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The persistence of Okun's Law and how to weaken it

Policy Paper no 23

Author: Stefan Marth (WIFO)

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WIFO

How strong is the correlation between unemployment and growth really?

The persistence of Okun´s Law and how to weaken it

MARTH Stefan
Junior Fellow at the Austrian Institute of Economic Research

We examine Okun´s Law on the basis of new growth perspectives and in the context of the WWWForEurope project. By comparing Okun´s work from 1962 with the latest IMF and OECD surveys, a connection is set up and Okun´s theoretical framework is updated and its persistence is examined. In addition, the implicit logic of Okun´s Law is expressed and stressed, and literature is reviewed from this point of view as well. Furthermore, the main implicit component of Okun´s Law - productivity - is taken into account when discussing its breakdown in the WWWForEurope context. After applying the „Difference method", we derive the conclusion that the Okun coefficients and intercepts vary substantially between countries.

Keywords: Okun´s law, heterogeneity, technological progress, labour market interventions

JEL Codes: JO3, JP28, JB2, JB4 and JH2

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1. Introduction

Representatives and top economists of countries all over the world have been asking themselves which political measures to take in order to fight unemployment. As unemployment is the source of economic depression, crime and drifting apart of the society, measures have to be taken against it. According to many economic schools of thought, such as the Keynesian, the most important goal is to increase employment. Employment can be generated by triggering growth.

But the following questions still remain: What rate of growth is actually necessary to increase employment? And secondly, especially in the EU-28, where labour mobility is high in comparison to earlier times: What growth rate is necessary to really reduce unemployment? Today we can predict that future growth will be lower than past one. As a consequence of this, higher growth rates will not be observable, even if policy measures target this. Moreover, growth can not be triggered by increased energy consumption and emissions, if the stop of the ongoing men made climate change is desired. In addition, unemployment and public deficits are big dilemmas in Europe, therefore solutions have to be presented addressing those problems.

The WWWForEurope project focuses on those low-growth scenarios and tries to give solutions to the current debate of how to generate clean and sustainable (i.e. *green*) growth in an increasingly competitive environment.

First of all, what is the WWWForEurope project? This projected started in April 2012 as a four year research project funded by the European Commission. The overarching question for the Project is to present a new European growth and development strategy, including a socio-ecological transition to high levels of employment. Furthermore Beyond-GDP goals, such as well-being of citizens, social inclusion, resilience of ecological systems (including climate stability) are mainly addressed in this project. Policy recommendations are given to achieve the socio-ecological transition towards the new European strategy. We contribute to this new thinking by proposing how we could generate employment in a low *green growth* scenario. Because of this, this paper tries to find an answer to the following main question: How strong is the correlation between unemployment and growth?

Okun´s Law expresses this key stylized fact: The relationship between unemployment and growth.

In the 2nd section we will present general definitions of employment and unemployment. In addition to this, the historical context of these concepts will be presented to the reader shortly. Section 3 deals with Okun´s famous work from 1962, which gave the substantial advice to policy makers to generate growth in order to fight unemployment. His paper will be reviewed and compared to several viewpoints from different economic schools of thought. Section 4 consists of a brief literature review on the topic. Section 5 includes some relevant stylized facts on the topic. In the 6th section, we will stress the heterogeneity of different countries for Okun´s Law. The 7th section discusses possibilities of how to break down Okun´s Law. Section 8 investigates Okun´s Law for 12 OECD countries for the period between 1960 and 2015 by using Okun´s "Difference method". Section 9 concludes.

2. Employment

As an introduction, we will give an overview over the definitions of employment and unemployment. This is to form a general understanding about the main variables forming Okun´s Law.

2.1 Definition of employment and unemployment

2.1.1 Employment

First, we will give a very brief overview of what is meant under the term "being employed". In my opinion, the International Labour Organization (ILO) gives the most accurate guidelines in this field, and therefore we will introduce shortly their International Classification of Status in Employment (ICSE, namely the ISCE-93)[1]:

"This classification is a set of discrete values which can be assigned to the variable "type of contract which a persons has with other persons or organizations when performing a particular job" (ILO). The following groups belong to this new classification:

1. Employees – who get a basic remuneration not directly dependent to the revenue of the employer
2. Employers – who hold self-employment jobs (remuneration depends on profits), engage one or more persons to work for them (employees)
3. Own-account workers – self-employed, do not engage employees
4. Members of producer´s cooperatives – who hold self-employment jobs in a c-operative producing goods and services
5. Contributing family workers – self-employed in an establishment operated by a related person, but too limited degree of involvement to be considered a partner
6. Workers not classifiable by status – insufficient relevant information is available, and/or who cannot be included in any of the preceding categories

Those categories were designed so that they are mutually exclusive and exhaustive and categorization to only one of them is possible.

Next, we will give a short insight into the structural change of employment over time. Even if Okun´s Law has nothing to do with the structure of the economy, it is still useful to have a

[1] For further details please visit the website of the ILO: http://ilo.org/global/statistics-and-databases/statistics-overview-and-topics/status-in-employment/current-guidelines/lang--en/index.htm

comprehensive understanding of how Okun´s observations can be classified (Fig. 1 – Development of employment , see Fig. 1).

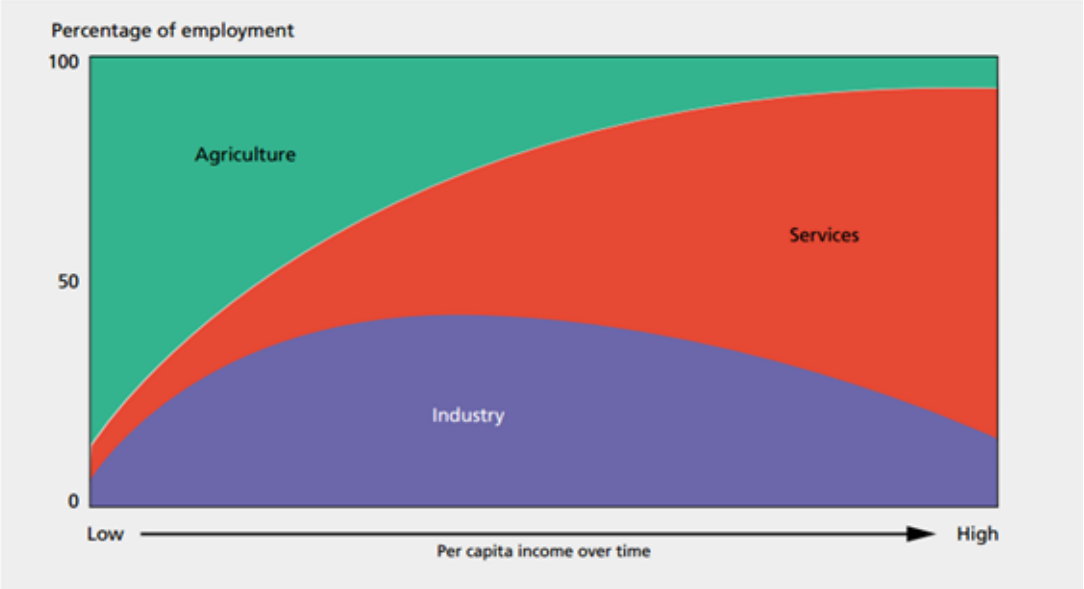

Fig. 1 – Development of employment (Soubbotina & Sheram, 2000, p. 51)

Fig. 1 shows that the share of the services sector in relation to employment as a whole increases as income per capita gets larger over time. In 2012, the European Union´s shares of employment were as follows (World Bank, 2012):

- Agriculture 1.8%
- Manufacturing 25.2%
- Services 72.8%

Okun used data from 1947 – 1960, when the services sector played only a minor role, and the industrial sector took the greatest share of the economy.

2.1.2 Unemployment

When defining unemployment, we will again use the ILO international standard definition, as those criteria describe it most accurately[2].

Basically, the following three main criteria should be satisfied simultaneously:

- Without work (i.e. not being in paid employment or self-employment)

[2] For further details in this issue see: http://laborsta.ilo.org/applv8/data/iloce.pdf

- Currently available for work (i.e. being available for paid employment or self-employment during the reference period)
- Seeking for work (i.e. having taken specific steps in a specified reference period to seek paid employment or self-employment)

First, people who have future engagements (not in the reference period) should still be regarded as being "unemployed". Second, persons temporarily temporarily not attending work should be regarded as unemploymed if their absence was not accompanied by a formal lay-off. Third, according to the ILO, *availability for work is being interpreted as the ability and readiness to work. However, the person needs to be provided with a work opportunity*. This criterion is included is, because the ILO wanted to exclude people who are seeking work to begin at a different date (later), and to exclude those who cannot start work for reasons such as studies, family responsibilities, etc.

Various types of unemployment will be presented next, as well as economic explanations causing them.

2.1.2.1 Structural unemployment

According to IMF (IMF, 2010) e.g. sectoral shocks such as large house price busts raise unemployment beyond the level predicted by Okun´s Law (we will go into more detail later on). Very often structural unemployment problems come to the daylight as a consequence. Structural unemployment occurs if there is a mismatch between demand and supply in an economy. Those inefficiencies occur if a labour market does not provide suitable jobs for everyone who is seeking for a job. A deeper explanation might be that the skills of the unemployed people do not match the jobs available.

Another potential impact on structural unemployment may be external shocks. Such shocks are for instance the replacement of workers in a production line due to automatisation, or simply the unemployment caused by foreign competition.

An additional driver of structural change within the labour market can be the boom-bust effects of the housing market. This can be in a way that the bursting of a housing bubble causes a shift in the labour market away from construction (sectoral reallocation). Milton Friedman described structural unemployment as the 'natural' rate of unemployment that the economy would settle in the long run in the absence of shocks. Orlandi (Orlandi, 2012) emphasized the absence of shocks here, because shocks could cause a higher rate of structural

unemployment. Take for example the oil crisis from 1973 and 1979/1980, where the rise in oil prices triggered labour market structures to alter.

Structural unemployment can be measured with a so-called unobserved component model, where short term fluctuations are removed. (For further technical background on this matter see (Orlandi, 2012)). The geographical component is also included in this type of unemployment, geographical immobility should be reduced in order to combat structural unemployment. Structural change, Globalisation and Capital replacement are often main drivers of structural unemployment as well.

Another main source of structural unemployment could be collective negotiations. In this case the bargaining power of trade unions could be harmful to the economy. An example of this is Spain, where the only beneficiaries of collective negotiations were the ´insiders´ who held jobs with permanent contracts and high levels of employment protection[3]. Those people pushed the wages up during the crisis, making even more people redundant.So collective negotiations can be a source of structural unemployment if misused.

2.1.2.2 Frictional unemployment

The second type of unemployment is called frictional unemployment. This refers to the time period when a transition takes place for people switching to their future jobs. The sources of frictional unemployment include people entering the workforce after school, or their re-entering the workforce after having raised children. However, frictional unemployment also refers to the time span when people change jobs because they move or they just want to change their careers because of different interests.

Those arguments have to be distinguished from the arguments of structural unemployment when we talk about workers getting fired, which is also a part of frictional unemployment. In general we can say that this is more individual-based than the structural approach, as this is heavily influenced by voluntary decisions. The capabilities of an individual would even make it worthwhile sometimes to refuse a job offer just to wait for a more attractive one. According to Diamond (1980) this implies that the equilibrium will generally not be efficient due to this externality.

[3] Álvarez and Miles-Touya (2012) examined those rigidities with respect to the structural unemployment in more details.

Another main aspect which influences frictional unemployment is the internet-based job matching. If firms value the firm-specific knowledge they have, and do not get people redundant (even in downturns) and do not have the possibilities to replace employees with equivalent skills by the internet easily, this form of unemployment is going to be low.

2.1.2.3. Cyclical unemployment

Cyclical unemployment refers to the lack of aggregate demand in an economy (therefore it is often referred to as Keynesian unemployment). It means that the number of unemployed workers supercedes the number of job vacancies as less production needs less workers. Another view might be the change in sectoral demand within an economy.

Abraham and Katz demonstrated that aggregate demand movements can produce a positive correlation between the growth rates across sectors and the unemployment rate. The results in this paper support the perspective that mere sectoral shifts have not been an essential source of cyclical unemployment fluctuations. The sectoral shift here refers to a change in demand for workers in certain sectors. If workers were perfectly mobile and substitutable (perfectly trained), no such shift would have an effect on the economy, as workers simply get hired by an expanding firm after getting redundant by a firm going bust. As this is not the case, cyclical unemployment takes place in the real world (Abraham & Katz, 1984).

3. Okun´s law

This section introduces the original work from Arthur Okun (Okun, 1962). By using three different methods, Okun derived the main conclusion that a *three percent increase of real GNP leads to a reduction of unemployment of one percent* and *a one percent increase in unemployment leads to a three percent reduction in real GNP*. This is a very essential fact when formulating desirable economic policies. All three methods are introduced in this chapter, although greater focus is laid on Okun´s "first difference" method and his "gap" method. At first, the theoretical framework is built up and compared with the current literature in this field. Afterwards, Okun´s empirical results are presented based on the previous framework. The implicit logic of Okun´s ´security´ version is followed by comparing neoclassical and Keynesian viewpoints in this matter. The last part deals with alternative approaches.

3.1 Revisiting the work of Okun

"How far we stand from the target of full employment output is important information in formulating fiscal and monetary policy." (Okun, 1962, p. 98)

When Arthur Okun developed the concept of Okun´s law in 1962, he tried to explain the relationship between the unemployment rate and the change in output. Based on U.S. data over the period from 1947-1960, he suggested that "each additional percentage point in the unemployment rate above four percent has been associated with about a three percent decrement in real GNP." (Okun, 1962, p. 99)

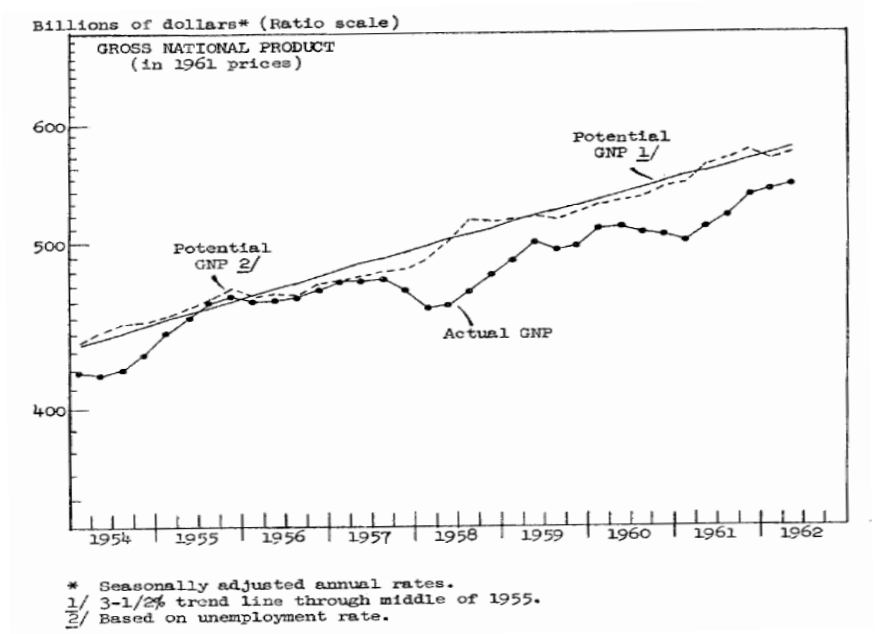

Fig. 2 – Gross National Product (Okun, 1962)

In Fig.2, Okun illustrated how potential GNP fluctuated around its trend growth rate in the period from 1954 to 1962. The "gap" between actual and potential GNP can be obtained from this diagram as well.

In order to be able to estimate the necessary growth rate to reduce unemployment, one relies on binding macroeconomic statistics and assumptions. Okun´s main assumptions were

1) Full employment at 4 percent
2) The labor force consists of people having a job and are currently seeking for a job (no hidden reserves)

3) Technological knowledge, capital stock, natural resources, skill and education are taken as they exist

In addition to this, he emphasized the fact that the output loss would exceed the 3 percent rate in late expansion and recession periods, and would be slightly less than 3 percent in early expansion (Okun, 1962, p. 103). This output loss causes unemployment to rise more in late expansion. Plus, this is the first causal direction in Okun´s logic*: A loss in output causes unemployment to rise since workers get redundant*. The reverse direction´s logic is that *unemployment causes people to spend less, therefore a decline in output sets in* since demand is not given any more.

The simplicity of this model is the main reason why it is questioned by many economists: Mankiw (Mankiw, 1994) suggested Okun´s rule of thumb would be closer to two than to three. But why did they call it „rule of thumb"?

As Knotek stated, the unemployment rate, as well as the growth rate, „varied considerably over time and over the business cycle". However, he claimed, Okun´s law might still be effective as a forecasting tool, provided people take its instability into consideration. Furthermore, he claimed that in reality *Okun´s law would be a „statistical relationship rather than a structural feature of the economy"* (Knotek, 2007, p. 73)

The reason for this quote is based also on U.S. data from the beginning of 2003 until the first quarter of 2006: During that period the Real GDP in the U.S. grew at an average annual rate of 3.4 percent. During this period, the unemployment rate continued to decline. An answer to this puzzle was given by Arthur Okun: According to Okun´s law, unemployment was supposed to fall. However, when growth slowed to less than 1.7 percent, unemployment still continued to decline. How is this possible?

Knotek argues that Okun´s conclusion is based on the assumption that more labour is required to produce more goods and services within an economy. However, more labour can also mean, that employees work longer hours, not just more workers are hired. It is important to mention here that those are arguments which support Okun´s Law in the long-run. In the short-run, however, it does not necessarily have to be the case that a loss of total output leads to an (immediate) increase of unemployment (Knotek, 2007).

3.2 Theoretical framework of Okun´s Law

When presenting the theoretical framework of Okun´s Law one needs to understand the various methods Okun used in his paper. He grounded his main conclusions that a *one percent increase in output is associated with a 0.3 percent decrease in unemployment* as well as a *one percent increase in unemployment is associated with a three percent decrease in output growth* on three methods: The difference method, the gap method and the dynamic approach. In this section we will present those methods with their adhering theoretical foundations.

3.2.1 The difference method

First of all, Okun described the difference model as how *percentage* changes in the real growth rate at a pre-defined period of time (often quarter of a year in his paper) affected the change in the unemployment rate *in percentage points* for the same period of time.

This assumption can be written down in a formula[4], where

(1) $$\Delta U_t = \alpha + \beta \Delta log Y_t + \Delta \varepsilon_t.$$

Here Δ symbolizes the *absolute change* from the previous period[5], α symbolizes the constant, β symbolizes the Okun coefficient, U_t is the unemployment rate at period t, Y_t is the growth rate of output (*log* since we talk about percentage changes) and ε_t is the error term.

The intercept α has a special role here: It equals the change in unemployment if economic growth is zero. A high value of the intercept suggests greater difficulties in reducing unemployment or that stronger growth is required to prevent from more unemployment. Usually, countries like Spain have very high Okun´s Law intercepts. (IMF, 2015)

Out of (1) you can derive the ratio "$-\frac{\alpha}{\beta}$" as the "rate of output growth consistent with a stable unemployment rate, or how quickly the economy would typically need to grow to maintain a given level of unemployment." (Knotek, 2007, p. 75)

β should be negative since a rise in output growth is associated with a drop in unemployment (vice versa).

If we now consider the case that many countries are included in the specification, we need to adjust formula (1) to[6]:

[4] see (Ball, et al., 2012) or (Knotek, 2007)
[5] i.e. if unemployment in period t-1 was 5% and in period t it is 4% than the absolute change is +1%

(2) $$\Delta U_{i,t} = \alpha + \sum_{i=2}^{N} \beta_{1,i} c_i + \sum_{i=1}^{N} \beta_{2,i} c_i \Delta log Y_{i,t} + \varepsilon_{i,t}$$

Here $\Delta U_{i,t}$ is the change in unemployment in country i at year t, c_i is the dummy variable for country i (other than for country 1 in order to avoid perfect collinearity) and $\Delta Y_{i,t}$ is output growth for country i in period t.

Our empirical analysis is based on equation (1), we calculate the Okun coefficient for each country separately.

Lee was an outliner in the literature. He took Y_t as the dependent variable, making the constant α in this case an intercept term capturing the mean growth rate (*in our case however, variable α represents the rise in unemployment if we perceive a zero output growth*). (Lee, 2000)

He furthermore stated the problem of cointegration which would in addition lead to a higher Okun coefficient. His formula is therefore misspecified if output and the unemployment series are not only individually integrated, but are also cointegrated.

This coefficient is usually negative, as rapid output growth is associated with a falling unemployment rate, and vice versa a slow or negative growth rate is associated with a rising unemployment rate.

3.2.2 The gap method

The intuition of this approach is to set up a connection between the level of unemployment to the "gap" between potential output and actual output. Okun declared this fact in the following sense: "If, in fact, aggregate demand is lower, part of potential GNP is not produced; there is unrealized potential or a ´gap´ between actual and potential output." (Okun, 1962, p. 99)

The following intuition is based on the paper of Ball et al.: We presume now that potential levels of output, employment, and natural rates of unemployment exist. According to Okun, the potential output is determined by the country´s productive capacity and if it changes, this is due to technological changes or factor accumulation. The long-run levels of employment and the natural rate of unemployment depend on the size of the labor force and on frictions in the labor market (Ball, et al., 2012).

[6] based on IMF (2015)

According to Ball et al., it is better to measure potential output and the natural unemployment as accurately as possible, than to assume a constant equilibrium unemployment rate and a constant potential growth rate as *it is implicitly assumed in (1)* (Ball, et al., 2012).

Now, we assume that shifts in aggregate demand cause output to fluctuate around its potential level. Due to this movements, firms hire and fire workers and therefore change employment. And if employment changes, unemployment changes also (in the opposite direction). We can now derive the following formulas for those two assumptions:

(3) $$E_t - E_t^* = \Upsilon(Y_t - Y_t^*) + \omega_t, \text{ with } \Upsilon > 0$$

and

(4) $$U_t - U_t^* = \delta(E_t - E_t^*) + \mu_t, \; with\; \delta < 1$$

Where E_t is the log of employment, Y_t is the log of output, U_t is the unemployment rate and * symbolizes the potential level.

If we now substitute (3) into (4), the gap version of Okun´s Law can now be derived:

(5) $$U_t - U_t^* = \beta(Y_t - Y_t^*) + \varepsilon_t, \; with\; \beta < 1$$

Where $\beta = \Upsilon\delta$ and $\varepsilon_t = \omega_t + \delta\mu_t$. The Okun´s coefficient β now depends on the coefficients in the two relationships that are the basis of this law (which would be another mathematical expression than what (Gordon, 1984) proposed).

Okun took a slightly different approach in his "gap" version which was explained by Knotek: A high rate of unemployment is typically associated with idle resources. Therefore actual rate of output is below its potential (Okun, 1962) (Knotek, 2007).

This intuition can now be written as

(6) $$U_t = U_t^* + \beta(Y_t^* - Y_t)$$

Where U_t is the unemployment rate at period t, U_t^* is the unemployment rate associated with full employment, and β is the (Okun) coefficient which would need to be positive to confirm the intuition that actual output (Y_t) is below its potential one (Y_t^*).

Again, the simplicity of the law could lead to various problems. The main one: How should we define the potential output of an economy? For this reason, many variations and proposals

were brought up by economists which differ substantially from Okun´s work. An explanation for (6) is that if output falls below potential, this gives rise to a negative output. This in turn would trigger unemployment to increase. In contrast, if actual output exceeds potential output, unemployment is expected to fall. Chamberlin defined the potential output as the equilibrium level of output where the economy can grow without experiencing inflationary or deflationary pressure (Chamberlin, 2011).

Here in this version, unemployment and output trends are necessary. This opens up room for many procedures of how to generate those trend series. Lee used three alternative methods to overcome the criticism here: the Hodrick-Prescott (HP filter), the Beveridge-Nelson filter (BN filter), and an unobserved component framework estimated with the Kalman filter. Again, Lee is an outsider in the literature, taking the output gap as the predictor variable on the left (Lee, 2000).

3.3 Okun´s results

After having looked at the methods by which Okun formed his general proposal, we can now derive his conclusion in more detail. At first we will look at his "Difference method", which is symbolized by (1).

By taking equation (1) into consideration we can now have a look at his results[7]:

(7) $$U_t = 0.3 - 0.3Y_t \quad (R^2 = 0.79)$$

Where U_t is the *absolute change* in the unemployment rate (*measured in percentage points*) from period t-1 to t, and Y_t is the percentage change in real GNP from period t-1 to t.

As a consequence we can say that this version captures the contemporaneous movements between unemployment and growth. In his paper, Okun proposed that real GNP remains unchanged if unemployment rises by 0.3 percentage points. The reason for this are secular gains in productivity and growth in the labour force, both factors for pushing up the unemployment rate. Those effects would be captured by a disturbance term, which is not explicitly shown in Okun´s equation, but is only assumed due to the R^2 of 0.79. Ball et al. concluded this disturbance term to be really small, meaning "Okun´s Law fits well in general" (Ball, et al., 2012).

[7] In Okun´s work the formula is Y = 0,3 – 0,3X (Y = unemployment rate, X = percentage change in real GNP), but since we keep the terminology straight we named the variable $Y = U_t$ and $X = Y_t$ to avoid any confusion.

Okun stated furthermore that, one percentage point more in the unemployment rate means 3.33 percent less GNP. This is a conclusion he did not explicitly mention how to calculate. The only possible assumption here is the following:

Our α of equation (1) is 0.3 in Okun´s equation. Now we need to take the inverse of our Okun coefficient β if we want to know by how much output declines if unemployment rises by 1 percentage point. So if ΔU_t = +1 (increase in unemployment of 1), then $\Delta Y_t = -3.33$ percent (after divided by the Okun coefficient of 0.3). This means as previously stated that a 1 percentage point increase of unemployment leads to a 3.33 percent decline in potential GNP.

With respect to our gap method we need to remember equation (6). Okun presented an equation of the Council of Economic Advisers to the Joint Economic Committee in 1961:

(8) $$U_t = 3.72 + 0.36(Y_t^* - Y_t), \quad (R^2 = 0.93)$$ [8]

So what do the numbers of equation (8) mean?

First of all, the estimated 3.72 is the unemployment rate associated with full employment. This implies that with a zero gap (potential = actual output), the unemployment rate is 3.72 percent (very close to the calculation of 4 percent back then).

Again we need to consider the following points: What would happen if unemployment (U_t) rises by 1 percentage point? By deriving the inverse of the gap coefficient (0.36), we get the result of 2.8 percent decrease in output growth.

The main conclusion here is therefore the following: A 1 percentage point increase in unemployment is associated with a 2.8 percent loss of potential output "or a somewhat larger percentage of actual output when actual is below potential." (Okun, 1962, p. 100).

In his work of 1962, Okun also used a third method, which he called "Fitted trend and elasticity method". We will not go into too much detail here, the results of this method also confirm the previous hypothesis. The only difference is that according to this method, if unemployment is at 5 percent (so 1 percent above its natural rate), then the estimated GNP

[8] The reader needs to take into account two things:
1) The slope terms (here 0.36) ran from 0,28 up to 0,38 consistently in Okun´s work. Those equations were "fitted to various paths and different periods." (Okun, 1962, p.99)
2) The original equation was *U = 3,72 + 0.36 gap*, but again due to simplified terminology we renamed the variables.

gap is 3.2 percent (3.2 percent less actual GNP than its potential). This version does not assume a trend as the gap version does, that is why you could call it a ´dynamic approach´.

3.4 Implicit logic of Okun´s Law

When talking about Okun´s Law, some basic assumptions need to be taken into account. First, as Gordon stated, we have a basic identity that decomposes Okun´s GNP (Y) into output per hour, aggregate hours per employee, the labour force participation rate, and the working-age population. (Gordon, 2010)

This implies several things. First, *productivity matters*. It matters because output per hour can vary and it may compensate for aggregate hours per employee. Second, labour market regulations matter in terms of the working-age population (which may be extended or declined) and also the aggregate hours per employee, if maximum hours per week are implemented as a policy tool.

Furthermore, as Barreto and Howland correctly pointed out, a fundamental error occurs in Okun´s Law. This error concerns "magnitude and interpretation of coefficients from the direct and reverse regressions of unemployment on output" (Barreto & Howland, 1993, p. 2). It is not the same if Y is regressed on X or X is regressed on Y[9]. In this paper we tried to implement a structured version where in every method of Okun´s Law we perceived output as the explanatory variable and unemployment as the dependent variable. We are therefore in accordance with the majority of the literature (Lee (2000) is an outliner in this case).

So overall, one needs to determine what he or she wants to predict: Either the person wishes to predict unemployment given a certain level of GNP or vice versa.
It is not sufficient to assume the same β (of equation (1)) to predict GNP given a certain rate of unemployment: β varies with changes in structural parameters, such as the structure of the economy, and we have seen in the first section that the structure of an economy varies over time. So economic conditions should prevail in the sample period.

Our paper, however, focuses on the long-run, making this assumption redundant since structural parameters are about to change regularly.

[9] One has to add that this is the difference between the ´security´ version Okun chose, which is purely based on a theoretical view (taking the inverse of one variable leads to a specific conclusion), and the empirical version where the reverse causality is tested against each other.

Now let us take the example of Japan: Many studies have reported a high Okun coefficient in the case of Japan (e.g. Hamada & Kurusoka (Hamada & Kurosoka, 1984)). Barreto and Howland argue that this is due to a systematic error included in running the wrong (linear) regressions. Also the use of the coefficient´s reciprocal may enlarge the Okun coefficient to a too large extent. (Barreto & Howland, 1993)

Their estimation results are shown in Fig.3:

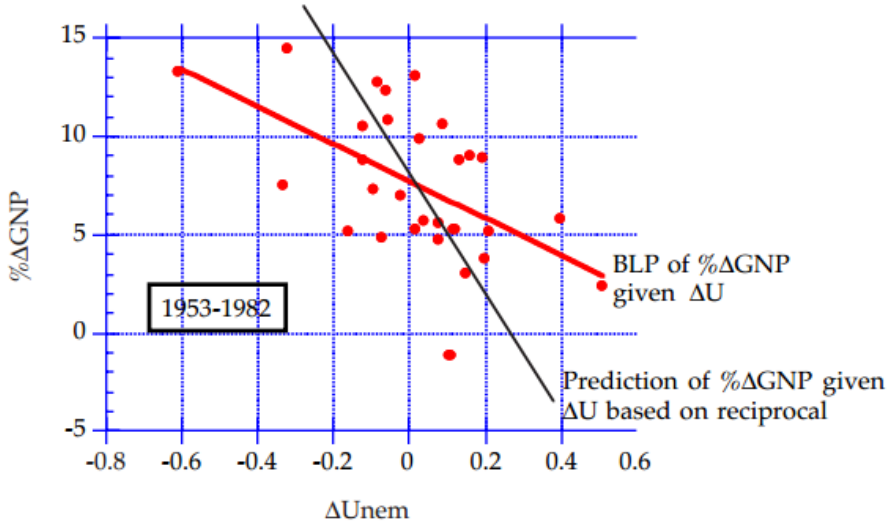

Fig. 3 – Reciprocal error of Okun´s Law, (Barreto & Howland, 1993, p. 21)

Fig. 3 symbolizes that the Best-Linear Predictor of %ΔGNP given for a one percentage point change in unemployment = -9,46. Based on the reciprocal of this the prediction of the percent change in real GNP based on a given change in U has a far steeper trend.

Another main point from Barreto & Howland are the error terms linking GNP and unemployment. They claim that on average, part of the decrease in unemployment should be attributed to negative unobserved shocks in productivity and hours. This occurs if unemployment decreases overproportionally than the rise in real GNP. Also if there are higher than average increases in real GNP (due to more than average decreases in unemployment = causality), part of the high increases in real GNP is based on positive unobserved shocks in productivity and hours (Barreto & Howland, 1993).[10]

The definition of unemployment in Okun´s work (U = 100 – E (Employment)) in a world with high labour mobility with a closer European integration may be plausible but is vastly

[10] Gordon (2010) attributed 1/3 to productivity and 2/3 to aggregate hours.

simplified. The overall labour force (here = 100) needs to be widened by mobile workers from neighbouring countries who take a substantial share of an economy´s workforce.

3.5 Different viewpoints of Okun´s law

Since Okun´s law gives indirectly the recommendation of generating growth in order to fight unemployment, it lies in its nature that controversial debates occur. The main question here (and also for the WWWForEurope project) is to answer a very central question: Which tools should we use in order to generate growth (if this is desirable)? In the following section I will give the two major viewpoints on Okun´s Law nowadays: The neoclassical and the Keynesian viewpoint. In addition an alternative approach is being presented where output is decomposed into its main components.

3.5.1 The neoclassical viewpoint of Okun´s law

The foundation of Okun´s law can be viewed in different ways. Stiassny & Sögner described the neoclassical viewpoint in the following way: „From a neoclassical point of view with a permanently cleared labor market only structural and frictional unemployment can exist“. (Sögner & Stiassny, 2000, p. 4) The main idea of this concept is, that unemployment only exists due to *rigidities*, unemployment is therefore always voluntary, since people can always work for less money. Therefore they are able to take on jobs for a lower wage, they simply do not want to. In addition, people searching for a new job in a boom period still have low wage aspirations and are therefore willing to take on a particular job. The consequences are shorter searching times in upswings with lower unemployment. Here, every individual is indifferent between additional work and additional leisure.

At this equilibrium the real wage equals the reservation wage (the minimum wage a worker is willing to accept to work). In this school of thought, no such thing as an unemployment trap is taken into account, where disincentives may occur for people to accept work: The unemployment trap refers to a situation when unemployment benefits and other social security payments discourage people to work. People merely accept lower wages to get employed.

3.5.2 The Keynesian viewpoint of Okun´s law

"When the final result is expected to be a compromise, it is often prudent to start from an extreme position." (Keynes, 1920)

John Maynard Keynes focused on a different perspective when perceiving unemployment. In his opinion the underlying condition for unemployment does not lie in the supply side of the economy, but in the lack of demand. As firms change their output plans, less labour force is required. This, in turn, leads to changes in labour demand and therefore effects the unemployment rate.

Keynes can be interpreted in three different ways (Snowdon, et al., 1994): First, there is the "*hydraulic interpretation*". The IS-LM curve stands in the centre of this model (it was also taken over later by many neoclassical economists). The main approach here are wage and price rigidities, whereas unstable expectations only play a minor role. One of the main issues of this model of interpretation "was the lack of convincing reason for wage and price rigidities." (Snowdon, et al., 1994, p. 74). The second interpretation was the "*fundamentalist interpretation*". Here, the influence of unstable expectations because of uncertainty was viewed as the most important feature. This Post-Keynesian school of thought is characterized by rejecting the hydraulic interpretation, saying that "the problems of decision making under conditions of uncertainty lay at the heart of his [Keynes´s] system."

The third approach of interpreting Keynes is "the *modified general equilibrium approach*". Here, the markets´ bases are the choices of the individual traders. It can be considered as the "economics of unemployment disequilibrium" where involuntary unemployment is based on a dynamic disequilibrium. In contrast to static neoclassical economics, involuntary unemployment can be the case in perfectly competitive economies with flexible prices and wages (Snowdon, et al., 1994, p. 74).

3.5.3 Alternative Approaches

"While this approach has the undeniable advantage of maintaining the analysis in the spirit of the initial [Okun´s Law] estimates and authorizing comparisons with previous estimations, it can hide the underlying mechanisms which are at work between output and unemployment movements." (Boussemart et al., 2012, p.2)

Many economists have questioned the linear approach of Okun such as Knotek (2007), Crespo-Cuaresma (2003), or Boussemart et al. (2012).

Boussemart et al. (2012) took a more sophisticated approach, they decomposed output into its main component: productivity (assumed Cobb-Douglas):

$$Y = AN^{\alpha}K^{\beta} = A\,[P * (1 - U)]^{\alpha}\,(C * K)^{\beta} \tag{9}$$

where Y is the Real output, N is the number of workers, K is the capital input, C is the capacity utilization rate, A is the Total Factor Productivity (TFP), P is the labour force, and U is the unemployment rate.

This intuition is based on the fact that the mean combined effect of technical change and technological gap accounts for nearly 30% of the total Okun´s Law coefficient.

So after calculating the ratio of real output to potential output and taking logs (for further details see (Boussemart, et al., 2012, p. 5) he derived an unemployment gap which is specified as being dependent on the real output gap, the TFP gap, the labor force participation gap, and the capacity utilization rate.

It may seem helpful to include those productivity-based components in equation (5), since variations in the unemployment gap can be explained.

In a more sophisticated version, (Blanchard, 1989) interpreted Okun´s Law as a relationship between VAR innovations in output and the unemployment rate.[11] His results were generally confirmed by (Weber, 1997).

4. Literature review

In this chapter we will give a brief overview of the current literature on this topic. First of all, the question needs to be answered whether Okun´s Law still holds as a rule or whether his main assumption – *a one percent increase in output is associated with a three percent decrease in unemployment* – is already broken down when considering new data. Harvard economist (Mankiw, 1994) confirms Okun´s Law, however, he states that a one percent increase in output is associated with only a two-percent decrease in umemployment. It is important to mention that he used a different dataset, as he used observations from 1951 until 1994.[12]

[12] Also in his updated versions of "Macroeconomics" (e.g. the version of 2009) he confirms this statement, even by extending his observations by several more years.

Gordon (1984) decomposed real GNP into the employment rate, hours per employee, labor productivity, labor force participation and population. Then he investigated which components would contribute to a typical Okun estimate of "2.5 to 3.0" (*A one percentage point decrease in unemployment is associated with 2.5 to 3.0 percent increase in output*). In his analysis he derived a natural unemployment rate of 6 percent (Okun assumed 4). His main attention was laid on the productivity component, he proposed the conclusion that "a permanent increase in the economy´s use of its resources causes only a temporary increase in productivity above its long-run trend. Thus any argument for raising the economy´s utilization rate must rest on the benefits of job creation rather than on the benefits of a permanent productivity bonus." (Gordon, 1984, p. 562).

Based now on this approach of splitting up the growth rate, we can derive different Okun coefficients for various countries. In the OECD study, different Okun coefficients were calculated for the US and Canada (2.5), for the Euro Area (4) and for Japan (7), suggesting that unemployment is more responsive in the US and Canada (lower growth is needed to reduce unemployment) (OECD, 2012, p. 35). This means that *Okun´s Law estimated for one country cannot be readily used as a benchmark in other countries*.

The OECD study suggests furthermore the evidence of structural instability in the Okun´s Law relationship in nearly every country (OECD, 2012, p. 35). In the Euro area economies, the change in unemployment associated with a given change in output has risen over time (unemployment got more responsive, possibly due to labour market reforms, meaning the *Okun coefficient got lower*). In most countries however, unemployment changes appear to fluctuate around their long-run trend.

Ball et al. came to a same conclusion, saying that the relationship is strong and stable. They investigated Okun´s Law for data on the United States since 1948 and for twenty advanced economies since 1980. However, they also say that the Okun coefficient (*the effect of a one percent change in output on the unemployment rate)* varies considerably over different countries (Ball, et al., 2012).

The World Bank investigated Okun´s Law in East-Asian countries and compared agricultural to non-agricultural jobs. They conclude that Okun´s Law is far more stable in non-agricultural jobs. Interestingly, they claim that agricultural jobs even act countercyclical in times of crises (World Bank, 2012).

The latest IMF survey also finds "unambiguous evidence validating the Okun´s law across a wide range of countries". (IMF, 2015, p. 15). When investigating the general causes of unemployment, they claim that `cyclical factor` (i.e. the drop in GDP growth) explain around 50 percent of youth unemployment and 60 percent for adult unemployment across all advanced European countries. The survey also investigates what *type of growth* – i.e. consumption growth, investment growth and export growth – has the largest effect on unemployment. Their results suggest that youth and adult unemployment rates are far more sensitive to consumption growth and and less sensitive to export growth.

On the other hand, surveys such as IMF suggest that the relationship broke down during for the time of the Great Recession of 2008-2009, meaning that the drop in output was not associated with a ´fixed´ drop in unemployment (IMF, 2010).

De la Fonteijne gave different explanations for the rejection of Okun´s Law on a micro basis. First, the hoarding of workers in an economic downturn: When people do not get redundant straight away because of lower demand, this is often referred to as ´sticky workforce´ (argument for the occurrence of structural unemployment, see section "Structural unemployment"). Many companies react on less demand by creating and storing larger stocks, only after a while, workers are made redundant.On the contrary, if a company faces an upswing, the hiring of suitable workers may take time and their training and the additional capital needed are also arguments for the delay in 'adjusting' (de la Fonteijne, 2013).

Huang and Yeh also confirmed Okun´s validity by testing a data sample of 53 countries during the period of 1980 to 2005 (1108 yearly observations). With respect to the upcoming discussion of the methods being used, the authors used a Pooled Mean Group (PMG) estimator in order to account for the possibility of cointegration between unemployment and output. Their results not only confirm the validity of Okun´s law in the short-run, but also suggest a linkage for the long run (Huang & Yeh, 2013, pp. 191-199).

One of the most common techniques for measuring Okun´s Law is the usage of the HP filter. Boussemart et al. used it for determining mainly the potential level of output and the natural rate of unemployment (Boussemart, et al., 2012).

Economists such as Gordon reject the HP filter, as well as the band-pass filter, because of its oversensitiveness for the business cycle. He rather used the Kalman trend technique because of its allowance to use outside information on the business cycle and size (Gordon, 2010).

Many authors have already widened the basis of merely estimating the standard linear specification. Sögner found no evidence of structural changes in Okun´s Law, whereas Lee found strong evidence of structural breaks when estimating the correlation between cyclical unemployment and output (Sögner, 2001) (Lee, 2000).

Other authors such as Crespo-Cuaresma focused more on the short run and on a more dynamic approach. He estimated a regime-dependent specification of Okun´s Law, where the inverse relationship between cyclical unemployment and cyclical GDP is allowed to differ across recessions and expansions (this would overcome the underlying mistake in the logic of taking the inverse of one to the other as explained earlier). He also used the HP filter and a bivariate structural time series (to isolate the cyclical component of the variables of interest). He found out that the effect of growth on unemployment is asymmetric and significantly larger in recessions than in expansions (Crespo-Cuaresma, 2003).

Reasons for this asymmetry may be due to factor substitution, changes in sectoral growth rate and LFP, asymmetric adjustment costs between contracting and exoanding, and the role of mismatch (Holmes & Silverstone, 2006).

The natural problem of long-run cointegration was addressed e.g. by White and Chu. As a solution to their bi-variate model they used the Engle-Granger method to control for cointegration (White & Chu, 2013).

A summary of the above mentioned can be obtained from Table 1.

With respect to the persistence of Okun´s Law in the literature we can conclude that there is no uniform consistency visible. Even though the majority does validate Okun´s Law, there are some studies suggesting its breakdown during recessions (e.g. (Lee, 2000); (Knotek, 2007)).

In addition we found that the Okun coefficient got lower over time in most studies. By comparing Okun´s work with recent US data we come to the conclusion that the 2 percent change in output has more statistical validity than the 3 percent Okun proposed. Also there is some evidence proving the weakening of this proposal.

However, huge variation in the Okun coefficient across countries exist in the literature. This will be confirmed later on by our analysis.

Author	Method	Data set	Econometric specialty	Result for intercept	Result for Okun coefficient	Author´s remark
OECD (2014)	Difference method	OECD countries and 6 emerging countries from 1988 - 2010	-	0.66 (for all persons) and 1.33 (for youth)	1.9% for all persons, and 4% for youth	Okun´s Law strong and stable
OECD (2012a)	Difference method and Gap method	G7 economies from 1960 - 2011	rolling regressions and lags	-	2.5% in the US and Canada, 4% Euro Area, 7% Japa	OL strong and stable, greater flexibility arising from labour market reforms
Ball et al. (2012)	Difference method and Gap method	20 OECD members in 1985 from 1948 - 2011	rolling regressions and lags, Hodrick-Prescott filter until 2007	0.4 or 0.5	2% on average	OL strong and stable
World Bank (2012)	Gap method	8 East Asian countries from 1997 - 2011	data on agricultural employment, FGLS	-	no clear results, coefficient rose in the crisis	OL holds particularly well for agricultural jobs (= *shock absorber in a downturn)*, more rigid labor market regulations result in a lower Okun coefficient
IMF (2015)	Gap method	22 advanced European countries from 1980 - 2012	Hodrick-Prescott filter, multivariate approach for measuring labour market (LM) features	varying from 5 (Spain) to 2 (Greece, Ireland, Portugal) to 0 (Austria, Netherlands)	varying from 0.2% (Austria and Luxembourg) to 1.8% (Spain), few significant results; explanatory variables with respect to LM features are included	youth unemployment is more sensitive to economic growth than adult unemployment
IMF (2010)	Dynamic method combined with difference method	21 advanced World economies from 1980 - 2010	inclusion of dummies for recession periods, explanatory variables such as EPL, Unemployment Benefits, Share of temporary workers	-	OL coefficient gets significantly larger in recession meaning that sectoral shocks raise unemployment beyond the level Okun predicts	responsiveness of unemployment to output has increased over past 20 years, OL breaks down during recessions
de la Fonteijne (2013)	Difference method	US data from 1947 - 2002	inclusion of sticky versus flexible workforce; simulation of an RBC model	-	1.8% for the US	OL is strong and stable, however the frequency distribution of GDP evolution is decisive
Huang and Yeh (2013)	Difference method	53 countries from 1980 - 2005 (cross-country panel) and 50 states of US (cross-state panel) from 1976 to 2006	Autoregressive Distributed Lag framework estimated by Pooled Mean Group approach	-	0.2% on average (highly significant) for cross-country, and 0.15% for cross-state (also significant at 1%)	OL´s validity is confirmed, both in cross-counry and cross-state panel
Boussemart et al. (2012)	Modified gap method	16 OECD countries from 1980 - 2004	Malmquist index to measure the productivity gap and Hildreth-Lu correction, as well as HP-filter	-	0.29% on average	OL is unstable over time and over the RBC. Discrepancies are caused by a technological gap to frontier countries
Knotek (2007)	Difference and dynamic method	US data from second quarter of 1948 to second quarter 2007	rolling regressions, forecasting	0.38 from 1948 to 1960 and 0.28 from 1948 to 2007	0.07% for both regressions	OL has not been stable over time, difference is persistent in times of recessions and expansions
Lee (2000)	Difference method and Gap method	16 OECD countries from 1963-1984	HP filter, Beveridge-Nelson decomposition procedure and Kalman filter based on NAIRU	-	2.04% on average, with the outliner of Japan (12.6% under Kalman filter). UK = 1.39% (Difference), Austria = 3.68% (Difference), US around 2%	OL has not been stable over time, there is strong evidence for structural change.

Table 1 – Persistence of Okun's law in the literature

5. Some stylized facts

Okun´s Law is one of the key stylized facts in economic history. The Okun coefficient varies significantly and substantitally across countries, representing the countries´ large heterogeneity. Some stylized facts are presented to the reader here in order to better understand section 6 and the structural changes many authors proposed when examining Okun´s Law (such as (IMF, 2010) e.g.). The main focus is laid on labour market dynamics in advanced European countries.

Our main focus is on the long-run perspective of Okun´s Law, but since our data set contains the crisis years from 2007 on as well, a general understanding why the Okun coefficient may differ will be presented to the reader. Authors such as Crespo-Cuaresma claimed that the effect of growth on unemployment is significantly larger in recession periods than in expansion periods (Crespo-Cuaresma, 2003). But what were the key stylized facts back then?

First, the crisis had output and investment in the euro area dropped by 2 and 19 percent respectively in comparison to their pre-crisis peak. Construction was the hardest hit sector with a loss in sectoral output of 20 percent. As a consequence, around *4 million jobs were lost across advanced Europe* during this time period, causing the unemployment rates to rise to tremendous levels: In mid-2014, youth unemployment in the Euro area was at 24 percent (in 2007 it was 15 percent), and adult unemployment was at 10.25 percent in mid-2014 (in 2007 it was 6.5 percent). Obviously, huge differences across countries arose in the level and change of youth unemployment. *The IMF classified countries "into four buckets"* (IMF, 2015, p. 7):

1) those that witnessed large increases in youth unemployment during the crisis, but had relatively low pre-crisis levels (e.g. Ireland or Cyprus)
2) those that had above-average unemployment rates before the crisis, but during the crisis only had small increases (e.g. Belgium, France, Finland and Sweden)
3) those that had high pre-crisis-levels already and suffered high increases (e.g. Greece, Spain and Italy)
4) those with low pre-crisis levels and low increases or even declines in unemployment (e.g. Austria, Germany, Netherlands)

One reason for the varying Okun coefficients across countries (as we will see later on) is the fragility of their labour markets. Youth unemployment is very fragile and concentrated. An indicator of this fragility are temporary contracts:

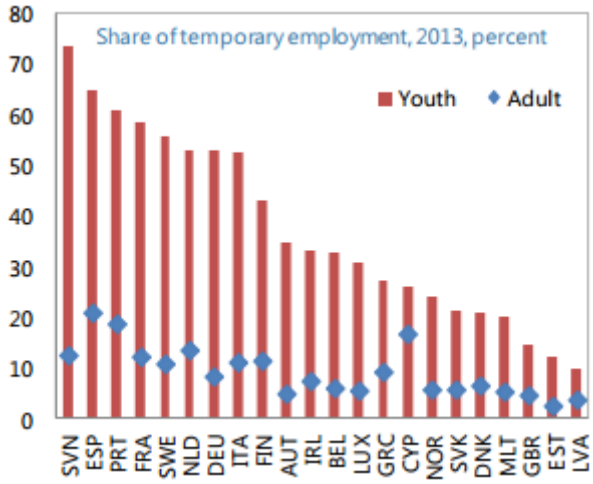

Fig. 4 – Share of temporary employment in 2013 across Europe (IMF, 2015, p. 7)

In Fig. 4 we can see that particularly in *Spain, Italy and Portugal, the share of temporary employment was especially high*. Those countries suffered from the largest increases in youth unemployment during the crisis. What concerns the concentration of youth unemployment is that it tends to be in sectors which are more susceptible to the business cycle such as manufacturing, wholesale and retail trade, and hotels and restaurants. Those very important *labour market features lead to varying Okun coefficients*. Because temporary contracts workers can be made redundant more easily in economic downturns, this causes a higher relative unemployment rate. *This is in turn causes a larger Okun coefficient in recessions (i.e. a rise in unemployment of one percentage paint trigger an overproportional decrease in the real output rate).*

6. Heterogeneity across different countries

"…despite the primary attention to U.S. data in the existing literature, there is anecdotal evidence of heterogeneity across countries." (Lee, 2000, p. 350)

Here in this section, we will have a look at the microfoundation for heterogeneity across countries. Because Okun only used US data as a basis for his proposal, this ´benchmark´ for other countries is questioned. For many European countries, mainly EU members the Okun coefficient is usually larger than for the US (see (OECD, 2012).

To give an answer to that puzzle why this is the case, we are going to have a look at the necessity to achieve growth: According to Blanchard and Illing it is essential to achieve a specific rate of growth in order to avoid unemployment due to two reasons:

First, the labour force is about to grow over time (higher participation of women in the labour force, higher geographical mobility within the EU etc.), and as a result, a higher rate of growth is needed to prevent people from unemployment. An example for this statement is Austria. Austria has the highest employment rate of all time, but unemployment is still rising. This makes it essential to achieve a higher growth rate in order to reduce unemployment. Another problem that may occur are the hidden labour reserves. People who are not being registered as seeking a job, but then suddenly going to work can also contribute to a higher participation rate not correlating with lower unemployment (Blanchard & Illing, 2006).

The second big argument is productivity. If we remember equation (9) we can see how real output is decomposed into its main components. One of them is the TFP: In reality, the productivity of a country/a country´s companies gets/get higher over time. The main source here is the technological improvement not just in production, but also in the tertiary sector. As a consequence, less people are needed to achieve the same amount of output. For that reason *output growth needs to outperform its productivity rate*.

To sum the two points up, if the labour force grows annually by 1.3% and productivity increases by 3.2%, then the economy needs to grow by 4.5% merely to sustain the current rate of unemployment.

Even if the above factors may cause significant differences between the various Okun coefficients some tests proved those assumptions to be wrong. Ball et al looked for explanatory variables in this case, such as the OECD´s employment protection legislation (EPL). They concluded that in theory "greater employment protection should dampen the effects of output movements on employment and therefore reduce the Okun coefficient." (Ball, et al., 2012, p. 19) However, the relationship had the wrong sign and the results were insignificant. The same happened with the assumptions of the other plausible explanatory variables: The share of long-term unemployment in total unemployment and the share of long-term unemployment in total unemployment. What is possible on the other hand is to take a closer look at the various countries: In the following example we will try to illustrate the examples of USA and Germany using the above explanations.

6.1 USA vs. Germany

By using the "Difference method" and by deriving the necessary thresholds, Blanchard got the following results in his work (Blanchard & Illing, 2006):

Countries	Growth rate which is necessary, to reduce unemployment by 1%	Decrease in the unemployment rate, if growth rate is 1% above its average
Germany	2.3%	0.25%
USA	2.8%	0.37%

Explanations for the higher threshold in the US may be because the growth in population was higher and therefore a higher threshold was needed in order to merely maintain the original level of employment.

Furthermore, a distinction between recessions and expansions needs to be accounted for. In Germany one of the most effective tools to overcome the recession was the labour market tool of "Kurzarbeit". With this concept, firms were more able to adjust to worse economic circumstances and could keep human capital within their premises, whereas in the US the hire-and-fire principle made more people redundant. If an economy´s labour market is more flexible, unemployment gets more responsive to output changes (i.e. the Okun coefficient gets lower), because if currently employed people get redundant, those "insiders" are the first ones to take other jobs than the long-time unemployed.

6.2 Further reasons for variations in the Okun coefficient

It is worth to mention that a lower labour turnover *(associated with a higher Okun coefficient)* also has many positive aspects. As firms seek to smoothen their employees´ fluctuations, the job security (as it is the case in Japan) is way higher than in countries with high labour turnover, mainly when the production declines. As a result, the „hire and fire" culture in the US does reduce unemployment more effectively when generating growth, however in economic downturns, the person can get fired more easily too.

IMF applied a multivariate approach in order to account for the heterogenous labour market institutions in different countries. They claimed it would not "be feasible to estimate country-specific effects of several labor market factors simultaneously" (IMF, 2015, p. 12), therefore they also considered another model specification – a univariate approach and a univariate approach with interaction term. The intuition of this is that labor market features may affect the way unemployment rates respond to the business cycle, and this impact varies across countries (results are significant!). Those labour market features consist of lower labour costs, or a higher spending on active labour market policies (ALMP) (especially for training), which

tend to lower unemployment. On the other hand, higher opportunity costs of working (gross and net benefit replacement rates) and stronger labour market duality (higher shares of workers on temporary contracts and lower employment protection) tend to raise unemployment.

Another point to be taken into consideration is the necessity of a higher growth rate of one country compared to another. As Blanchard claims, the US needs to have a bigger growth rate, as immigration at that point in 2006 was greater than in Germany and for that reason the labour force grew by a bigger extent too (Blanchard & Illing, 2006).

Another explanation for the smaller growth threshold in Germany might be the smaller increase in productivity. So the trade-off between higher competitiveness (high productivity), but in turn greater need for higher growth rates needs to be outbalanced. As production increases, the switch to other production factors, like capital, could be a reason for not hiring additional workers in the first place. According to the Harrod-Domar-Model, growth is possible with increasing intensity of capital. So we can conclude that if capital intensity grows by 3 percent, an output growth of 3 percent does not necessarily lead to a reduction in unemployment, as the percentage of capital intensity may overcome the increasing output growth rate.

The Okun coefficient got lower (*i.e. unemployment got more responsive to output changes*) in Europe since the 1980s, because many companies had to overthink their workplace warranty policies. The companies were guaranteed a more flexible reaction to changes in demand, so as a consequence hire and fire-restrictions were weakened in several cases. This is the reason the Okun coefficient of Europe (4) is settled between the US´s (2.5) and Japan´s (7) where labour protection is very high (OECD, 2012). This statement is confirmed by Stiassny and Sögner, who found the lowest reaction of unemployment on GDP growth in Japan and in Austria (social partnership model) (Sögner & Stiassny, 2000). In addition to this, the weakest effects of output variations on employment were also observed in Japan and Austria, whereas the strongest effects could be seen in the US and Canada. The implication of this study was (again) that „countries with highly protected labor market actually exhibit a low reaction of employment to GDP variations, while the persistence in the unemployment is stronger for these countries“. (Sögner & Stiassny, 2000, p. 22)

7. How to break down Okun´s Law

Since growth perspectives do not look too optimistic, one has to ask the question whether there are possibilities to generate employment with smaller rates of growth. Plus, we have to stress the fact that ´jobless growth´ needs to be avoided. Here in this section we will outline some facts about productivity, the energy situation and some possible actions in the context of the WWWForEurope project.

According to Antal, we have to develop strategies that help to solve environmental and unemployment issues simultaneously. In order to implement those strategies, the feasibility of existing growth strategies needs to be examined. The author distinguishes between *green growth* (sustainable economic expansion), *a-growth* (indifference about growth), and *degrowth* (sustainable economic contraction) (Antal, 2014).

7.1 About the necessity of productivity

"In Okun´s version a one percent decline in output relative to trend is divided up into a reduction of 1/3 point in productivity and 2/3 point in aggregate hours." (Gordon, 2010, p. 11)

When talking about sustaining a certain rate of unemployment, usually a productivity rate is assumed, which in turn leads to the necessity of generating a sustainable growth rate: If Germany has an annual productivity increase of 2%, the economic growth rate needs to supercede those 2% in order to generate employment. But what if there is no need for an eternal growth rate? In this chapter we will try to give solutions to the problem of substituting workforce with machines as a result of higher productivity.

First of all, we will illustrate why productivity is so important mainly for our generous European welfare states. Baldwin and Wyplosz formulated the essence of productivity gains in the following way (Baldwin & Wyplosz, 2012):

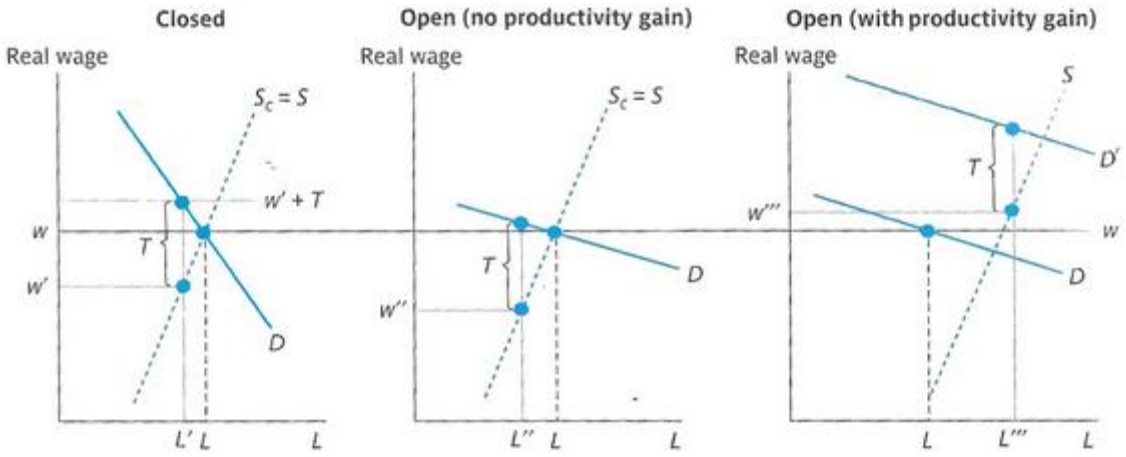

Fig. 5 – Effects of productivity gains on the real wage (Baldwin & Wyplosz, 2012)

In a closed economy (left diagram in Fig. 5), the Social Policy "distortion" (symbolized by a tax T) causes a decrease in the real wage rate from w to w´ (the take-home payment). In such a case those distortions can also be seen as necessities within our cultural circle: Limits on working hours, obligatory retirement benefits, maternity leave, sick leave are very often taken for granted, but in reality those policies causes costs for a company, which is expressed in the above mentioned social "tax". In the second diagram, an economy exposed to free trade can be observed. Here the demand curve for workers is flatter, because of more competition between the states. An imposition of a social tax has therefore a far bigger impact on the demand curve for labour as it has in a closed scenario. The take-home pay falls more to w´´ in the second diagram, because of the following reason: "Greater openness gives consumers a wider range of options; when T is imposed more of it gets paid by workers than by consumers. In other words, the greater price sensitivity forces workers to bear more of the burden of the social-policy ´tax´" (Baldwin & Wyplosz, 2012, p. 221).

Furthermore, if the workers´productivity increases, this enhances the value of them for the company, so demand for them shifts up (as can be seen in the third diagram from the left). Now the implication of the social policy tax, is more than compensated, workers even earn higher real wages than before (this productivity gains which take place in reality can be a consequence of trade-efficiency).

Strongly related to this topic is the concept of *unit labour costs*, the vital determinant of competitiveness. One of the biggest mistakes is the constant focus on absolute costs. The costs of one unit of labour needs to be put in relation to their corresponding productivity level.

According to the OECD, Unit labour costs are the average cost of labour per unit of output and are calculated as the ratio of total labour costs to real output.

As we can observe in Table 2, the costs in the whole European Area (EU-15, EA-17, EU-27) are lower than in the US in the total economy, whereas unit labour costs in the manufacturing sector are lower in the US:

	Compensation per employee Current prices		Output per person employed Current prices		Unit labour costs	
	Total economy	Manufacturing	Total economy	Manufacturing	Total economy	Manufacturing
	US = 100				Levels (wage share)	
EU-15	80.8	77.1	85.8	73.0	0.582	0.696
EA-17	79.2	74.7	84.6	69.8	0.573	0.667
EU-27	70.0	60.8	74.7	59.9	0.584	0.680
Switzerland	138.8	.	133.3	131.8	0.672	.
Japan	82.0	74.7	85.7	86.8	0.619	0.553
United States	100.0	100.0	100.0	100.0	0.593	0.544
	EU-27 = 100					
EU-15	115.4	126.9	114.8	122.0		
EA-17	113.2	122.9	113.2	116.7		
EU-27	100.0	100.0	100.0	100.0		
Switzerland	198.1	.	178.5	220.2		
Japan	117.1	122.8	114.8	145.0		
United States	142.8	164.5	133.9	167.1		

Source: Eurostat (AMECO), WIFO calculations.

Table 2 – Comparison of Unit Labour costs in 2011 (Aiginger, et al., 2013, p. 45)

As we can see, unit labour cost levels in the US and the EU-27 are nearly equal for the economy as a whole (total economy). Switzerland is a perfect example of how productivity can transform very high absolute costs – in Switzerland compensation per employee is 69% higher than in the EU-27 (138,8% against 70% in the total economy) – into low unit labour costs. After this transformation, Switzerland is not even 9% more expensive in the total economy (0.672 against 0.584).

So far, we have seen on the one hand the necessity for productivity gains according to economic theory. In reality, the labour-saving productivity gains are very often in contradiction with the aim of achieving more employment. In this chapter we will try to give some solutions to this.

7.2 Actions how to deal with productivity

Now we will focus on how we could handle the productivity component accordingly. We are already living in a low-growth industrialized economy. When taking measures such as more automatization, one has to consider that mainly in a low-growth economy, huge productivity gains can be fatal (if not directed well), because they may cause low-skilled people to get redundant.

Job qualifications in general have shifted more towards white-collar work. What needs to be taken into account here is that the middle tier of white-collar workers are especially vulnerable to replacement by computers or outsourcing (labour-saving technological progress). With the help of information and communication technology (ICT) many firms were able to produce more output, although the relative number of employees related to output has declined.

7.2.1 Slowing down technological progress

The first option would be slowing down the technological progress. However, if a country decides to 'stop' productivity, its competitiveness with the rest of the world suffers a lot. This approach is questionable as technological progress indicated various improvements:

1) The annual productivity change in the non-farm business sector by the decade 1950 – 2000s has grown between 2 – 2.5%
2) Index of growth in US Real GDP per capita has gone up significantly
3) Real median household income has gone up significantly

Or, as Garofalo claimed, the productivity gains on average were 3.1% per year per worker and 4% per year per hour. This created wealth from the wage earners has multiplied by 3.67, with an annual growth of 3.3% (Garofalo, et al., 2000).

For that reason only slowing down the technological progress in turn for sustaining the current rate of employment is not a very wise option.

Another point, when discussing this issue is the world´s division into two groups: *Technological leading countries* and *non-leading countries* (let us assume those are close to the frontier and have the capacity to catch up). Boussemart et al. suggest that an increase in the leading countries also stimulates the potential level of TFP in follower countries so that

the gap between their actual level of TFP and their potential level of TFP widens in those countries too (Boussemart, et al., 2012).

Let us take our case: A country refuses to stick to technological progress. The result is merely the slipping down on the hierarchial ´world ladder´. Taken the microeconomic perspective, its own productivity gap (so the difference between its actual level of productivity and its potential) widens, causing a *reduction in real output*.

However, it may be possible that no interventions of the government need to take place in this case. According to Gordon two important bases for productivity growth (in this case in the US) may cause its decelaration (Gordon, 2013, pp. 13-19): First, the importance of new interventions decreases (older interventions such as the wheel or hot water caused far more productivity gains than electronical devices do nowadays). Second, the new generation lacks better education than their previous generations. In addition, the scarcity of natural resources may either reduce further productivity growth or may contribute to the transition towards the digital economy.

All in all, the option of slowing down technological progress is not suggested.

7.2.2 Redirecting the technological progress

"On a global level, past economic growth has been accompanied by increasingly serious environmental problems including climate change, various types of pollution and the loss of biodiversity and ecosystems." (McNeill, 2000)

Sufficiently fast decoupling is feasible. This is central for the sustainability of our planet. If not, output growth is unsustainable, and other possible growth strategies must come into place such as green growth or degrowth. According to Antal, welfare-decreasing changes in the global socio-ecological system are unavoidable. However, this could be counter-balanced if technological progress is redirected towards resource-saving technologies. If the government than provides bonus payments or rewards for companies who succeed in doing this, this may even act welfare-increasing (expressed in monetary terms). If you also count the better ecological environment, this is definitely welfare-increasing. The problems with quick decoupling occur three-fold (Antal, 2014):

1. Geopolitical reasons - Half of the population lives in countries (including emerging countries) where a transition towards resource-intensive lifestyles had already taken place or is in current progress
2. Economic reasons - Most easily extractable resources have already been used up and the next stage (such as shale gas) is increasingly dangerous and energy intensive - *environmental burdens per unit of resource use are rising*
3. Systemic reasons - This group contains rebound effects: Renewable energies which reduce CO_2 emissions may in turn lead to greater land use (use of wood) or water conflicts. A very important aspect which is also part of the systemic reasons is the socio-technological lock-in. Because the majority of investments have been made in infrastructure, which is environmentally unsustainable, the lock-in of those institutions (*path dependence)* will lead to several political, economic, and social problems.

After having introduced main reasons why the process of redirecting technological progress towards resource-saving technologies may be difficult, we will have a closer look at what is still necessary to achieve it.

7.2.2.1 From dirty to green energy

"We know the country that harnesses the power of clean, renewable energy will lead the 21st century." (Barack Obama, Delivery Address to Joint Session of Congress, February 24th, 2009)

In the debate between Paul Ehrlich and Julian Simon (Sabin, 2013), Simon suggested that technology would respond to scarcities. So if e.g. oil got scarce, people would develop techniques to support the promotion of green energies. However, the problem about Simon´s hypothesis is on the one hand the wide availability of coal as one of the main sources of fossil energy, and on the other hand, the major problem with the political will of the ruling governments in Europe and the US. With the exemption of Germany proclaiming the ´Energiewende´, most governments would not act in a proactive, strategical manner, but in a preventive one. Focussing on low costs in order to gain high competitiveness is on the agenda of many leaders.

A side effect of the mere focus on low costs in absolute terms is the consequence of making resources cheaper. However, if oil, coal, and other fossil energies get cheaper over time, the redirection of technological progress will not take place.

As Heutel and Fischer claimed in a more microeconomic point of view, technology of green energy ought to outcompete the technology of fossil energies. In this case, political intervention might not be necessary in the long run, as companies shift their attention to more productive resource usage (Heutel & Fischer, 2013).

The role of governments in this part is restricted to the surveillance of the market adjustment (stepping in in the event of a non-desirable path), and also (but only to a limited extent) the temporary supporting of the green industry. In the year 2012, subsidies of $544 billion were granted to fossil energies, in turn only $101 billion were granted for green energies (IEA, 2013). The shift towards green energies requires workers to adjust, sufficient training has to be provided by the state in order to *avoid structural unemployment*.

In the absence of environmental policy, however, the environment might drive beyond a critical threshold. It is up to economists to set up incentives for every company to start CO_2 deducting machines for example. Positive externalites here are not pecuniary, but according to green growth and sustainability rankings (those new indicators are proposed by the WWWForEurope project), those companies can be rewarded for their efforts to protect the environment. The difficulty is the following: By purchasing such machines, companies need to have some profitability in order to make future use of it, and this strategic path is up to policy makers. The redirection of technological progress leads to future superior strategy, as can be seen by the example of Denmark. Denmark was the only country in the EU-28 which succeeded in the absolute decoupling of resources (the other states only succeeded in relative decoupling).

7.2.2.2 Energy situation in the EU

"A low cost position derived from currency devaluations, cost-cutting and beggar-thy-neighbour policies are, in this view, ineffective tools for raising the long-run competitiveness of an industrialized country." (Aiginger, et al., 2013, p. 14)

The key drivers of environmental problems are energy use (CO_2 emissions), materials use and land use. According to Antal, the *global materials use reacted sensitively to recessions and economic slowdowns* (Antal, 2014). This means that the usage got less in times where the economies barely had positive growth rates.

Emerging and industrialized countries have reached a level which is fundamentally unsustainable, since more than half of the growing population world population lives in areas

where a resource-intensive lifestyle goes hand in hand with growing GDP (Steinberger, et al., 2013).

Coal, fuel, and nuclear power face a decreasing trend in the EU (IEA, 2013). The dependence on gas is a fact the EU seeks to get independent of. By making a unilateral commitment to reduce overall greenhouse gas emissions from its 28 Member States (compared with the 1990 levels) by 20% the European Commission set an important step towards smart, sustainable and inclusive growth with its Europe 2020 Strategy.

Cheap energy is not the solution. In fact, a mere emphasis on costs as a main driver of competitiveness and indicator of success should be neglected. It is necessary to mention that problems may occur if costs are too high in relation to their productivity, but "when they are broadly in line – and the current account is balanced – further cost-cutting is an unhelpful strategy for rich countries" (Aiginger, et al., 2013, p. 14). Is therefore essential to choose a *high-road strategy* - to increase productivity - instead of a *low-road strategy* - only focus on reducing costs.

A very strong focus in debates is currently laid in the question whether Europe should start extracting shale gas. Besides the non-foreseeable consequence of such a heavy intervention in nature, the economic impact on reducing that dependency is very modest too:

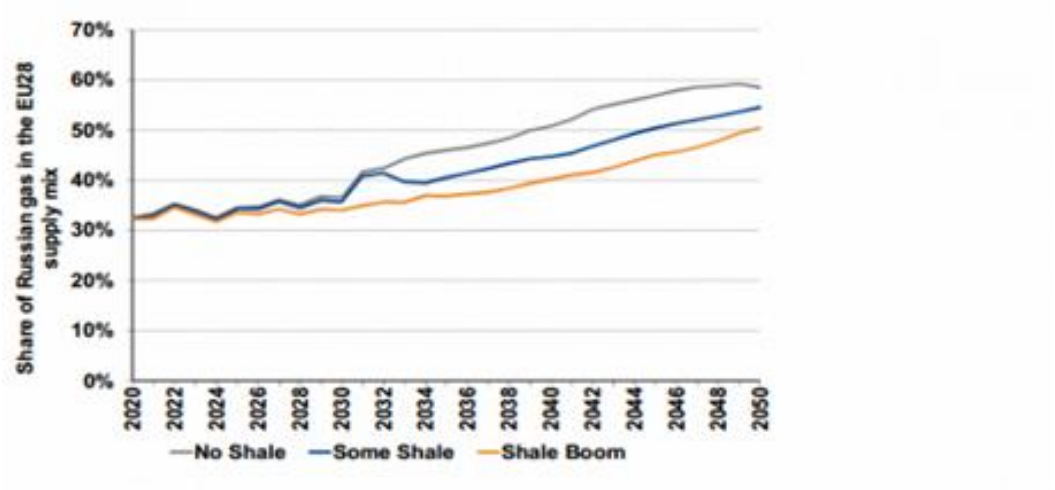

Fig. 6 - Share of Russian gas in the EU28 supply mix (Pöyri, 2013)

As we can see in Fig. 6, even if the boom of shale gas set in, the share of Russian gas in 2050 would still be at 50 percent (this study did not take into account current economic sanctions). Otherwise (in a no shale scenario), Pöyri concluded the share of Russian gas in the supply mix

to be about 59 percent in 2050. For further scenarios and economic impacts of the extraction of shale in the EU see their study (Pöyri, 2013).

7.2.3 Reducing working time

The third option is to reduce the working time. This is important, because in Okun´s Law, an output decline of one percent contains a 2/3 point reduction of aggregate hours (Gordon, 2010, p. 11).

The aim of achieving a higher work-life balance is a favourable one, not only because it enhances the living conditions of everyone and increases their leisure time (more time for family/children etc.). As Bloom and Van Reenen found out, there is a correlation between productivity and higher work-life balance (WLB). Additionally, they have added that according to their data, a higher WLB is desired by employees. According to the recent OECD Better Life Index, an average person in the OECD works 1776 hours a year, with the US only scoring 6.7 points out of 10 (10 = best WLB), so there is need to take less working times into account (Bloom & Van Reenen, 2006).

As Garofalo claimed, in an efficiency wage, dual labour market economy characterised by only two sectors, the manufacturing and the services sector, reducing working time could work to increase employment. It is essential to mention, that in his model the country is not influenced by international competition (which could eventually be realized if a whole union (e.g. EU), or a in a broader sense, a whole free trade area would decide to implement this policy). But anyway, let us look on his proposal (Garofalo, et al., 2000).

First of all, he pointed out that many countries within Europe, such as France, Germany, the Netherlands, or Belgium have negotiated a reduction of the working time (in turn for a higher hourly pay) in the hope that more jobs would be created. Another argument in favour of this policy is merely the *fair* exchange for the productivity gains over the years. The basic idea was to create more employment, as (based on the simple assumption) that current work would be divided through the remaining work force. In Belgium, with the Vande Lanotte Act, two modalities were proposed of the reduction: A defensive one, giving firms the opportunity to restructure when being in difficulty, and an offensive one for those companies which wanted to hire more employees. Incentives on behalf of the government were provided in terms of allowing the companies to pay less social security contributions, and the granting of employment assistance for the companies who took those policy actions.

Garofalo concluded that "on one hand it seems obvious that the simple arithmetic rule according to a working population of N millions which work on average H hours per week (for a total of NH weekly hours), a 10% reduction in H should imply a same amount employment increase. On the other hand it is clear that such a calculation does not take into account, in between the others, the productive structure of the referring economic system." In his dual sector approach, the first one (manufacturing) was supposed to be efficient and competitive where salaries where determined by an efficiency-wage approach. The services sector can be compatible with higher employment, higher hourly wages for both kind of workers [qualified and unqualified] and lower effective hours. The gain in employment in this model is concentrated in the secondary sector (services), as the number of workers per team in the secondary sector varies inversely with the minimum wage and the fixed amount of weekly hours per worker. Plus, the services sector does not face international competition, so the hiring of additional workers does not have any effects on its competitiveness (higher costs). In the manufacturing sector, large companies with a tayloristic structure are assumed and workers are allowed to work overtime and relative wages are indicated as fairness indicators. For that reason, high skilled workers in the manufacturing sector refer to wages earned by those working in the secondary sector (Garofalo, et al., 2000).

However, governments merely proposing the reduction of working time is an insufficient tool. Raposo investigated the effect in Portugal, when the government decided to reduce the maximum standard workweek from 44 to 40 hours. One of the consequences were that the reduction of working hours was compensated by the use of overtime (Raposo & van Ours, 2010, pp. 61-63).

Even John Maynard Keynes perceived this as an appropriate tool to overcome the labour-saving technological progress in the long-run. But since we are living in a globalized economy, such actions need to be implemented by supranational institutions.

7.2.4 Reduction of labour force

Another way of sustaining the current level of employment is to simply not alter the absolute number of the workforce. In this case a strict immigration policy might be an option. However, the synergy effects of countries facing international trade and free movement of labour and services have been proved to be incredibly advantageous. This debate is hardly influenced by the skills of the migrants. High-skilled migrants are definitely helpful for an economy, because they can compensate possible shortages.

The concept of complementarity vs. substitutability in the labour force is key here. An example of this may be the following: A hotel in an expensive country, such as Switzerland, has very high costs for unskilled workers compared to other countries. Allowing migration in this case leads to substitutability between unskilled home and unskilled foreign workers: The foreign workers are likely to take over the jobs of the unskilled home workers. However, since more hotels get competitive in this way, they may be able to expand or build more hotels in their home area and this leads to an increased demand for skilled home workers then, who are supposed to lead those hotels. This is a perfect example of complementarity, so migrants coming in increase demand for skilled workers.

This may also happen in a way that migrants create their own jobs when coming in, which may in turn compensate to a certain extent the substitutability of home unskilled workers, if they take over those jobs. A very similar argument to the reduction of labour force is the representation of temporary agency workers. The inclusion of this group into a suitable Okun model can be subject of further research. This is mainly important, since many rich economies (bordering to poorer ones) are faced by this fact. The intercept α (threshold to reduce unemployment) in this case may rise very high, since larger growth will be needed to overcome at first the remaining capacity of temporary agency workers from abroad and then turn to domestic long time unemployed in order to reduce unemployment.

7.2.5 Further labour market interventions

In order to weaken Okun´s Law, Antal proposed following additional (active interventional) possibilites: First they could implement an environmental tax reform, whose revenues could be reused for reducing the taxes on labour. This would on the one hand trigger the reduction of more land use, energy use and materials use and on the other hand decrease the costs of labour for each employer (job creation?).

Another possibility might be the change of the marginal costs of labour by making wages more flexible. Paying a base wage plus either profit-related cash bonuses or shares of the company would be a possibility. Of course this greater flexibility needs be negotiated with trade unions and needs to be rewarded in turn.

The increase of public employment is another influential task which is up to policy makers. Even if this may sound intuitively logical (instead of merely paying people unemployment benefits, let them put some effort in the economy), this is not a long-term solution for a

market economy, as adjustment to international standards gets lost and is accompanied by a loss in competitiveness.

The return to a subsistence economy would be an unconvential option. To rely on traditional production techniques aimed at self-sufficiency or sustainable households is an option which would not increase the state´s expenses very much, since self-sufficient people need less money (by holding animals, plants or growing vegetables at home, the need for unemployment benefits decreases). This non-wage employment obviously does not contribute to capitalist progress, and it only offers limited access to transportation, communication and other goods and services that people want but cannot be produced at a local stage (Antal, 2014).

8. Empirical results

In this section, empirical data are collected. We examine 12 OECD countries from 1960 to 2015 based on Okun´s "difference" approach. Our main focus was to derive the intercepts, since those symbolize very important labour market features of a country. So far, this has not been paid very much attention on in the literature, although this is essential information on the ´status´ of a country. The Okun coefficient gives a better understanding on how the economy reacts when it is ´moving´ (either in a downturn or an expansion), the intercept however gives important information about growth thresholds of a country which need to be achieved. This intercept is heavily influenced by productivity growth and labour force participation, whereas the Okun coefficient is influenced by labour market institutions. In addition, the sample period of 1960 to 2015 gives important information whether Okun´s Law holds over the medium and long-run.

8.1 Data

We decided to use the “First Difference” method since this is the most common one in the literature. The problem of cointegration can be solved by using the Engle-Granger procedure (such as (White & Chu, 2013)) or by using the PMG estimator (such as (Huang & Yeh, 2013)).

Our sample was taken from the AMECO database and consists of 12 OECD and EU countries: Austria, Belgium, Finland, France, Greece, Ireland, Italy, Netherlands, Portugal,

Spain, Sweden, and UK[13]. We took European countries, because this paper is written in the context of the WWWForEurope project. The sample includes observations from the year 1960 to 2015 and represent the unemployment rates (measured in percent of civilian labour force) and GDP data (measured at current prices for each year), making a sum of 1344 observations in total.

We decided to implement a longer time span, because we are investigating whether Okun´s Law holds in the medium- to long-run, not in the short-run.

Before we take a closer look at the empirical results, a short overview of unemployment rates will be presented in Fig. 7:

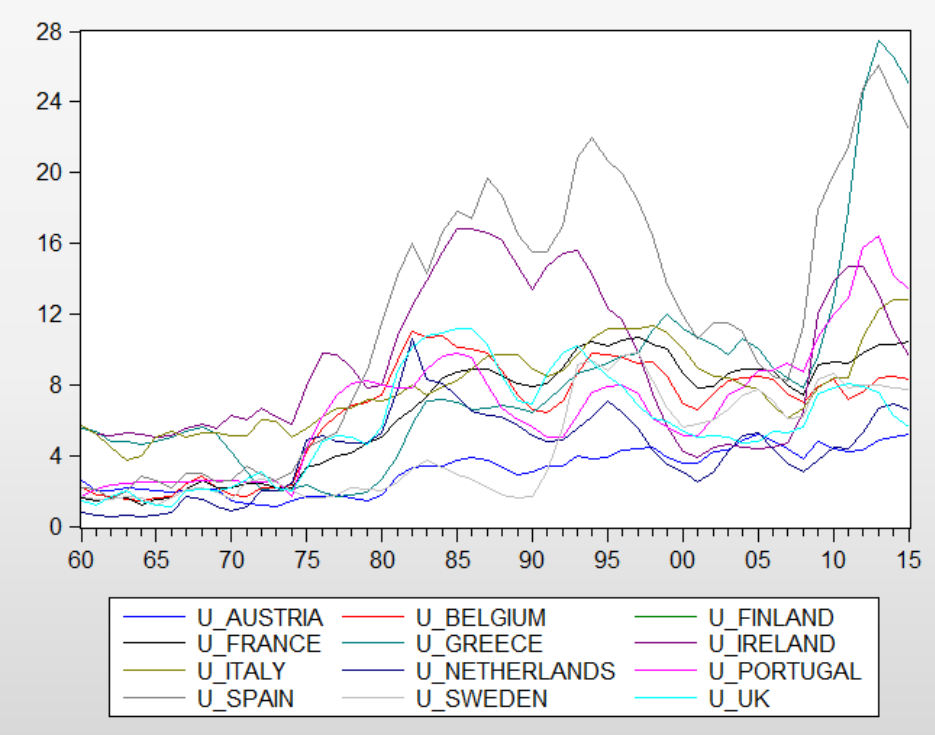

Fig. 7 – Unemployment rates in 12 OECD countries (own figure)

Here we can observe the big outliners of Greece and Spain after the Recession of 2008. Before the time of the ´Celtic Tiger`, Ireland was one of the greatest problem children with an unemployment rate of around 16 percent in 1983 (Spain again had the highest unemployment rate of nearly 23 percent in 1993). Although the countries could be considered homogenous, the unemployment rates vary substantially, this is due to their different labour market structures, policies etc. Our findings are consistent with what is proposed by the (IMF, 2015)

[13] We did not include Germany, because data from West Germany (until 1990(and Germany (from 1991) would need to be combined and the reunification may lead to disturbing results.

in Section 4. In comparison to this we can have a look at the growth rates of those countries (Fig. 8):

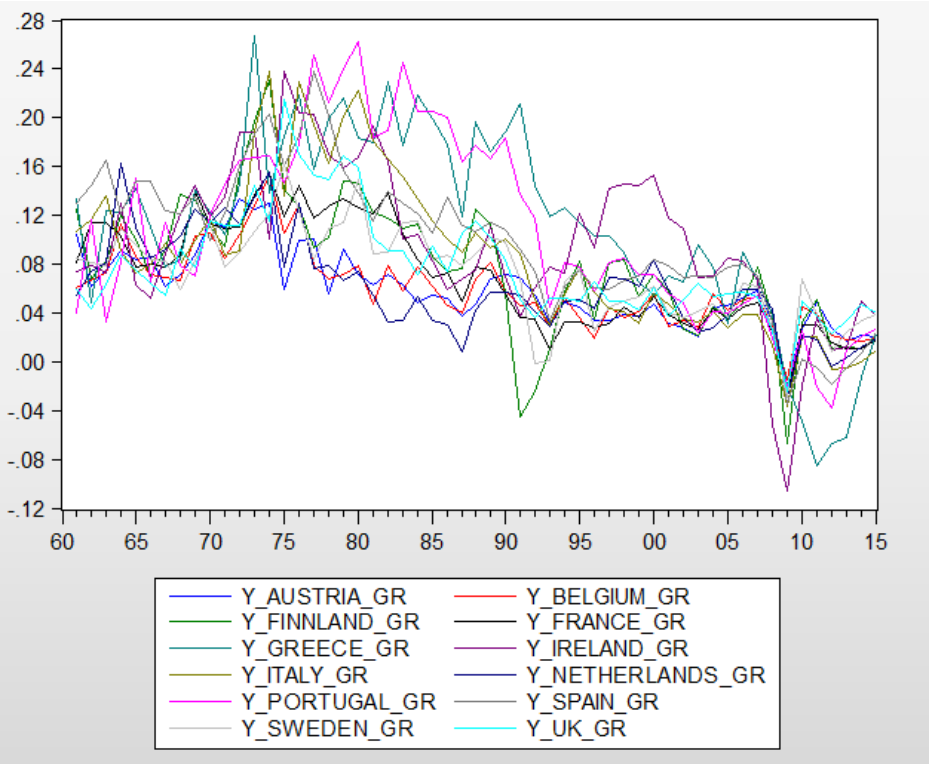

Fig. 8 – Growth rates in percent of 12 OECD countries (own figure)

Here we can see that countries had growth rates averaging 17 percent in the 70s and the beginning of the 80s but started to decline ever since. Outliners here are Portugal and even Greece who had growth rates above 24 percent during that time. We need to mention here that those growth rates are nominal rates and since inflation at this time was also very high due to the oil price shocks of 1973 and 1979, real GNP growth was not that high. We are well aware of the fact that Okun´s data were based on real GNP growth and not on nominal GNP growth, but the main purpose of our following calculations is the illustration of the heterogeneity across countries and for that reason, it does not make a big difference.

In the Big Recession of 2008 we can see that nearly everybody suffered from the same decline in GDP.

8.2 Methodology

After collecting all the necessary data. We calculated the logs for our output growth rate and the absolute changes in unemployment (percentage points). Now we are able to apply equation (1). Our first attempt was to calculate this based on OLS (see Table 3).

Country	Intercept (t-Statistic)	Okun Coefficient (t-Statistic)	R^2
Austria	0.252842** (2.426847)	-3.438206** (-2.222095)	0.09
Belgium	0.074768 (0.336971)	0.60117 (0.184104)	0.001
Finland	0.90198*** (3.185291)	-9.832556 (-3.321149)	0.17
France	0.180373 (1.320754)	-0.292075 (-0.176349)	0.001
Greece	1.219901*** (4.017110)	-7.709242*** (-3.485959)	0.19
Ireland	0.517669 (1.537613)	-4.599057 (-1.586019)	0.05
Italy	0.300027** (2.014562)	-1.960761 (-1.423936)	0.04
Netherlands	0.230288 (1.028028)	-2.031943 (-0.663501)	0.01
Portugal	0.439357** (1.991879)	-2.117607 (-1.261014)	0.03
Spain	0.892289* (1.911846)	-5.257273 (-1.299531)	0.03
Sweden	0.78086*** (3.420718)	-9.394183 (-3.322450)	0.17
United Kingdom	-0.047740 (-0.196314)	1.598845 (0.585209)	0.01

Table 3 – OLS estimations (own calculation)

*OLS Note: * symbolizes significance at the 10% level, ** at 5% and *** at 1%*

In Table 3, we can find the various intercepts (including t-statistics), the Okun coefficients (including their t-Statistics) and the R^2 of each country.

We can see that only 9 out of 24 coefficients show significant results. The positive intercepts, however, are largely consistent with what we proposed in our theoretical framework.

The interpretation of the coefficients is already discussed in detail in Section 3.2.1, but to recap we take e.g. the case of Austria. The intercept suggests how unemployment would change if economic growth was zero. The result of 0.25 indicates that the unemployment rate rises by 0.25 percentage points if economic growth is 0 (= α of equation (1)).

The value of -3.44 for suggests that if ΔY (output growth) is +1 percent, then U declines by -3.44 percentage points. The result is not in line with Ball et al.´s results (2012), who suggest the smallest Okun coefficient for Austria. Since Austria has a relatively high employment protection (in comparison with other more liberal welfare states such as the UK, Ireland, or to some extent the Netherlands, and its labour market can be considered more rigid in comparison to liberal welfare states such as the UK e.g., this is a reasonable result.

Overall, the results are not satisfying, for this reason we enhanced our econometric model.

In a next stage we accounted for the contemporary correlation of the residuals in our data. By using the Feasible General Least Square estimator (FGLS) we control for heteroscedasticity in the data. With the FGLS estimator we can better control for common ´trends´ such as the Great Recession in 2008, the Golden Age in the 70s and 80s, the Oil crises from 1973 and 1979 and also the bursting of the Dotcom bubble in 2000. Furthermore, the FGLS method is consistent and asymptotically more efficient than our previous OLS estimator. Even if heteroscedasticity does not cause bias or inconsistency when using OLS, the usual standard errors and t statistics are no longer valid.

Table 3 differs from Table 4 in the following aspects.

In Table 4 we find similar results than in Table 2 but have one very important difference: *Now the majority of our coefficients show us significant results even at the 1% level.*

In addition, all our intercepts show positive signs with an average of 0.575. The average Okun coefficient of – 4.93 is comparable to the results of the OECD (OECD, 2012), who proposed an average Okun coefficient of 4 for the whole Euro Area.

In the case of Austria we see that unemployment would rise by 0.28 percentage points now, if $\Delta Y = 0$.

In addition we see the large heterogeneity between countries. Countries with the highest Okun coefficients such as Sweden (9.7) Finland (8.2), Spain (7.8), Austria (3.9), or Portugal (3.8)

can be considered to have a rather protective labour markets in comparison with countries such as the UK (1.5), or the Netherlands (2.6).

Inconsistent here is the very high Okun coefficient for Ireland (5.2), since this country is also characterized by liberal welfare state characteristics.

Our results can now be obtained from Table 4:

Country	**Intercept (t-Statistic)**	**Okun Coefficient (t-Statistic)**	**R^2**
Austria	0.277495*** (3.215429)	-3.850531*** (-3.181872)	0.08
Belgium	0.282121* (1.784572)	-2.847913 (-1.412766)	0.02
Finland	0.773867*** (3.268920)	-8.191150*** (-3.677193)	0.17
France	0.342423*** (3.327631)	-2.615301** (-2.464882)	0.04
Greece	1.243331*** (4.594868)	-7.917972*** (-4.249879)	0.19
Ireland	0.575646** (2.306982)	-5.195882*** (-2.938773)	0.05
Italy	0.401981*** (3.134803)	-3.130258*** (-2.883454)	0.02
Netherlands	0.264811 (1.409634)	-2.593879 (-1.098466)	0.01
Portugal	0.618620*** (3.325161)	-3.792633*** (-2.956135)	0.01
Spain	1.140363*** (3.171793)	-7.749998*** (-2.805876)	0.02
Sweden	0.804090*** (4.593805)	-9.719038*** (-4.936797)	0.17
United Kingdom	0.194157 (1.092161)	-1.517541 (-0.879130)	0.02
Mean rate	0.575	-4.93	

Table 4 – FGLS estimations (own calculation)

*FGLS Note: * symbolizes significance at the 10% level, ** at 5% and *** at 1%*

With respect to the intercepts of Table 4, we can observe smaller values for the UK (although not significant), the Netherlands, Belgium and Austria. The highest values were derived for Greece and Spain, both countries which face severe economic problems. Therefore the intercept acts as an appropriate indicator about the rigidity of a country´s labour market.

Among those countries are Sweden and Finland, characterized by a generous welfare state. Unfortunately we can not provide any economic explanation for this.

To sum it up, we can confirm the large heterogeneity of the Okun coefficient across countries. However, we also suggest to test the data via the "Gap method": It is better to estimate the natural rate of unemployment and the potential level of output as accurately as possible, than to assume the problem anyway (Ball, et al., 2012).

9. Conclusion

In this paper, one of the key stylized facts in economic history was investigated with respect to its persistence and weakening over time. We found evidence that Okun´s Law is still valid, however, it faces breakdowns (the Okun coefficient gets higher) during recessions in several countries. For this reason we propose an adoption of Okun´s Law with new data and the use of advanced econometric methods such as the PMG estimator or the Engle-Granger procedure in order to account for long-run cointegration in the Difference method.

Since we found a large heterogeneity across countries, one has to have a closer look at each country. Growth thresholds which need to be reached in order to reduce unemployment vary substantially across countries. The main factors influencing the varying intercepts (i.e. how unemployment changes if output growth is 0) are productivity growth and labour force participation. The Okun coefficient is mainly influenced by labour market institutions, and the labour market´s flexibility.

Because the exclusion of environmental impacts and social welfare effects is no longer an option in mainstream economics, we present solutions regarding how to break down Okun´s Law. Those solutions are presented in the context of the WWWForEurope and its new indicators of how to measure competitiveness (see (Aiginger, et al., 2013)). Our main proposal, the redirection of technological progress towards resource-saving technologies, is examined and suggestions are presented for their implementation. Further options include the slowing down of the technological progress, the reduction of the working time, the reduction of the labour force, and further labour market interventions (such as increasing public employment, or the support of subsistence households).

Further research is required in this field, and should be conducted under the new low growth perspectives and the inclusion of sustainability.

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Figures

Tables

Project Information

Welfare, Wealth and Work for Europe

A European research consortium is working on the analytical foundations for a socio-ecological transition

Abstract

Europe needs change. The financial crisis has exposed long-neglected deficiencies in the present growth path, most visibly in the areas of unemployment and public debt. At the same time, Europe has to cope with new challenges, ranging from globalisation and demographic shifts to new technologies and ecological challenges. Under the title of Welfare, Wealth and Work for Europe – WWWforEurope – a European research consortium is laying the analytical foundation for a new development strategy that will enable a socio-ecological transition to high levels of employment, social inclusion, gender equity and environmental sustainability. The four-year research project within the 7th Framework Programme funded by the European Commission was launched in April 2012. The consortium brings together researchers from 34 scientific institutions in 12 European countries and is coordinated by the Austrian Institute of Economic Research (WIFO). The project coordinator is Karl Aiginger, director of WIFO.

For details on WWWforEurope see: www.foreurope.eu

Contact for information

Kristin Smeral

WWWforEurope – Project Management Office

WIFO – Austrian Institute of Economic Research

Arsenal, Objekt 20

1030 Vienna

wwwforeurope-office@wifo.ac.at

T: +43 1 7982601 332

Domenico Rossetti di Valdalbero

DG Research and Innovation

European Commission

Domenico.Rossetti-di-Valdalbero@ec.europa.eu

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