employment tendencies both across time and across OECD-23 countries. In addition, over the period between 1980 and 2009, the so-called *Okun's* coefficients were estimated by a rolling regression method. Finally, I concluded that the link between labour and output growth has obviously and temporarily changed after the mid-1990s, which could be determined by the increasing role of such economic factors as. technology, labour and political institutions etc.

Growth accounting approach in various OECD countries

In growth accounting approaches as a result of physical capital accumulation, or simply technological changes, the GDP apparently grows in the long run. However, factorizing the components of GDP growth also reflects the fact that economic growth cannot simply be explained by changes in capital stock and technology but labour also expected to play a determining role. First, let us choose a simple neoclassical aggregate production function:

$$Y_t = A_t K_t^{\alpha} L_t^{1-\alpha} \quad (1)$$

Where [Y] is the GDP, [K] and [L] are physical and labour capital in the period [t]. The [A] naturally represents a 'catch all' factor for technology, the role of institutions and other relevant features, which measures how productively capital and labour are used in production. Thus, assume a constant return to scale and similarly define the employment rate as $[e_t] = L_t/LF_t$, where LF denotes the labour force. We also know that the so-called economic activity or participation rate [p] is estimated as $[p_t] = LF_t/N_t$. where [N] is the active population. These equations allow us to express labour as follows: $[L_t] = p_t*e_t*N_t$. Hence, the production function yields:

$$Y_t = A_t K_t^{\alpha} L_t^{1-\alpha} = A_t K_t^{\alpha} (p_t e_t N_t)^{1-\alpha} \quad (2)$$

Taking both sides of equation their logarithm leads to the following log-linear form:

$$\ln Y_t = \ln A_t + \alpha \ln K_t + (1-\alpha) \ln p_t + (1-\alpha) \ln e_t + (1-\alpha) \ln N_t \quad (3)$$

Introduce unemployment to the equation as follows. Let us denote the unemployment rate as [u], where $[u_t] = U_t/LF_t$, so the number of unemployed $[U_t] = u_t*LF_t$. Thus, we also know that the labour force [LF] equals the sum of labour and the unemployed, so $[L_t] = LF_t–U_t$. Hence, $[L_t] = LF_t–u_t*LF_t = LF_t*(1–u_t)$. Denote the active to total population ratio by $[a_t] = N_t/P_t$, where [P] is the total population. Finally, the equation of labour can be substituted as $[L_t] = p_t*a_t*P_t*(1–$

u_t). Since the rate of unemployment is generally not very high (ab. 7.5% as an average, 1980–2004), we can use the approximation that $[\ln(1-u_t)] \approx -u_t$. Hence, replace the labour by the active to total population rate, the economic activity and unemployment rates as in the previous Equation (3).

$$\ln Y_t = \ln A_t + \alpha \ln K_t + (1-\alpha)\ln p_t + (1-\alpha)\ln a_t + (1-\alpha)\ln P_t - (1-\alpha)u_t \quad (4)$$

So the differentiation of Equations (3) and (4), with respect to time, expressed GDP as a function of the growth rate *components*. The residual, which is not explained by these factors, is labelled the Total Factor Productivity (TFP), denoted by A. Using the available time series data[1] of the USA and EU-15 countries from the Groningen University's Growth Accounting [GGDC] and the EC's Annual Macroeconomic Database [AMECO], the growth accounting results are reported in Table 1.

The results are in accordance with expectations. Economic growth after the millennium decreased, and the effects of physical capital have been steady at 0.6 and 0.9 per annum. Thus, physical capital could be given a continually greater weight in equations. Meanwhile, the role of the (un)employment rate, with the exception of the period 1980-1990, had a marginal effect. The sign is however not always positive (or negative) in the case of the unemployment rate, which resulted in a quite significant slowdown in business cycles. Changes in the population rates or equivalently that of the participation rate contributed to economic growth with a magnitude similar to that of physical capital accumulation. Hence, some labour components are more or less relevant in estimations. All in all, according to the results the TFP played a key role in economic growth alongside the technological shocks.

[1] Estimations used time series of physical capital (K), GDP in costant prices, constant return to scale (α), population, civilian employment and unemployment rates.

Table 1
The results of growth accounting equations, 1980-2004

	USA			EU-15		
Period	1980-1990	1990-2000	2000-2004	1980-1990	1990-2000	2000-2004
a(K)	*28,6*	*29,4*	*29,6*	*27,7*	*31,1*	*33,5*
1-a(L)	*71,4*	*70,6*	*70,4*	*72,3*	*68,9*	*66,5*
ΔY/Y	3,34	3,23	2,70	2,56	2,72	2,50
ΔA/A	1,26	1,53	1,24	1,23	1,20	0,60
α·ΔK/K	0,85	0,77	0,84	0,81	0,90	1,07
(1-a)·⊿p/p	*0,47*	*-0,02*	*-0,06*	*0,13*	*0,21*	*0,41*
(1-a)·⊿e/e	*0,12*	*0,08*	*-0,20*	*-0,07*	*-0,05*	*0,03*
(1-a) ⊿N/N	*0,64*	*0,87*	*0,88*	*0,47*	*0,45*	*0,39*
(1-α)·Δa/a	-0,03	0,00	0,18	0,26	0,01	0,00
(1-α)·Δu/u	-0,12	-0,08	0,20	0,07	0,05	-0,03
(1-α)·ΔP/P	0,67	0,87	0,70	0,22	0,44	0,39

Source: own calculation based on annual data from GGDC and AMECO Databases.
Notes: Gross Fixed Capital Stock (K) and GDP (Y) are in 2000 constant prices

How the link between output and labour changed: a literature review and the Okun's postulate revisited

Traditionally Okun's law is commonly measured by the variations between unemployment and real output over the business cycles.

Typically, the negative correlation of GDP growth and unemployment has been named after the economist Arthur Okun, who firstly documented this rule of thumb in the early 1960s [Okun, 1962]. He suggested that a one-percentage point change in the unemployment rates is associated with an approximately three per cent change in output in the opposite direction. This is regarded as a benchmark for policymakers to indicate the cost of increasing unemployment. There are two alternative approaches to estimating this trade-off which feature in the literature, namely a first-difference and a 'gap' model. In this study, as followed by Gordon (1984) and Hsing (1991), the gap model was designed to provide time series behaviour over the cycles. This specification is based on the notion of a 'gap' between actual and equilibrium output and also unemployment rates:

$$\left(u_t - u_t^*\right) = \beta\left(y_t - y_t^*\right) + \varepsilon_t \qquad (5)$$

Where [y] denotes the actual rates and [y*] represents the log of potential or trend level of real GDP, and [y–y*] captures the cyclical level of output (gap) in the period [t], thus [u–u*] yields the deviation between the actual and natural rate of unemployment (the unemployment gap). Thus, [β] can be interpreted as the Okun's coefficient, which was estimated originally for the USA between 1948 and 1960. Although the rule in other case studies has been checked empirically many times i.e. by Kaufman (1988) and Prachowny (1993), but this negative correlation still seems to exist. However, the values of the coefficient vary with time and differ across countries by around 0,1 and 0,7 [Paldam, 1987], [Moosa, 1997], [Lee, 2000].

The estimations presented in this article also consider the usefulness of Okun's law for policymakers and economists. The concept of usefulness focuses on two main questions. First, does this rule of thumb show a reliable relationship across OECD-23 countries? Second, is the postulate a useful tool to indicate the changing macroeconomic tendencies?

Nevertheless, directly unobservable information is needed regarding both the natural unemployment rate and potential output. One of the most widely held concepts of potential output is the level that represents a balanced state of the economy [Giorno et al., 1995]. This balance provides a sustainable noninflationary growth path of output. Stable inflation also corresponds to a natural level of unemployment due to the theoretical Phillips-curve consideration [Phillips, 1958], which is related to a certain level of output via the Okun's law [Torres et al., 1990]. According to another line of theorising by Friedman (1968), on the natural rate hypothesis, the unemployment rate cannot deviate permanently from its natural rate, which implies that it converges to the structural rate in the absence of shocks. However, the natural rate is not easy to measure even for developed countries because of certain structural and hysteresis problems.

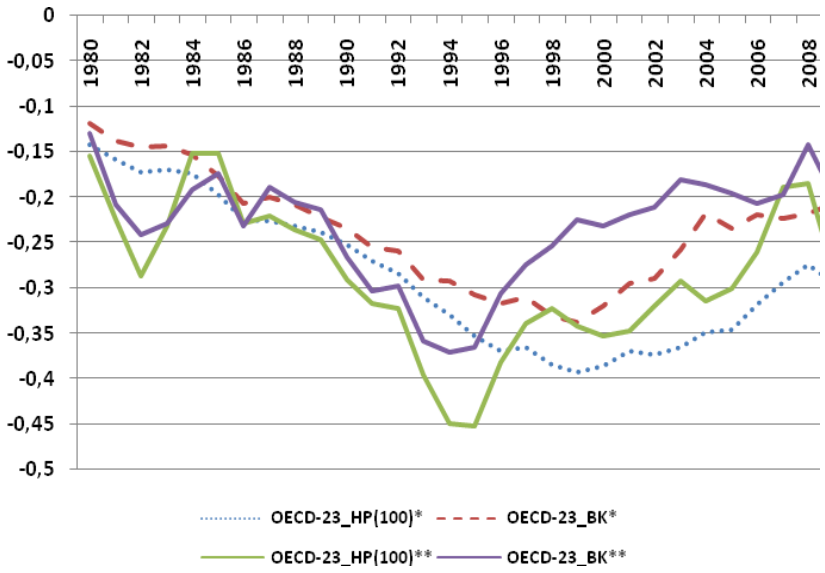
Unfortunately, there is no consistent agreement on the proper procedure that generates these natural and potential trends. The traditional business cycle literature often defined cyclical and long-run components as revealed by the Hodrick-Prescott filter [Hodrick–Prescott, 1980]. In the AMECO Database are only yearly panel data are available for the existing period, so I decompose the series with a commonly accepted smoothing parameter set at 100. An extremely wide-ranging survey by Canova (1998) compared the properties of several univariate methods and found that both detrending filters extract different types of information from the data. All of them are heavily criticized from different aspects, but generally, if another i.e. band-pass filter concludes the same consistent tendencies we could accept these results. All in all, I still use an alternative approach by Baxter and King (1999) in estimations, which overcomes to some extent the well known drawbacks of high-pass filters.

In addition, my results in comparison with an earlier empirical study by Knotek (2007) have been expanded for 23 OECD countries. Such a long time period from 1980 to 2009 can hide the correspondence between the economic factors. To capture this variation, this article

uses a rolling regression method, which could estimate a particular relationship over many different sample periods. Each regression produces an estimated set of coefficients and variations. Since the World War II, as classified by the National Bureau of Economic Research Institute, no economic expansion in the USA has lasted more than ten years. Hence, each 11-year sample period is probably guaranteed to contain the data from at least one recession. In order to stabilize the relationship over time, I used another 6-year sample period, where the models were still significant and the coefficients relatively sensitive to business cycles.

Figure (2) represents the rolling regression estimates for the different periods. Several features can be seen from this Figure. First, the same consensus estimates are highlighted with two different univariate filter methods. Second, the Okun's coefficient has been consistently negative (0.12–0.45) and varied considerably over time and over business cycles. Third, each set of [β] parameters experienced moderate fluctuations (except for the years of early 1980s and 1990s), but in particular around the mid-1990s they suddenly increased. This suggests that the link between unemployment rates and output growth has obviously and temporarily changed. In other words, an increase in output gaps caused lesser decline in unemployment rates. However, the onset of the Great Moderation does not appear to play a relevant role in driving changes in Okun's coefficient. In the mid-1980s the changes should affect the estimates around the year 1990 because of the 6-year sample periods. Hence, Okun's law may not be able to provide extraordinary information about changing macroeconomic trends in labour markets and output fluctuations, so more empirical approaches and methods are needed to indicate the structural changes.

Figure 2 Rolling regression estimates of Okun's coefficients



Source: own calculation based on AMECO Database.
*Notes: (1) real GDP in constant prices. (2) using an * 11-year annual and a ** 6-year sample period. (3) the p-values of [β] coefficients are under 0,01 in all period. (4) t-stats and R^2 are in appendix.*

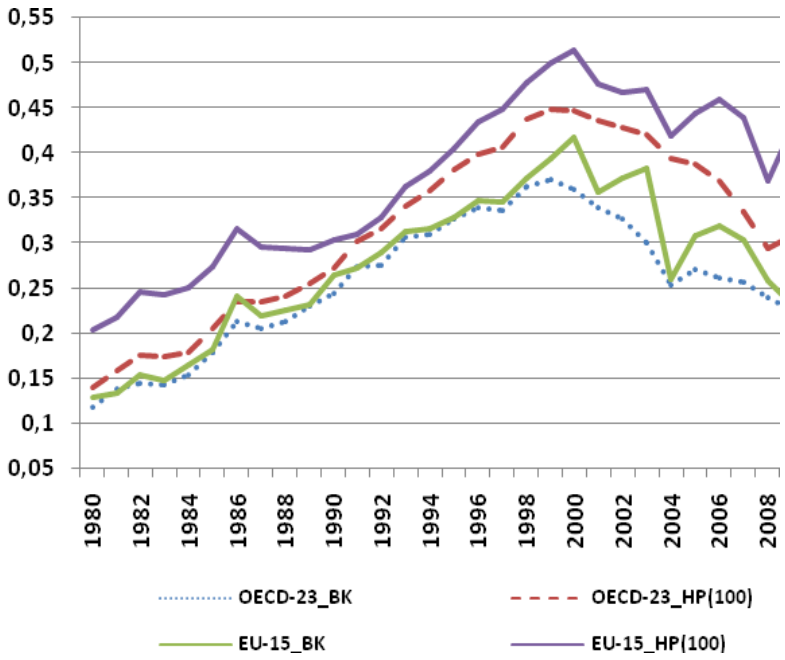
Finally, let us exam how employment rates respond to the changes to output growth. So, define the employment rate as $[e_t] = L_t/LF_t$ and Equation (6) denotes similarly the gaps of actual and trend rates:

$$\left(e_t - e_t^*\right) = \gamma\left(y_t - y_t^*\right) + \varepsilon_t \quad (6)$$

The [γ] parameter can be interpreted as a coefficient, which indicates the relationship between employment and output growth. I again use the HP(100) and BK-filter to detrend cyclical and trend components in estimations for EU-15 and OECD-23 countries. Figure (3) shows the same findings that the [γ] coefficient has consistently been positive (0.12–0.51) and varied over time but the correspondence between these two factors has changed after the mid-1990s in both countries.

In other words, an increase in output gaps obviously caused lesser changes in employment rates.

Figure 3 Rolling regression estimates of [γ] coefficients



Source: own calculation based on AMECO Database.
Notes: (1) real GDP in constant prices. (2) using 11-year annual sample period. (3) the p-values of [γ] coefficients are under 0,01 in all period. (4) t-stats and R^2 are in appendix.

Conclusions

This paper was concerned with the phenomenon of the 'Great Moderation'. It concludes that the relationship between economic growth and labour has been transformed over the last few decades. The author was pointed out that these changes cannot have occurred thanks only to good luck but that cyclical responsiveness was seemed

to be essential to understanding them. Hence, this article has shed light on the dynamics of labour market and economic growth performances for various OECD countries. According to the growth accounting, the TFP played a key role in economic growth with a change of magnitude similar to that of physical capital and labour accumulation. In addition, estimating the Okun's rule of thumb with an alternative rolling regression method, results suggested that an increase in output gaps caused lesser changes in (un)employment rates after the mid-1990s.

These interesting findings may reveal a serious dilemma for policymakers because nowadays, compared to the 1990s, the macroeconomic environment does not seems to aid the *ex post* acceleration of (un)employment rates through expansive fiscal and monetary policies. My estimations concluded only the changing tendencies that indicate the increasing role of such economic factors i.e. technology, labour market and political institutions. In particular, over the last few decades the slightly declining inflation also suggests that the natural rate is probably closer to the (un)employment rates. Hence, deliberate government measures can only be successful in the long-run if they alter the aggregate supply side for the favourable natural rate of labour and potential output growth.

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Appendix

Table 2 The t-stats of [β] coefficients and R^2 results of Okun's law in different periods

	OECD-23_BK		OECD-23_HP			OECD-23_BK		OECD-23_HP	
Period	**t_stat**	**R^2**	**t_stat**	**R^2**	**Period**	**t_stat**	**R^2**	**t_stat**	**R^2**
1970-1980	-5,28	0,33	-6,62	0,31	**1970-1980**	-4,50	0,34	-3,42	0,28
1971-1981	-5,71	0,31	-6,94	0,30	**1971-1981**	-5,95	0,39	-4,98	0,31
1972-1982	-5,67	0,32	-7,10	0,35	**1972-1982**	-6,46	0,45	-5,18	0,31
1973-1983	-5,16	0,31	-6,68	0,41	**1973-1983**	-5,18	0,44	-4,65	0,28
1974-1984	-5,37	0,32	-6,78	0,42	**1974-1984**	-3,62	0,44	-3,93	0,28
1975-1985	-5,97	0,27	-7,62	0,39	**1975-1985**	-3,91	0,44	-3,67	0,25
1976-1986	-6,88	0,31	-8,84	0,43	**1976-1986**	-6,82	0,51	-5,57	0,23
1977-1987	-6,82	0,30	-9,08	0,45	**1977-1987**	-6,34	0,55	-4,60	0,17
1978-1988	-7,33	0,33	-9,72	0,50	**1978-1988**	-7,07	0,67	-5,44	0,27
1979-1989	-7,78	0,35	-9,89	0,55	**1979-1989**	-7,67	0,68	-6,63	0,39
1980-1990	-8,15	0,41	-10,22	0,59	**1980-1990**	-9,23	0,66	-8,05	0,49
1981-1991	-9,35	0,42	-11,62	0,61	**1981-1991**	-11,46	0,67	-9,27	0,49
1982-1992	-9,60	0,42	-12,78	0,63	**1982-1992**	-11,83	0,69	-8,66	0,48
1983-1993	-10,91	0,50	-14,36	0,67	**1983-1993**	-12,19	0,75	-8,87	0,58
1984-1994	-11,24	0,51	-14,95	0,67	**1984-1994**	-12,10	0,75	-8,90	0,58

1985-1995	-11,66	0,51	-15,56	0,66	**1985-1995**	-10,73	0,68	-8,13	0,53
1986-1996	-12,07	0,53	-16,00	0,67	**1986-1996**	-8,86	0,60	-6,68	0,42
1987-1997	-11,30	0,51	-15,11	0,66	**1987-1997**	-8,73	0,64	-6,26	0,45
1988-1998	-11,60	0,53	-15,32	0,67	**1988-1998**	-8,76	0,71	-5,66	0,50
1989-1999	-11,62	0,52	-15,24	0,66	**1989-1999**	-8,90	0,67	-5,18	0,34
1990-2000	-10,57	0,51	-14,58	0,65	**1995-2000**	-9,10	0,65	-5,50	0,31
1991-2001	-9,60	0,48	-13,98	0,64	**1996-2001**	-8,21	0,62	-5,05	0,38
1992-2002	-9,36	0,50	-14,23	0,66	**1997-2002**	-6,92	0,58	-4,49	0,36
1993-2003	-8,06	0,49	-13,07	0,66	**1998-2003**	-6,99	0,64	-4,19	0,42
1994-2004	-7,13	0,41	-12,12	0,62	**1999-2004**	-8,57	0,72	-4,41	0,47
1995-2005	-7,56	0,38	-11,83	0,57	**2000-2005**	-7,65	0,66	-4,54	0,47
1996-2006	-6,98	0,38	-10,64	0,54	**2001-2006**	-5,60	0,54	-4,25	0,36
1997-2007	-6,54	0,39	-9,72	0,55	**2002-2007**	-4,19	0,54	-3,48	0,18
1998-2008	-5,97	0,41	-9,15	0,52	**2003-2008**	-4,21	0,51	-2,26	0,26
1999-2009	-5,19	0,42	-9,67	0,58	**2004-2009**	-6,03	0,51	-2,56	0,51

Source: own calculation based on AMECO Database.

Table 3 The t-stats of [γ] coefficients and R^2 results in different periods

	OECD-23_BK		OECD-23_HP		EU-15_BK		EU-15_HP	
Period	**t_stat**	**R^2**	**t_stat**	**R^2**	**t_stat**	**R^2**	**t_stat**	**R^2**
1970-1980	5,28	0,33	6,57	0,32	4,45	0,36	6,17	0,34
1971-1981	5,71	0,31	6,94	0,31	4,40	0,34	6,48	0,36
1972-1982	5,66	0,33	7,26	0,37	4,68	0,38	6,99	0,45
1973-1983	5,16	0,31	6,83	0,42	4,19	0,35	6,64	0,47
1974-1984	5,38	0,32	6,93	0,43	4,44	0,37	6,62	0,49
1975-1985	5,96	0,28	7,82	0,41	4,46	0,31	6,86	0,44
1976-1986	6,95	0,32	9,09	0,45	5,53	0,35	8,01	0,48
1977-1987	6,85	0,31	9,29	0,47	4,99	0,33	7,68	0,46
1978-1988	7,35	0,33	9,96	0,52	5,29	0,35	8,17	0,51
1979-1989	7,89	0,37	10,44	0,57	5,37	0,39	8,31	0,59
1980-1990	8,26	0,43	10,88	0,62	6,31	0,50	8,69	0,67
1981-1991	9,66	0,44	12,78	0,65	6,87	0,52	9,54	0,72
1982-1992	9,87	0,44	14,01	0,66	7,50	0,52	10,65	0,73
1983-1993	10,98	0,52	15,40	0,70	7,81	0,54	11,63	0,73
1984-1994	11,38	0,53	15,82	0,69	7,85	0,57	11,62	0,72
1985-1995	11,85	0,53	16,40	0,69	7,98	0,56	11,95	0,72
1986-1996	12,34	0,55	16,98	0,70	8,45	0,59	12,77	0,74
1987-1997	11,70	0,53	16,54	0,70	7,75	0,56	12,53	0,74
1988-1998	12,14	0,55	17,28	0,72	8,20	0,58	13,33	0,76
1989-1999	12,16	0,55	17,31	0,71	8,48	0,58	13,58	0,76
1990-2000	11,32	0,54	16,67	0,70	8,22	0,58	12,91	0,75
1991-2001	10,42	0,51	16,02	0,69	6,32	0,53	11,01	0,72
1992-2002	10,00	0,52	15,78	0,70	6,89	0,55	11,25	0,73
1993-2003	8,69	0,51	14,37	0,69	6,39	0,55	10,67	0,72
1994-2004	7,77	0,43	13,27	0,65	4,60	0,47	9,08	0,68
1995-2005	8,20	0,40	12,96	0,61	5,01	0,43	8,99	0,66
1996-2006	7,75	0,40	12,00	0,59	4,91	0,43	8,60	0,65
1997-2007	7,08	0,41	10,71	0,58	4,35	0,42	7,69	0,62
1998-2008	6,23	0,42	9,43	0,53	3,60	0,44	7,23	0,59

1999-2009	5,37	0,42	9,97	0,59	3,06	0,45	9,50	0,65

Source: own calculation based on AMECO Database.