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Contents

1 Introduction 1

2 Potential output, potential growth and the output gap 4

2.1 Estimating potential output 5

2.1.1 Univariate methods 5

2.1.1.1 Hodrick-Prescott filter (HP-Filter) 6

2.1.2 Multivariate methods 7

2.1.2.1 Production Function (PF) Approach 7

2.1.2.2 Structural Vector Autoregressive (SVAR) Model 8

3 Potential output and financial crises 9

3.1 Expected theoretical impact of financial crises on the input factors 12

3.1.1 Labor input 13

3.1.2 Capital accumulation 18

3.1.3 Total factor productivity (TFP) 20

3.2 Policy responses 22

3.2.1 Japan 22

3.2.2 Finland 25

3.2.3 Some comments and comparison of Finland and Japan 27

3.2.4 Policy response of the euro area countries to the current crisis 29

3.2.4.1 Support for the labor market 31

3.2.4.2 Investment support 33

3.2.4.3 Business support 35

3.2.4.4 Discussion of the policy measures 36

3.3 Current estimates of potential output growth 37

4 Empirical part 40

4.1 HP filter method 40

4.2 Production Function (PF) method 44

4.2.1 Production function 44

4.2.2 Defining the potential input factors and potential output 44
4.2.3 Description of the data 46
4.2.4 Basic estimation of potential output 47
4.2.5 Three scenarios of medium potential output growth 49
4.2.5.1 Scenario 1: average pre-crisis TFP growth 51
4.2.5.2 Scenario 2: permanently lower TFP growth 52
4.2.5.3 Scenario 3: permanently higher TFP growth 54
4.2.5.4 Some comments on the results 56

5 Summary and conclusion 58

Bibliography 60

List of figures 64

List of tables 65

Abstract 66

Abstract (German) / Zusammenfassung 66

Annex 67

Curriculum Vitae 77

1 Introduction

"The world economy is fitfully getting back to normal, but it will be a "new normal"."

The Economist, 3rd October 2009

Potential output and the output gap, derived from the concept of potential output, are key indicators for fiscal and monetary policy. For politicians, responsible for economic policy measures, estimations of potential output and the output gap are of great importance to evaluate the development of the business cycle and the macroeconomic performance of a country. The political programs often depend on the development of potential output.

Estimates of potential output and the output gap are used by the European Union (EU) in their macroeconomic surveillance procedures. Especially in the Stability and Growth Pact, which should ensure that the Member States of the euro area maintain the budgetary discipline, the output gap is used for calculating indicators of cyclical adjusted fiscal balance.[1] These indicators are used in turn for assessing the observation of the convergence criteria and therefore are very useful indicators of the fiscal policy stance.[2]

Concerning the monetary policy, the concept of potential output and the output gap are key indicators for the European Central Bank (ECB). The primary objective of the ECB's monetary policy is ensuring price stability in the euro area. In order to evaluate all the relevant information that is important for assessing the risks to inflation the ECB's policy actions are based on the "two pillars", economic

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[1] *Cyclical adjusted fiscal balance is thereby the one that would occur when output were at its potential level.*

[2] *See European Commission (2001)*

analysis and monetary analysis[3]. For both analytical perspectives the concept of potential output is of great relevance. For example, a positive output gap (actual is above the potential production level), often occurring in boom periods, implies an overheating of the economy and thus is an indicator for inflationary pressure. Thus, as the central banks use the output gap as one of the leading indicators of inflation and thus monetary policy, achieving good estimates of potential output is of great interest for the ECB. Orphanides (2000) showed that the systematic mismeasurement of the output gap in the 1960's and 1970's led to inappropriate activist stabilization policy and therefore was the main factor of the Great inflation in the 1970's in the United States.

With the bankruptcy of the US investment bank Lehman Brothers on the 15th of September the most severe downturn since the great depression in the 1930's started. In the short-run the crisis led to a strong fall in the potential output level due to negative effects on all input factors of production. The post crisis development in the medium-and long-run are, however, less clear. The theoretical cases are a full recovery-, a permanent loss- and an increasing loss over time scenario. Which scenario will be more likely heavily depends on the policy programs implemented and the effects on the input factors (labor, capital and total factor productivity).

In the theoretical and empirical analysis in this thesis I describe the effects of the current crisis on potential output and its input factors. Thereby I concentrate only on the euro area. By varying the assumptions about the medium-term development of total factor productivity, whereby the assumptions are based on the theoretical analysis of the policy programs implemented by the euro area countries, it is shown that the recovery scenario of potential output in the post-crisis period heavily depends on this input factor. Dependent on the assumption I could simulate all three theoretical cases. Regarding the policy actions taken, the most plausible case is a permanent loss in potential output level.

The diploma thesis is structured as follows: Chapter 2 shortly explains the concept of potential output, output growth and the output gap. It also gives a broad overview of the most important methods used to estimate potential output.

[3] *European Central Bank (2009b)*

Chapter 3 deals with the theoretical effects of economic crises on the input factors (labor, capital and total factor productivity) of the production function. Furthermore the policy responses of the euro area countries in the current crisis and their impact on the input factors are analyzed. Chapter 4 is the empirical part of the thesis. First, two different methods are used in order to get own estimates of potential output. In the last section of the chapter three medium-term scenarios, which differ in the assumption about the future development of total factor productivity, are performed. The last chapter of the thesis concludes and gives an outlook for further research.

2 Potential output, potential growth and the output gap

Potential output is usually defined as a measure of how much the economy could and would produce under hypothetical conditions of full utilization of all factors of production. In general, Arthur M. Okun's speech on the annual conference of the American Statistic Association (1962) about the significance and measurement of potential Gross National Product (GNP) is considered as the beginning of the development of methods for calculating potential output. According to Okun (1962), potential output can be understood as the macroeconomic production level without inflationary pressure. Thus potential output, as a supply concept, depends on the quality and quantity of the input factors, labor and capital, and on the state of technology of an economy. Higher levels of the input factors lead to a higher level of potential output.

Two other important economic indicators (potential growth and the output gap) can be derived from the idea of potential output. Potential growth is defined as the growth rates of the levels of potential output.

The output gap is the percentage deviation of the actual economic output level from the potential output level and thus measures the degree of utilization of the production factors in the economy. As potential output is the production level with stable inflation a positive output gap can be interpreted as the part of the output subjected to inflationary pressure. On the opposite a negative output gap can be an indicator for lower inflation rates or an upcoming deflation. As the potential output can be seen as the equilibrium level a positive or negative output gap means that the economy is somehow running at an inefficient rate.

2.1 Estimating potential output[4]

Potential output cannot be observed directly and thus has to be estimated using other economic variables that are available. The economic literature describes a variety of different approaches. This paper only briefly gives a broad overview of the different approaches. For more details see Hauptmeier (2009).

The methods can be classified in various ways. In this paper the methods are grouped into the two main categories: univariate and multivariate methods of calculating potential output. The evaluation of the most appropriate method has to be done on the basis of different criteria. The methods differ in their complexity of calculation, in their data needs for the calculation process and their reliability. The timeliness of the data also plays an important role for the choice of the right method. In general, the univariate methods in contrast to the multivariate ones are characterized by a high level of practicability. However, the reliability of the estimates is assumed to be bigger when using the multivariate methods.

2.1.1 Univariate methods

The univariate method only takes into account historical values of the target variables (in this case GDP). Most of the methods use some kind of filtering techniques with the aim of fitting trend lines to observed time series. The problem using this method is that it projects past values into the future without regarding that potential output is also determined by future expectations. However, the advantage of this kind of method is the relative simple practicability and the low data needs. However, the reliability of these methods is doubtful as other observable economic variables that influence potential output are not taken into account.

[4] *See: Hauptmeier (2009), pp. 87-99*

2.1.1.1 Hodrick-Prescott filter (HP-Filter)

This technical method is widely used, because it is very simple and it only requires output data for estimating potential output. It finds the value for potential output (y_t^*) that minimizes the difference between actual and potential output, imposing constraints on the extent to which growth in potential output can vary.

Using the HP-filter the following expression is minimized:

$$\min_{y_t^*}^{\mathrm{T}} \left\{ \sum_{t=1}^{T} (y_t - y_t^*)^2 + \lambda \sum_{t=2}^{T-1} [(y_{t+1}^* - y_t^*) - (y_t^* - y_{t-1}^*)]^2 \right\}$$

y_t^*, y_t being the potential and actual output respectively in time t.

The first term of the equation is the square of the difference between actual and potential output. It keeps the trend close to the observations. The second term reflects the square of the change in potential output growth and keeps the trend smooth. The central parameter in this equation, the relative weight of the two terms of the equation, is the so – called smoothing parameter λ, which is determined outside the model with values from zero to infinite. The choice of λ depends on the frequency of observations. (λ=1600 for quarterly and λ=100 for end-of-the-year data have become established).

Other univariate methods for estimating potential output, using some kind of filtering technique are the “Baxter-King” filter and the “Christiano-Fitzgerald” filter, which both belong to the “band-pass filters. For a further discussion see Bjørnland, Brubakk, and Jore (2005).

The main problem using filtering methods is the so-called end-point problem. To deal with this problem, the actual reference output series is being forecasted into the future. Thus, on the one hand the quality of the estimates of potential output and the output gap mainly depends on the quality of these forecasts. But on the other hand the current estimates of the output gaps influence the forecasts of GDP. The relation between the two variables is therefore a vicious cycle. Especially in times of turning points in the economic cycle the use of the HP-filter in order to get estimations of current potential output is problematic. Although a

change of the trend in the real GDP series can already be assumed, the HP-filter will not take this into account in a proper way.

2.1.2 Multivariate methods

The main idea of the multivariate methods is that there exists a relationship between a change in GDP and a change in other economic variables that can be observed. Here in this paper the production function (PF) method and the structural vector autoregressive (SVAR) models, the two most important representatives of this category, will be described. The main advantage of these methods is the higher reliability compared to the univariate methods as observable economic variables are taken into account. However, the calculation process is often quite complex as it is based upon economic models.

2.1.2.1 Production Function (PF) Approach

This method is widely used by international organizations such as the OECD, IMF or the European Commission to derive estimates of potential output. It is based on the assumption that a macroeconomic production function describes the connection between GDP and the input factors capital, labor and technological progress. Potential output is calculated by estimating a production function and then replacing its input factors by their potential values. There are a number of different functional forms of production functions. The one used most is the “Cobb-Douglas” production function. The advantage of this approach, compared to the univariate methods, using some kind of filtering methods, is that the reasons for changes in potential output can be explained by the key economic forces. The effects of structural changes and policies on potential output can thus be analyzed. The main disadvantage is that the method still uses some kind of filtering method as the HP-filter, mentioned above, to determine the potential input factors. So the end-point problem still features here. There is also a data problem when using this method, as measures of capital stock may often be of poor quality and so not very reliable. In summary, the production function method is superior to the univariate methods because they provide economic explanations for developments in potential output.

2.1.2.2 Structural Vector Autoregressive (SVAR) Model

Potential output in this case is estimated by using information from a number of highly correlated variables, such as GDP, unemployment and domestic inflation. Many modifications to the standard approach by Blanchard and Quah (1989) can be found in the literature. The SVAR model has the advantage that it imposes relatively few constraints on the relationship between the variables. The models are based on economic theory and thus not arbitrary determined. Another advantage is that there is no end-point problem using this method for estimating potential output. The main disadvantage, compared to the PF-method, is that the central variables that influence potential output cannot be identified. Furthermore, it is a non-transparent method and compared to the HP-filter method more complicated and can therefore not be executed very quickly.

3 Potential output and financial crises

Financial crises are usually followed by deep recessions in the economy. Reinhart and Rogoff (2009) studied the aftermath of severe financial crises, including emerging economies. Their investigations showed that financial crises lead to large losses in output and employment. There is an average peak to trough decline in output by 9.3 percentage points with an average duration of 1.9 years. Regarding the recent financial crisis of 2008 output declined by 4.1% in the euro area and 4.2% in the EU 27 in the year 2009.[5] At that time it seems that the recovery programs have been effective and the output could increase again in the year 2010 in the euro area. However the prospects for the following year are of great uncertainty. The financial downturn has not fully affected the labor market yet and the impact of the crisis on public finances is still to be faced. So a further negative loop cannot be ruled out. If the euro area should be out of recession there are still important questions to answer: Will the recent loss in GDP levels be easily recouped? Will the economy return to its "before crisis" potential output level? What are the effects of the financial crisis on the long-run potential growth?

[5] *European Commission (2010c)*

Three different scenarios for the impact of a financial crisis on potential output level and growth are possible:[6]

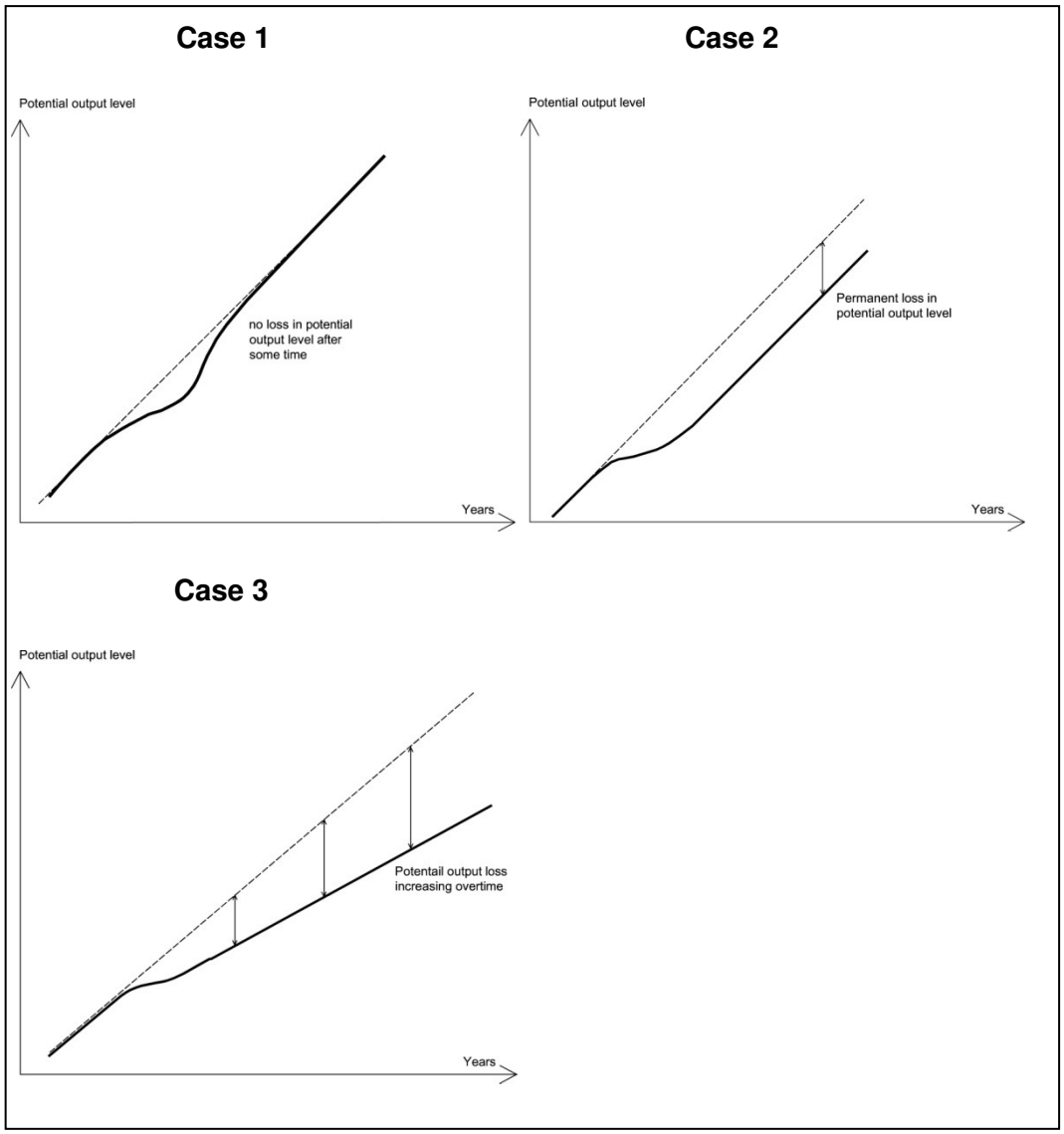


Figure 1: Three possible theoretical cases[7]

[6] *European Commission (2009a)*

[7] *European Commission (2009a), p. 11*

It seems to be inevitable that in the short run there will be a drop in the potential output level as a consequence of the current financial crisis. This is very likely due to the reduction in the productive capital stock and the negative effect on labor supply and structural unemployment. So all three cases account for the short run drop in potential output level.

- Case one shows the full recovery scenario where the potential growth rate is higher after the crisis is over and so the economy can recover all the lost output of the drop in the short run. In the long run the economy will return to its "before crisis" potential output growth path.
- The second possible scenario states that there will be a permanent loss in potential output level. The long-run potential growth rate after the crisis will return to its initial rate and so the short run drop in the GDP level cannot be compensated.
- The third scenario finally shows the worst case for an economy. A proper recovery from the crisis is not possible, leading to a lower growth of potential output after the crisis. So the loss in GDP level is increasing over time. This certainly implies severe damages for the economy and thus all necessary actions have to be taken in order to avoid such a scenario.

Taking a closer look at recoveries following a banking crisis, each of the three possible scenarios can be found in the recent history. Sweden, Finland and Japan suffered from a banking crisis in the early 1990's. Sweden's post-crisis potential output growth exceeded the pre-crisis rate and so was able to fully recover the losses in the output level. A kind of mixture between the first and the second scenario described above can be found in Finland in 1991. At the beginning of the recovery their post-crisis potential growth rate was as high as the pre-crisis one, but increasing slowly. In the end Finland was able to recover the losses in potential output but not as quickly as Sweden did it. Finally, the recovery of Japan is an example for a lower growth of potential GDP growth after the crisis and so the loss in level was increasing over time.

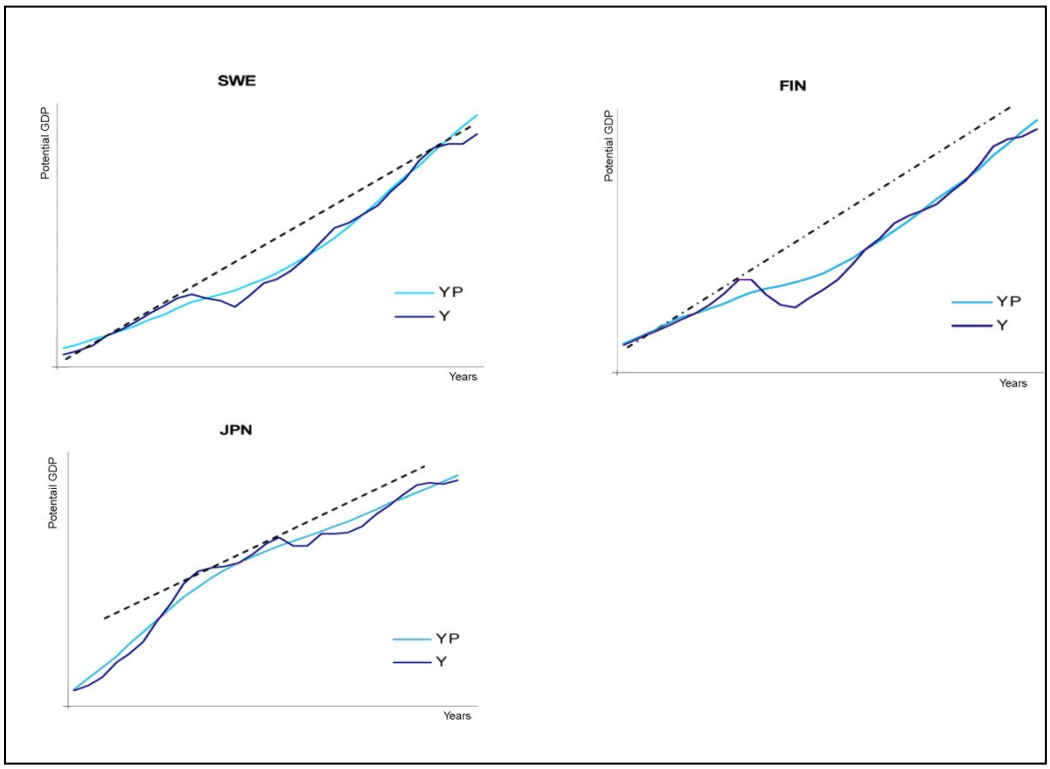


Figure 2: Level in actual (Y) and potential (YP) output of Finalnd, Sweden and Japan[8]

So the crucial question to be answered is why the recovery process in Sweden and Finland worked quite well but not so in Japan. Which policy programs should be taken in order to boost potential output growth after a recession? To answer this question it is important to thoroughly understand the impact of the crisis on potential output level/growth and therefore a detailed theoretical analysis of its components (labor, capital and total factor productivity) will be done in the next chapter.

3.1 Expected theoretical impact of financial crises on the input factors

According to the production function method the three input factors labor, capital and total factor productivity determine the level, and the growth, of potential

[8] *European Commission (2009a), p. 23*

output. Severe financial crisis, like the recent one in 2008, often negatively affect potential output growth through all three input channels. It is, however, not that clear what the long-run effects on potential growth are. If the right policy programs are being taken the possible negative impact of the crisis in the long run can be prevented and a strong recovery is feasible. Thus, the different policy programs of Finland, as the positive example, will be compared with the ones of Japan, as the negative example. However, one has to bear in mind that not all programs that are good for one country also have to lead to a strong recovery in other countries. Though, the positive examples can in some sense give indications about the most effective policy actions for countries affected by the crisis. At last, however, the policy responses have to be adjusted for each country and each crisis separately.

3.1.1 Labor input

Economic crises are always associated with declines in employment. Reinhart and Rogoff (2009), analyzing the aftermath of severe financial crises, found out that on average unemployment rises for almost five years, with an increase in the unemployment rate of about seven percentage points. The duration in the decline in employment is noticeable as it lasts on average about three years longer than the downturn in real GDP. Regarding the current financial crisis, the OECD estimated in November 2009, that the unemployment rate in the euro area will rise in the years 2009 – 2011, achieving 10.8% of labor force in the year 2011 (see Figure 3).

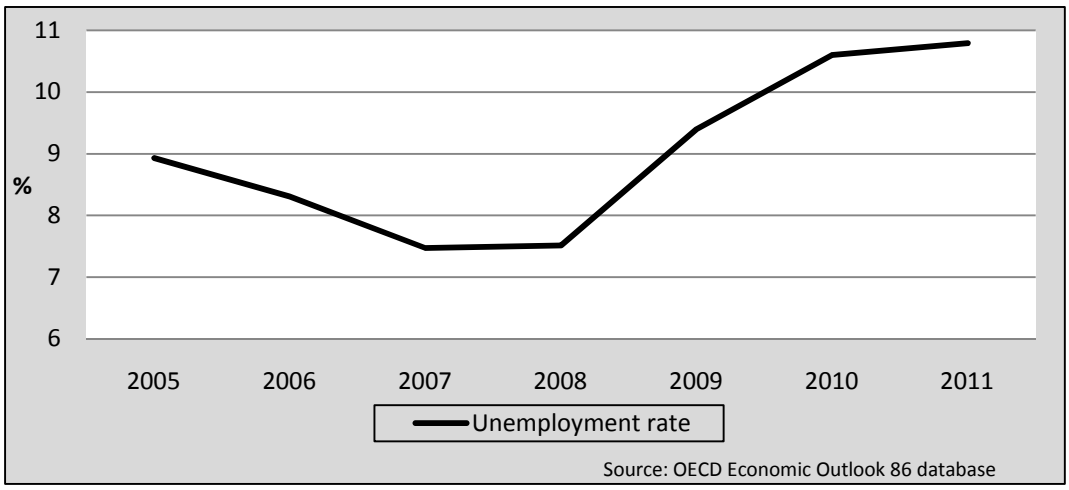


Figure 3 : Rising unemployment rate in the euro area

Standard macroeconomic models distinguish between the actual and the equilibrium (=structural) unemployment rate. The structural unemployment rate is defined as the rate of unemployment consistent with stable inflation (NAIRU: Non-accelerating inflation rate of unemployment).

Regarding labor supply it is very likely that there is a temporary increase in the short-term NAIRU during the recession period due to the slow reallocation process in the economy and the sluggish adjustment in prices and wages. So in the short run there will be some negative effects on trend participation rate and on the trend hours worked. These labor inputs should come back to its pre-crisis level if the crisis is short and wrong policy actions are avoided. This would leave the NAIRU in the long run and therefore the potential growth path unchanged.[9]

However, by weakening the labor market situation financial crisis can also lead to an increase in long-term structural unemployment. There are a number of empirical studies that try to find out the main driving forces of the NAIRU. The structural unemployment rate is only determined by labor market institutions and real rigidities but not affected by the actual unemployment rate.[10] Blanchard and

[9] *see European Commission (2009a)*

[10] *See: European Commission (2009a)*

Summers (1986) were among the first who embodied the idea that the equilibrium unemployment rate depends on the history of the actual unemployment rate. Such theories are called hysteresis theories. Hysteresis could possibly be explained by “insiders”, who already are employed, and “outsiders”, who are not employed, in the context of wage bargaining. Workers losing their jobs in turn also lose their ability to compete for jobs with the “insiders”. Mainly long term unemployment may cause a permanent destruction in human capital due to a deterioration of skills. Unlike the short term unemployed they do no longer compete for a job with the “insiders”. Thus, the extent on the downward pressure of wages due to the high unemployment is reduced resulting in persistence in unemployment. This can cause a long-lasting loss in potential output.

It is quite ambiguous what the effects of prolonged economic downturns are on the labor force participation. On the one hand the “discouraged worker effect” states that the high unemployment rate discourages vulnerable workers from seeking a new position. Mainly groups that are disadvantaged in the labor market, like women with children, low skilled workers or the youth and older people, are affected by this effect. Pichelman and Elmeskov (1993) found evidence that the “discouraged worker effect” can be significant. On the other hand the “additional worker effect” says that the loss of income due to the crisis can encourage second income earners to enter the labor force. There is also evidence that particularly for females this effect is important. A possible further reduction of the labor force participation rate can derive from bad policy decisions. Governments can set social and financial incentives to keep potential working forces away from the labor market, like making early retirements attractive to older people or encouraging the youth to study longer. Taking such actions should be avoided because on the one hand they are very expensive and on the other hand they even cannot solve the unemployment problem in the long run.

There is quite a clear consensus in the economic literature that structural unemployment is affected by real rigidities and institutional settings. Empirical studies find evidence that unemployment benefits, tax wedges, trade unions, the real interest rate and thus the cost of capital, employment protection legislation

(EPL), labor market policies, product market regulations (PMR) and the minimum wage affect structural unemployment.

A higher unemployment benefit improves the situation for workers in the case that they lose their jobs. For those who are already unemployed the incentives to search effectively for a new job decline and thus the downward pressure on the wages by competing with the employed workers falls. In both cases higher unemployment benefits may lead to upward pressure on wages and thus to a rise in the structural unemployment rate. Bassanini and Duval (2006) for example estimate that on average a ten percentage point reduction in unemployment benefit leads to a drop in the unemployment rate by about 1.2 percentage points. The argument should therefore also work for the opposite direction (rise in unemployment benefit leads to a rise in unemployment rate).

Higher labor taxes for the workers as a consequence of the rising fiscal burden due to the downturn, may also discourage workers from searching for a job, leading to the same effects on the structural unemployment rate as higher unemployment benefits.

Gianella et al. (2009) analyzing OECD countries and the impact factors of the NAIRU, find evidence that the long-term interest rate – used as a proxy for the cost of capital – has a significant impact on the NAIRU in all OECD countries but Portugal and Japan. The results they obtained suggested that the interest rate was a key driver of the surge in structural unemployment in the 1980's. The effect they found was close to one percentage point. In times of economic downturns it is likely that there is a durable increase in the risk premium on interest rates which in turn, following the empirical results of Gianella et al. (2009), would increase the NAIRU and therefore negatively influence potential output.

Other institutional settings are likely to affect the development of structural unemployment. The OECD has developed indicators of product market regulation (PMR). These indicators measure in a comprehensive and internationally comparable way the degree to which the states' policies promote or inhibit competition in the product market where competition is viable. The indicators cover the state control of business enterprises, legal and administrative barriers

to entrepreneurship and barriers to international trade and investment.[11] Gianella et al. (2009) find that in 14 out of 19 OECD countries the PMR indicators have a significant impact on the NAIRU. So in times of economic downturn a rise in the PMR index, stemming from strong barriers and therefore inflexibility in the product market, can hamper the restructuring process following a crisis.

Minimum wages and trade unions also affect the NAIRU through their impacts on wages. However this effect is not very likely to change due to economic crises.

Finally, the unemployment protection legislation (EPL) may affect structural unemployment. There is no consensus in the literature that this effect exists. On the one hand Bassanini and Duval (2006), for example, find no evidence that EPL has a significant impact on the NAIRU. On the other hand Furceri and Mourougane (2009) find evidence that in times of crises, countries with high EPL are likely to experience a marked rise in structural unemployment. The initial downturn can be damped by high unemployment legislation because it provides job security for workers. The long term unemployment rate, however, is negatively affected by stringent EPL due to the difficulties in the necessary reallocation of labor.

How strong the particular effects of institutional settings on the NAIRU in times of crisis are is an empirical question. Furceri and Mourougane (2009) tried to analyze this question by looking at data from past economic crises. They first found clear evidence that a downturn leads to a rise in the level of structural unemployment. The amplitude of the effect depends on the severity of the crisis. In case of very severe downturns structural unemployment rises by about 1.5 percentage points after five years. Second institutional settings affect the structural unemployment in the initial shock and in the adjustment process in the aftermath of the crisis. In particular they found that in economies with very rigid labor and product markets (high EPL, PMR and average replacement ratio) economic downturns increase structural unemployment significantly whereas they have not found such effects in relatively flexible economies.

[11] *See: OECD (2009c)*

Summarizing, economic crises bear some risks for a rising structural unemployment rate in the long run. Thereby the destruction of human capital, real rigidities and institutional settings are the main dangers for a permanent higher NAIRU and a negative effect on potential output.

3.1.2 Capital accumulation

Economic crises usually lead to a decreasing demand of products and so as a consequence to a lower incentive for investments. So from the beginning of a crisis there is often a very strong reduction in the investment rate which in turn negatively affects the capital stock which causes a drop in the level of potential output in the short run. But it is not only the decline in demand but also the increasing cost of borrowing due to financial crises that has a negative effect on investment. Such an economic condition in which capital is difficult to obtain is called credit crunch. It arises because crises always cause uncertainty about the future developments of the economy and of the individual company, which leads to an increase in the risk premia. For companies that are not best rated it is nearly impossible to borrow because the lenders' fear of bankruptcies or defaults. In the current economic downturn the credit crunch was very severe in some European countries leading to the situation that banks did not grant credits even to the best rated companies. Figure 4 shows that in the aftermath of the financial crisis the monthly growth rate of loans that was granted to non-financial corporations in the euro area was negative. On the one hand this can be explained by the credit crunch on the other hand it can partly be explained by the reduced demand for loans due the shortfall in demand.

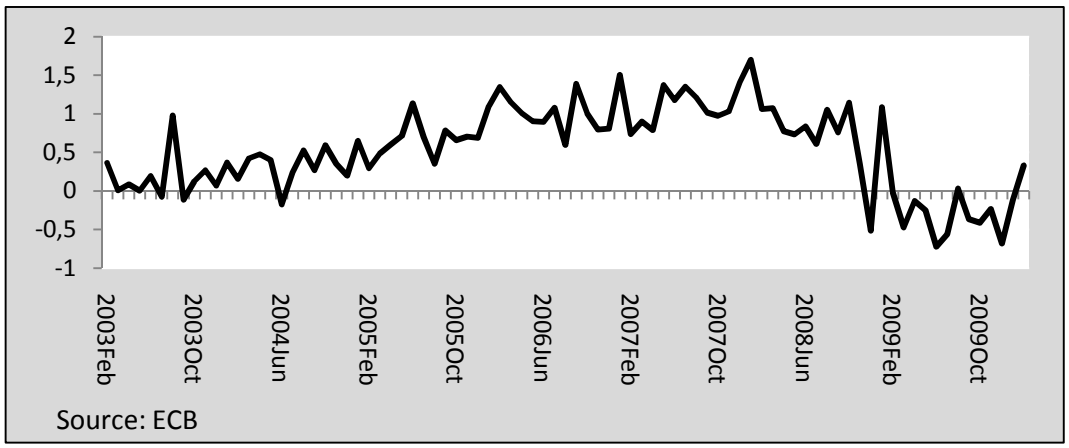


Figure 4: Monthly growth of loans to non-financial corporations in the euro area

It is quite obvious that such a credit crunch has a negative effect on capital accumulation and therefore also on potential output in the short-run. The effects in the long-rung are not that clear. However, according to the European Commission a longer-run adverse impact is also quite reasonable: *"Given the realistic prospect of permanently higher financing costs and the increased risk that a prolonged banking crisis could impair the vital capital reallocation process in economies or could lead to a "re-nationalisation" of EU financial markets, there is a considerable risk of a longer-run adverse impact on the pace of capital accumulation."*[12] However there seems to be a broad consensus among European policy makers that all essential actions have to be taken to avoid such a scenario.

A crisis can also negatively affect the capital stock through a rising depreciation rate as the existing equipments may become obsolete due to bankruptcies or/and reallocations within firms and between industries.

[12] *European Commission (2009a), p. 13*

3.1.3 Total factor productivity (TFP)

Total factor productivity is a measure of the efficiency of all input factors of a production process. It is commonly estimated as the residuals of the production function and it is therefore a variable that accounts for the effects of total output that is not caused by the inputs. As anything else than the traditional inputs of production falls under TFP it is not that clear what it really measures. So TFP productivity is often seen as equivalent with technological progress and efficiency. In the economic literature TFP is often seen as the main driving force of (potential) output growth within an economy. It is quite important to point out the possible effects an economic downturn can have on total productivity as the development of TFP after the crisis will surely be the major determinant of whether the economy will achieve a full recovery or not. There is however no clear answer what the effects of an economic downturn on total factor productivity will be. On the one hand there are arguments that TFP growth will be dampened in the aftermath of a crisis but on the other hand also plausible reasons for a positive impact of a crisis on TFP exist.

The total factor productivity levels and growth rates are traditionally higher in the manufacturing sector than in the service sector. In the last years there has already been a shift between these two industries, from the manufacturing sector to the service sector. As the crisis of 2008 has severely hit, for example, the construction and the automobile industry such affected sectors will reduce their activities which will cause a downward shift in the level of TFP. Furthermore, the crisis could also accelerate the process of the reallocation in the economy, leading to a permanently larger service and a smaller manufacturing sector. This in turn also has a negative impact on total factor productivity. However, the reallocation process could also positively affect TFP if countries shift the resources from slow-productivity industries into faster growing industries. In some European countries there could, for example, be a shift from construction industry, which has a rather slow productivity growth, to the very fast growing ICT (Information and communication technologies) industry.

Another negative effect the crisis can have on total factor productivity comes through a slow industrial restructuring process. This process heavily depends on the quality and speed of rebuilding the banking sector. Otherwise credit

constraints will remain and potentially profitable companies with high innovative capacity and growth prospects will be prevented from the start-up. The financial system may even not be able to allocate loans as productively as before the crisis because projects with a high return are often linked to a high risk. Such projects are discouraged by more cautious lending attitudes due to the crisis. Granting subsidies or state aids to banks in order to restructure them, in turn can lead to political dependence. So highly subsidized banks favor less efficient but larger firms because then they might be bailed out by the government in case of bankruptcies. This leads to an inefficient capital reallocation at the expense of innovative but vulnerable firms. Further, this may induce a lower TFP level and a lower rate in developing new innovative technologies which in turn will cause a lower TFP- and so a lower potential output growth.

R&D investments also affect total factor productivity. The effects of a crisis on R&D investments are less clear. On the one hand empirical literature shows that R&D is pro-cyclical. In bad times, especially if firms suffer from credit constraints, research and development spending tends to be scaled back, leading to less innovation and thus to a lower productivity. On the other hand it is also plausible that research and development is not pro-cyclical. This argument is based on the “opportunity-cost effect”. It states that during a recession firms have to focus on the most productive segments of their output due to the lower profitability. So labor and capital resources are often under-utilized and so the opportunity cost of using them to create new technologies are lower. These incentives to undertake R&D activities can have positive effects on total factor productivity. Another positive effect a recession may have on total factor productivity is the “creative destruction”, first introduced by Schumpeter (1942). Here economic downturns are assumed to have a cleansing effect on the economy by forcing the least productive firms out of the market during recession periods. This in turn will increase the average economy-wide productivity growth rate.

3.2 Policy responses

The possible effects of a financial crisis on the three input factors have been described in the previous chapter. However, the real effect on labor and capital input as well as on TFP depends very much on the policy programs of a country. National governments or rather their economic advisors try to find the best responses to financial crises in order to avoid long recessions. But, history shows that this is a very difficult undertaking and that some countries have been more successful than others. In this part of the work the impacts of policy programs on the three input factors and therefore on potential output growth will be analyzed on the basis of Finland as the positive example and Japan as the negative one (see Figure 2). As these crises had their origins in the banking sector and had repercussions on the real economy a comparison with the current crisis seems to be possible and plausible.

3.2.1 Japan

The crisis in Japan was caused by the crash of the asset price bubble, which was, according to Fukao (2003), created by expansionary monetary policy, tax distortions and financial deregulations, at the beginning of the 1990's. In connection with the crisis in Japan the phrase "lost decade" is often used in economic literature. A reason for the prolonged duration of the downturn is that there was a general optimism that once the aftermath of the bubble economy had been cleaned up the economy would come back to its pre-crisis growth rate path which had been very high compared to other economies. So in the first years after the crisis, in the first half of the 1990's, national authorities adopted a wait-and-see policy. The optimism was founded on the fact that the growth rates after the burst of the bubble were still positive albeit at a slower pace. The "lost decade" can be divided into three parts (see Figure 5): the recession of 1991-1993, the temporary recovery of the economy (1994-1996) and the deep recession of 1997-1999.

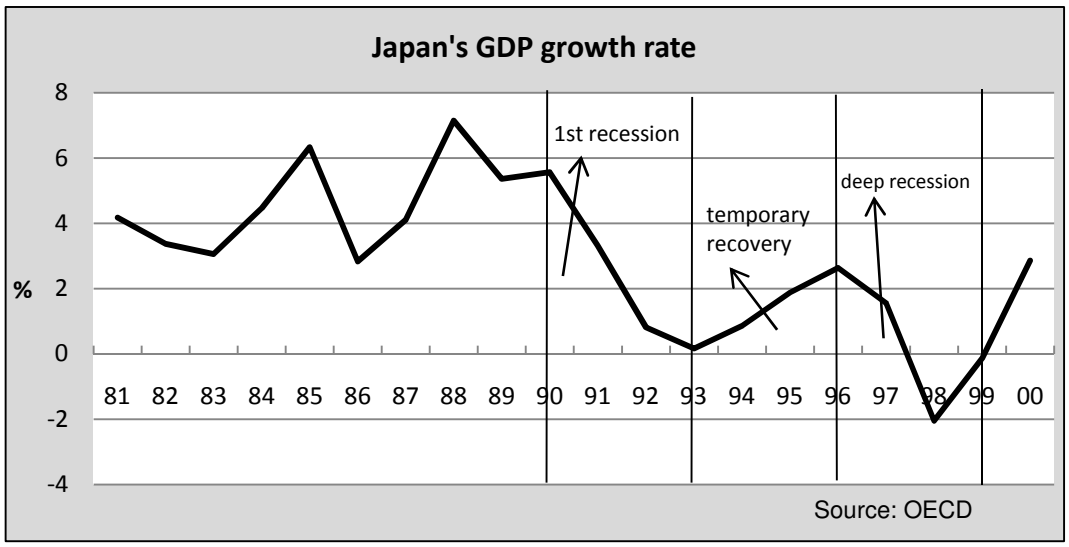


Figure 5: GDP growth rate of Japan's "lost decade"

Concerning the monetary policy, the Bank of Japan decided to cut the discount rate from 6.00% to 5.50% in July 1991, as the economy began to slow down. Over the next four years the Bank of Japan gradually cut the discount rate, until the official rate stood at 0.50% in September 1995. This rate was held constant up to the year 2000. As shown in Figure 5, these gradual cuts in addition to the fiscal policy measures described below may have helped to temporarily recover from the downturn.

However, regarding the whole decade, the expansionary monetary policy failed to achieve recovery. A reason for that is the non-performing loan problem in the banking sector. Due to the burst of the asset bubble many loans turned into bad ones, leading to huge problems for the Japanese banks. Therefore the banks used the low discount rate, which should actually act as a stimulus for the economy, to increase liquidity instead of increasing its lending. That means that the cheap costs of borrowing have not reached the consumers. In addition, the national authorities failed to achieve the essential restructuring of the banking system. At the peak of the non-performing loan problem in late 1997, one major bank and a big security firm failed, thus, with the crisis in the financial sector leading to a severe credit crunch, the economy went back into recession. The government provided capital injections for solvent banks and protections of

depositors of failed banks. But it failed to make the balance sheets of the banks more transparent and to force the banks to write off all their bad loans. Consequently, the public confidence in the banking system could not be regained.

In addition to the monetary policy measures, Japan also provided large fiscal stimulus packages during the “lost decade”. In the year 1992 to 1995 the government formulated seven stimulus packages and major tax reductions leading to a temporary recovery of the economy (Figure 5). However, the packages were often poorly directed to unproductive public work programs and to small firms and industries that where no longer economically viable and so did not lead to a long term recovery. These ineffective stimulus packages and the tax cuts lead to high fiscal deficits. In order to undertake budgetary consolidation, perceived to be a necessity because of the rapid ageing of the population, the Japanese government decided to tighten fiscal spending in 1997, justified by the relatively high GDP growth rate in 1996. The consumption tax rate was raised from 3% to 5%, the special income tax reductions ended and the patient co-payment under the national health insurance for the workers and the elderly increased. Furthermore, spending in public work was reduced.

Together with the financial sector crisis described above, the Japanese economy slipped into a severe recession. Recognizing that the economy was not ready for such a fiscal tightening, the government changed its fiscal policy again. Further tax reductions and increases in public work were implemented to stimulate demand and to come out of recession.

In addition to the monetary and fiscal policy errors mentioned above, Japan made significant structural policy mistakes. The Japanese authorities had great success in the 1980’s with their previous policy approach and thus were not willing to restructure the economy. Employment levels in affected industries were only slowly reduced and labor and capital resources were only slowly released for industries of the future. There was a general denial to shift resources from unproductive firms and industries to new, efficient ones. The overall industrial structure in 1999/2000 looked remarkably similar to that of 1989/1990.

3.2.2 Finland

Finland's economic development in the 1980's and 1990's can be characterized as a boom-bust cycle (see Figure 6).

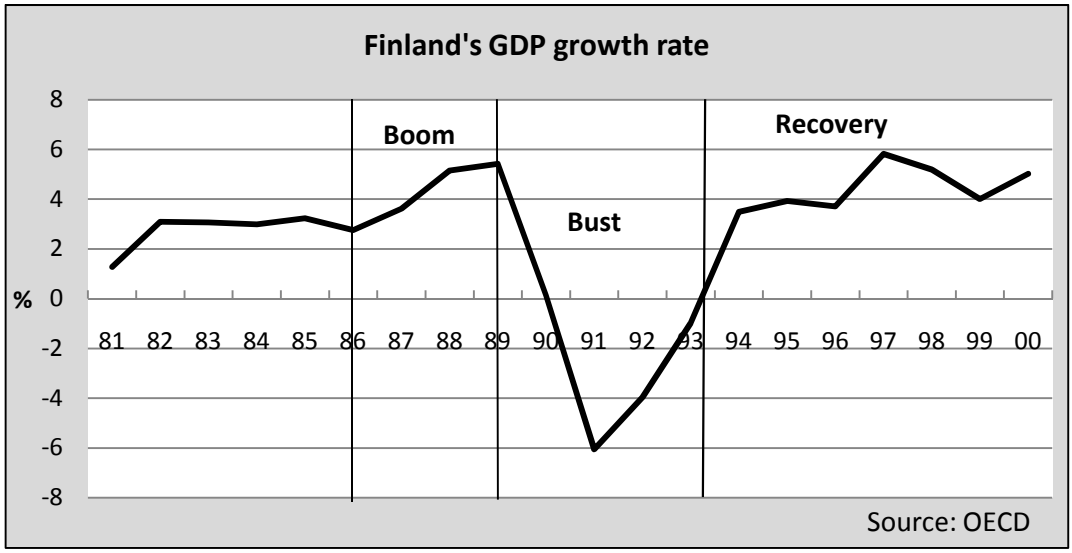


Figure 6: Finland's GDP growth rate, 1981 to 2000

With the deregulation of the banking sector and the financial integration of Finland with the rest of the world, the Finish economy experienced a strong boom phase in the second half of the 1980's (Figure 6). Bank lending increased dramatically which was channeled to the asset market. Rising asset prices and real estate prices resulted in an increase in public wealth. The availability of cheap borrowing with zero or negative real interest rate, due to high inflation, led to the creation of a financial bubble. But due to the strong GDP growth the government was unwilling to change the monetary and fiscal policy in order to gain control of the expansion in demand. This evolution led to an overheating of the economy and to indebtedness. The debts of the private sector for example, doubled between the years 1987 and 1990. In the years 1989 to 1991 some negative external shocks changed the economic situation. There was a slowdown in the international economy and the European interest rate rose in 1990. The

collapse of the Soviet Union reduced the export earnings by 10% in 1991 and the Finish terms-of-trade deteriorated by more than 15%. In order to defend the pegged exchange rate against speculative attacks the Bank of Finland increased the key interest rate up to 13%. These high interest rates combined with declining asset values depressed domestic demand. Investment and consumption were reduced and as a consequence GDP fell sharply by 13% (see Figure 6).

The decision to devalue the Finish currency 1991 and the abolition of the pegged exchange rate in 1992 improved the competitiveness of Finish firms and stimulated export growth. Without the peg the Bank of Finland was able to cut the interest rate which helped to stabilize asset prices and to end the deflationary process. By the end of 1993 the economy started a very strong recovery with GDP growth rates of about 4.5% on average for the rest of the 1990's (see Figure 6). The strong recovery was characterized by a rapid productivity growth due to fundamental structural changes in the economy particularly in their manufacturing sector. Finland restructured their economy from resource-based heavy industries to knowledge-based ICT industries and therefore used the economy for creative destruction, shifting labor and capital from inefficient firms/industries to new more profitable ones. In 1992, the electronic sector was smaller than any of the following industries: wood, metal or food. In the year 2000, however, it had overtaken them altogether and became the largest sector. New investments in machinery and equipment and spending on R&D, education and training improved productivity. The most prominent example for the high growth in the manufacturing sector is Nokia, which was the world's biggest manufacturer of mobile phones in the year 2000.

The restructuring of the economy contributed most to the high growth rates in the second half of the 1990's. However, in order to solve the banking crisis and to reduce public deficit further policy measures were taken in the post-crisis years. Concerning the banking sector, the recession created large losses for the financial institutions. Subsequently, the government took over the savings bank group, which faced the largest losses and the whole banking sector was given a capital injection by the government to avoid a credit crunch and a reduction in the loan supply. In addition a government-owned asset management company (Arsenal Ltd.) was founded, which took over the problematic assets of the supported banks. The recession and the necessary support for the banking

sector led to a rising public deficit in Finland. In order to achieve fiscal consolidation and to fulfill the EMU criteria fiscal policy was tightened (increase of taxes and cut of spending) in the first half of the 1990's. However, this did not help to reduce public debt because the reduced public spending restrained domestic demand and caused mass unemployment leading to higher social welfare spending and lower tax revenues than expected. Between the years 1994 and 2000, Finland was able to move the public sector financial balance from a deficit of 6% in 1994 to a surplus of 7% of GDP in 2000. This fast consolidation could be achieved through the rapid growth in the second half of the 1990's, the falling unemployment (from 17.9% in 1994 to 9.8% in 2000) and thus a decline in unemployment-related expenditures and lower payments due to the lower interest rate.

3.2.3 Some comments and comparison of Finland and Japan

In analyzing the effects of the policy measures on potential output growth in Japan and Finland in the post-crisis years one must take into account that the countries' starting point was different. For Finland which had a very resource-based economy before the crisis started it was easier to restructure the economy to a more innovation driven one than for Japan where the technology sector had already been very important in the pre-crisis years. Nevertheless, both countries were faced with the same problem, namely how to react to the decline in output and how to restructure the economy, shifting resources from inefficient sectors to more profitable ones in order to regain a sustained recovery of the economy. As described above, Finland in contrast to Japan used the crisis for a fundamental restructuring of the economy. After a steep decline of potential GDP growth in Finland the loss in potential output could be fully compensated in the post-crisis years with slightly higher growth rates than before the crisis. Japan's potential growth rate reaching very high values in the 1980's is declining since the beginning of the crisis (Figure 7).

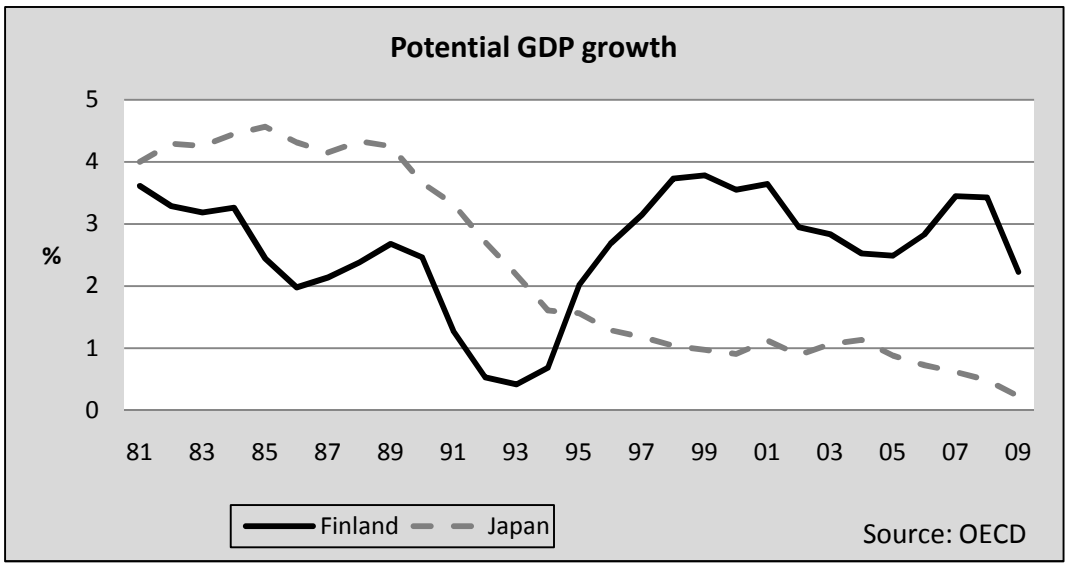


Figure 7: Potential GDP growth Finland and Japan, 1981 to 2009

According to the European Commission (2009a), the development of potential output growth after a crisis heavily depends on the development of TFP growth. TFP growth increased in Finland due to investments in innovation and R&D promoted by the restructuring of the economy. Japan, however, suffered from a decline in TFP growth in the post crisis years caused by a drop in investments due to a misallocation of resources and the prolonged problems in the banking sector. The demographic development in Japan, the fast rise of the share of the elderly population, accounted for an additional burden and became the most important factor for the decline in potential GDP growth.

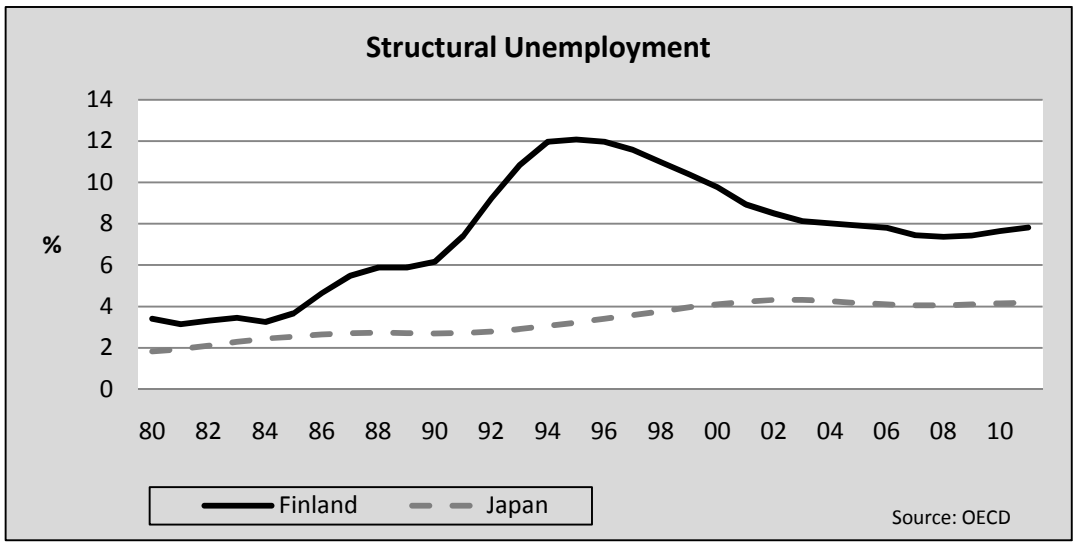


Figure 8: NAIRU of Finland and Japan

As far as structural unemployment is concerned, Finland faced a sharp rise in the NAIRU in the first years after the start of the crises. The fact that Finland succeeded in reducing the NAIRU in the recovery period, let the long-run contribution to potential growth of labor market factors turn positive. In Japan structural unemployment did not increase significantly and thus helped not worsening the impact of the crisis on potential growth (Figure 8).

3.2.4 Policy response of the euro area countries to the current crisis

The current financial crisis is the most severe since the great depression of the 1930's. Although the origins of the crisis were in the United States in autumn 2008 it quickly spread out to the euro area and the rest of the world. The financial sector was first affected but the crisis has also impacted the real economy through a squeeze in credit, a slump in consumer confidence and a contraction in world demand and trade, leading to a sharp drop in investment and output. In order dampen the impact of the crisis on the real economy and to ensure a strong recovery, the European Union announced the European Economic Recovery Program (EERP) for a coordinated European response to the downturn. The

strategic aims of the EERP are to stimulate demand and regain consumer confidence, to lessen the human costs of the downturn and its impact on the most vulnerable, to undertake the necessary structural reforms in order to be prepared for taking advantage when growth returns and to emerge as a low carbon using economy. The plan consists of an immediate budgetary impulse of € 200 bn (1.5% of GDP) in order to boost demand, whereby € 170 bn come from the Member States itself and € 30 bn come from EU funding in support of immediate actions. However, as the countries of the euro area have unequally been hit by the crisis because of different starting conditions (regarding fiscal room for maneuver or labor market institutions and different economic structures) each country took specific policy responses. The fiscal stimulus should be timely, temporary, targeted and coordinated, it should be a mix between expenditure and revenue instruments, it should be conducted within the Stability and Growth Pact and it should be accompanied by structural reforms that support demand and promote resilience[13].

The actions taken by the Member States are broadly in line with these principles announced in the EERP. The coordination of the national policy responses at the EU level enhances their effectiveness and efficiency. The policy measures contain financial rescue packages, fiscal stimuli, temporary support to hard-hit sectors and targeted support to vulnerable groups (For an overview of the measures taken in euro area states see Annex 1). A reliable and efficient financial sector is a precondition for a healthy and growing economy. Thus almost every country has undertaken interventions to rebuild financial stability and avoid a credit crunch. Governments gave guarantees on bank borrowing and used public money for capital injections. All countries of the euro area provided fiscal stimulus packages whose sizes varied because of the different fiscal margins and due to the extent they have been hit by the crisis. The largest fiscal stimulus of the euro area, aggregated over the years 2009-2010, is run in Spain and is of the order of 4% of GDP. Other sizeable stimuli are undertaken in Austria (3.5% of GDP), Germany (3.6% of GDP) and Finland (3.8% of GDP).

[13] *For further information on the principles see: European Commission (2008)*

In the following a closer look at the fiscal stimuli for the real economy (support for the labor market, for investment and business) will be taken, mainly with a view on the effects on potential growth.

3.2.4.1 Support for the labor market

According to the European Commission (2009c), 23% of all fiscal stimulus measures undertaken until May 2009 support a good functioning of the labor market and 21% of all measures were focused on the household's purchasing power. The main priorities of the countries were aimed at maintaining existing jobs, ensuring rapid (re-) integration into the labor market and supporting the most vulnerable. To avoid mass layoffs due to the demand shock many firms implemented short-time work models that were subsidized by public funds. The schemes were initially limited to a certain period and to workers of specific sectors or firms. As they have proved to be very effective in the short-term, the allowance to implement short-time work has been extended in some countries (Austria and Germany). Most of the measures undertaken by the countries were intended to "improve job placement and invest in re-training" and to education and life-long learning. Some countries provided incentives for additional training activities, whereby the opportunities were expanded in most countries. Many actions were also taken to support employment by reducing labor costs. Tax cuts, especially for low-wage earners, and other incentives to work, such as tax credits and tax allowances for people in work were implemented. These measures, often targeted to specific vulnerable groups, should not only increase the attractiveness to work but also mitigate the impact of the financial crisis on households and individuals by raising their income.

Additional social protection was given in some countries by a temporary extension of the unemployment benefit and by an increase in the minimum wage or other benefits. A first assessment of the measures taken confirms that the majority has a high ("measures are considered to be ambitious and comprehensive enough") or medium ("measures go in the right direction but are limited in scope") consistency with the principles announced in the EERP.[14]

[14] *See: European Commission (2008)*

However, there are a number of measures that could be more effective by rendering them more comprehensive.

The effects of the labor market on potential growth depend on the development of the structural unemployment rate (NAIRU). The OECD estimated in December 2009 that the NAIRU will rise slightly in the post-crisis years in the euro area (2008: 7.56%; 2011: 8.58%). This increase in the short-term can somehow be traced back to the expected strong increase in the actual unemployment rate in the euro area (2008: 7.51%; 2011: 10.8). In the absence of wrong policy measures the NAIRU will come back to its pre-crisis level in the medium-term, leaving potential growth unaltered. The policy measures taken by some countries of the euro area bear some risks for a lasting increase in the NAIRU. If the crisis persists, the temporary increase in the level and duration of unemployment benefit or of the minimum wage to sustain the household's purchasing power during the recession period can lower the incentives to work. This will result in a lower reallocation of jobs to more dynamic industries and thus increase the NAIRU. Therefore, it will be of great importance to reverse such measures and offer incentives to work once the recession period is over.

The European Commission estimated that a permanent reduction in the benefit replacement rate by 1% could increase potential output level by 0.35% in the long-term[15]. Short-time work schemes and other measures that encourage flexible working time as well as all policy responses focused on the support of training and re-training activities are appropriate to avoid long unemployment which would otherwise cause a permanent destruction in human capital and so in turn would lead to an irreversible rise in the NAIRU and to losses in potential output. However, the major risk associated with the short-time working scheme is overstaffing, resulting in a delayed impact on unemployment once the schemes end. Therefore these short-term measures need to be complemented by measures supporting the employability. Consequently, re-training activities and the essential reallocation of labor resources towards more effective industries are very important to cut structural unemployment rate and hence let labor market factors contribute more to a strong potential growth in the recovery period.

[15] *See: European Commission (2009a)*

According to the European Commission, an increase by 1% in the share of medium skilled workers that have been low skilled before will increase potential GDP by 0.04% and 0.35% in the medium-term and in the long-term, respectively. The effect of an increase by 1% in the share of high skilled worker (initially medium skilled ones) would even be higher (0.04% in the medium-term and 0.26% in the long-term)[16].

From today's perspective it is very uncertain if the established policies will be able to cut structural unemployment in the post-crisis years as most of the effects on the labor market can initially be seen in the upcoming years.

3.2.4.2 Investment support

Investment activities, especially private ones, have been severely hit by the current economic downturn. Weaker demand, tighter credit constraints and waning confidence led to a sharp fall in investment growth. The European Commission (2009d) estimates that total investment will contract by 10.7% in 2009 in the euro area. Investment growth is expected still to be negative in 2010 (-1.9%), before getting positive in the year 2011 (+2.1%). The countries of the euro area have targeted large shares of GDP at supporting investment (see Annex 1) whereby public support to investments was largest for physical infrastructure projects followed by investments focused on energy efficiency. Support to R&D investments was given the smallest share of the three categories. All the actions taken should be focused on the achievement of the EU climate change goals. In the EERP the European Commission[17] stated that investments in environmentally friendly infrastructure projects, the improvement of the energy efficiency of buildings and the promotion of "green projects" are of great importance. Planned investments in R&D and education should not be delayed or cut as in past recessions. In fact, fiscal incentives like subsidies or

[16] *See: European Commission (2009a)*

[17] *See: European Commission (2008)*

grants should be provided to increase private investments in R&D innovation and education. Investments in R&D are needed to increase productivity growth and to improve the competiveness of Europe. Furthermore, the Commission claims that the industries, mainly the construction and automobile sector, which were hit the most by the economic downturn, should face the challenge of the transition to a green economy. These measures should ensure that the crisis is used for a necessary restructuring of the economy, helping to boost recovery and long-term potential growth.

Concerning physical infrastructure, investment is focused on the transport sector and building and urban development. Most of the projects have already been planned so that they had or rather will have an impact in 2009 or 2010, respectively, in order to boost demand in the sort-term. The effectiveness, however, cannot be assured as delays in the construction sector are not unusual. The measures taken are broadly in line with the EERP (see Annex 1: "somewhat significant measures"), although there is scope for improvements. Many of the fiscal stimulus measures are used for traditional types of public investments (building roads, railways etc.) without a substantial shift towards green economy. According to the European Commission[18] nearly 30% of the physical infrastructure measures are targeted to the building sector without improving the energy efficiency. As a result, some countries have missed the opportunity to reduce the high energy dependency which negatively influences potential growth.

With regards to investments, to improve the energy efficiency most of the countries of the euro area have taken significant measures (see Annex 1) whereby subsidies to households for small-scale improvements, direct public investments for low-carbon or high energy-efficient public buildings were used the most.

Investments in R&D, as already described in chapter 3.1.3, tend to be pro-cyclical, meaning that spending on R&D usually drops dramatically during a crisis. However, such investments are very important for an increase in total factor productivity in the long-term and hence for a strong recovery of potential growth. So as to reach or even as to exceed the pre-crisis growth rates countries

[18] *See: European Commission (2009c)*

have to set incentives for firms to increase, instead of reduce, their spending in R&D during the crisis and in the post-crisis period. To support R&D investment many countries of the euro area have granted subsidies and direct funding, or provided tax credits and loans. However, as this fiscal stimulus does not have a large positive effect for the economy in the short-term, it is smaller than those for investment in energy efficiency and physical infrastructure. As for the other support of investments the EERP encouraged the countries to concentrate their research in green technologies. This can, according to the European Commission[19], only be found in a few states of the euro area. Regarding R&D a coordination, at least at EU-level, would be necessary and very important as to avoid research in the same field and to allow for an exchange of knowledge. However, such concerted actions are not planned.

3.2.4.3 Business support

The hard hit business sector has been given relatively large fiscal stimuli. Easing access to finance, a sector specific support (mainly for the automotive sector) and non-financial support measures are the main types being used. The main attention has been paid to the first category where most of the countries took highly significant measures. Concerning sector specific support in the automotive sector, a number of countries of the euro area have implemented scrapping schemes in order to boost short-term demand. However, these measures cannot account much for a recovery of potential growth as the actions taken will not be permanent. Regarding the non-financial measures some countries reduced the administrative burden and performed regulatory reforms in order to promote business startup. This can have positive effects on the long-term potential growth rate through an increase in all three input factors (labor, capital and total factor productivity).

[19] *See: European Commission (2009c)*

3.2.4.4 Discussion of the policy measures

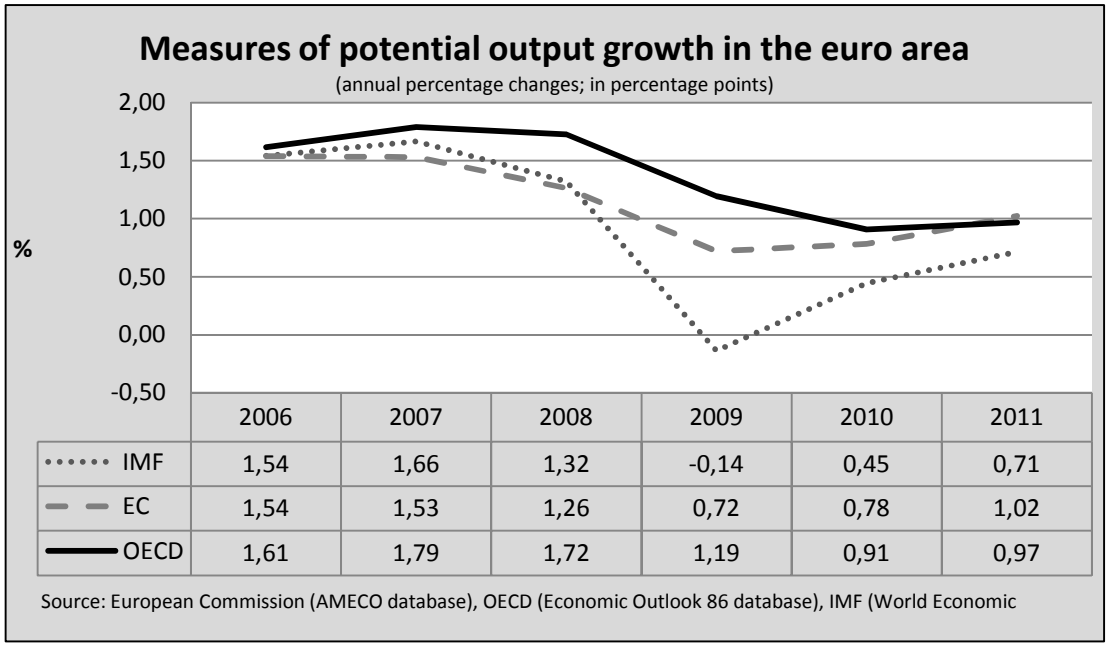
In conclusion, the measures taken as a response to the economic downturn have undoubtedly had some positive effects on economic activity in the short-term. According to the European Commission (2010a) real GDP of the euro area started to grow again in the third quarter of 2009. The overall annual real GDP growth was -4% in the euro area. For the year 2010 the European Commission estimates an ongoing slow recovery with a GDP growth rate of 0.7%. The projections, however, remain with great uncertainty as important economic sectors are still not stable (e.g. turbulences on the financial markets). As regards the effects on potential growth, clear answers cannot be given and will appear in a few years. However, in comparison to the two historic crises analyzed before, the impact can roughly be estimated. The crucial question to be answered is whether the countries of the euro area are successful in increasing total factor productivity, the main driving force for a strong recovery of potential growth in the post-crisis years. The measures taken by the countries are often focused on the short-term, neglecting the development in the long run. Although these measures have been very important to cushion the impact of the crisis (keep businesses going, avoid mass lay-off, stimulate demand, ….), now the main focus has to be put on measures that can increase the overall productivity of the economy. Prudent attempts of the member states to restructure the economy and the industrial sector to a more “green” one will not be enough in order to substantially increase TFP. The crisis should be seen as a great chance to catch up with the necessary investments in “green technology” that are long overdue. An increase in R&D investments, education and further re-training activities are also very important to achieve the restructuring of the economy. This will create a lot more jobs, increase the capital stock and also total factor productivity leading to a very strong recovery of potential growth in the long-run.

The measures taken so far are a first step in the right direction, but will not be enough to face such a strong recovery as the Nordic States after the crisis at the beginning of the 1990’s. It seems like the policy mistakes of Japan in the aftermath of the crisis could, however, be avoided in the current downturn. So it is very unlikely that the euro area will be concerned with increasing potential output losses in the following years. As it appears now, the scenario with a permanent

loss in potential output or a scenario in which the temporary losses can only be compensated after a very long period is most likely.

3.3 Current estimates of potential output growth

Figure 9 compares the current estimates of international institutions (IMF, OECD and European Commission) for potential output growth in the euro area in the short-term. The three institutions go together in their estimates that the annual growth rates declined in the year 2008 and 2009 whereby there is a sharp decline in 2009. The IMF estimated (World Economic Outlook database of October 2009), in contrast to the others, that potential growth will be negative in 2009. For 2010-2011 all three institutions see a slow recovery of potential output growth, however, the pre-crisis growth rates will not be reached. The decline is in line with the predictions of increasing structural unemployment and decreasing investment activities mentioned in the previous chapter. However, as these forecasts are of great uncertainty, the estimates of potential output growth could and will be revised in the future.



	2006	2007	2008	2009	2010	2011
IMF	1,54	1,66	1,32	-0,14	0,45	0,71
EC	1,54	1,53	1,26	0,72	0,78	1,02
OECD	1,61	1,79	1,72	1,19	0,91	0,97

Source: European Commission (AMECO database), OECD (Economic Outlook 86 database), IMF (World Economic

Figure 9: Measures of potential output growth in the euro area in the short-term

Figure 9 only shows the development of potential output growth until 2011. A direct annual comparison of medium-term scenarios (2012-2017) is not possible in a meaningful way, as the OECD for example only provides annual averages of a period for the medium-term and the forecast horizon is different between the three institutions. So the latest available medium-term scenarios for each institution will be presented separately.

The European Commission estimated that potential growth in the euro area will be 1.4% in 2012, 1.6% in 2013 and 1.7% in 2014 in the euro area[20]. The annual average growth rate of potential GDP between the years 2001-2005 was 1.8%, meaning that until 2013 these rates cannot be regained.

The furthest forecast is provided by the OECD, which estimated that potential growth in the euro area slightly recovers in the post-crisis period achieving 1.4% on average between 2012 and 2017 in the euro area.[21] This would be less than the pre-crisis growth rates of 1.7% between the years 2006 to 2008.

The medium-term development of potential output growth can also be analyzed using the IMF data[22], that provides forecasts until 2014. Figure 10 shows the forecasts for the euro area for real GDP and potential GDP. Potential GDP is not going to recover the losses from the downturn within 2014. Potential growth rates remain at a lower level than the pre-crisis ones, although they are estimated to increase continuously (2012: 0.9%; 2013: 1.1%; 2014: 1.3%). Using this data it looks like that the euro area might face an increasing output loss over time. But as the growth rates of potential GDP are slightly increasing, there is hope that over the long-term this trend holds on and the pre-crisis growth rates will be regained or exceeded. An implementation and continuation of the right policy measures, described above, in order to achieve the necessary restructuring of the economy, to avoid a permanent increase in structural unemployment and to set value on R&D measures will be necessary for a strong recovery and a higher

[20] *European Commission (2010b)*

[21] *OECD (2009b)*

[22] *That data are taken from the IMF's World Economic Outlook database October 2009*

growth path in the long-term. However, from today's view the data confirms the statement in the previous sector that the scenario in which the euro area is facing a permanent output loss over time is most likely.

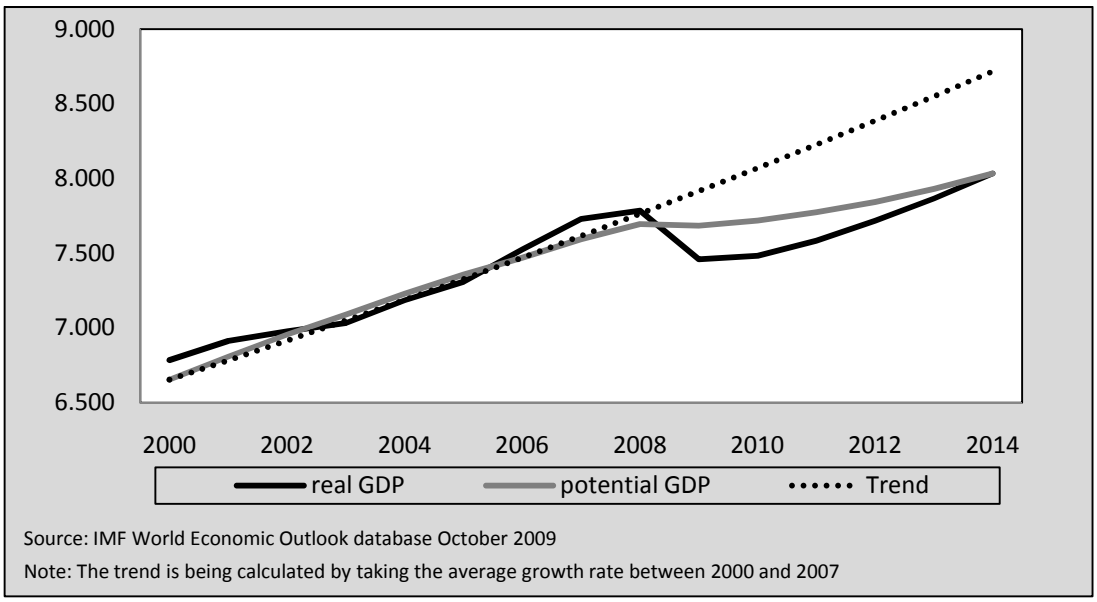


Figure 10: Level in actual and potential output for the euro area

4 Empirical part

4.1 HP filter method

In order to get a first own estimation of potential output for the euro area I will use the simple HP filter method which I have already described in the second chapter of the work. I use the data of real GDP from the IMF's World Economic Outlook databases as it provides the furthest forecasts (till the year 2014)[23]. The range of the data series is from 1991 to 2014 as the maximum period. As I use annual data the smoothing parameter λ is considered to be 100 (according to the European Central Bank which also uses this value[24]).

To illustrate the revisions of the forecasts of real GDP and the involved impact on the estimation of potential output I use four GDP series that differ in the year of their publication (2006 – 2009). To come up with end – point problem and therefore to get meaningful results of current potential output, it is very important to add forecasts to the real GDP series. Thus the estimation of potential output when using the HP filter only depends on the quality of the forecasts of real GDP. However, the forecasts of real GDP in turn can only be based on the information available in the year of their publication. So the HP filter results of current potential output get useless if the forecasts of real GDP have to be revised as more information about the future economic situation is available or were biased in another way. Thus, due to the uncertainty about real GDP forecasts, it is very likely that past estimations of potential output (using the HP filter) will be revised if new real GDP forecasts are available. It will therefore be shown that the past estimations of potential output will be revised downward when using the dataset of 2009 as the current financial crisis could not be taken into account in the former datasets.

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[23] *However, in the database real GDP data is not available for the euro area, and therefore I had to calculate a series of real GDP with the year 2000 as the base year using real GDP growth and nominal GDP of 2000.*

[24] *European Central Bank (2000)*

Figure 11 shows the forecasts for real GDP (in level and growth) available in September 2006, October 2007, October 2008 and October 2009. The crucial aspect of this comparison of forecasts for real GDP is the significant downward revision (in level and growth respectively) in the year 2009, compared to the forecast of 2008. Although the crisis was already taken into account in 2008 (abrupt, albeit short fall in real GDP growth), the severity and the long duration of the crisis was underestimated. In the recent forecast of 2009 the IMF estimates that real GDP growth will only slowly recover after the severe downturn in 2009 and finally converge to the pre-crisis growth rates until 2014. However, the forecasts are of great uncertainty, because the real development of the recovery is subject to severe risk.

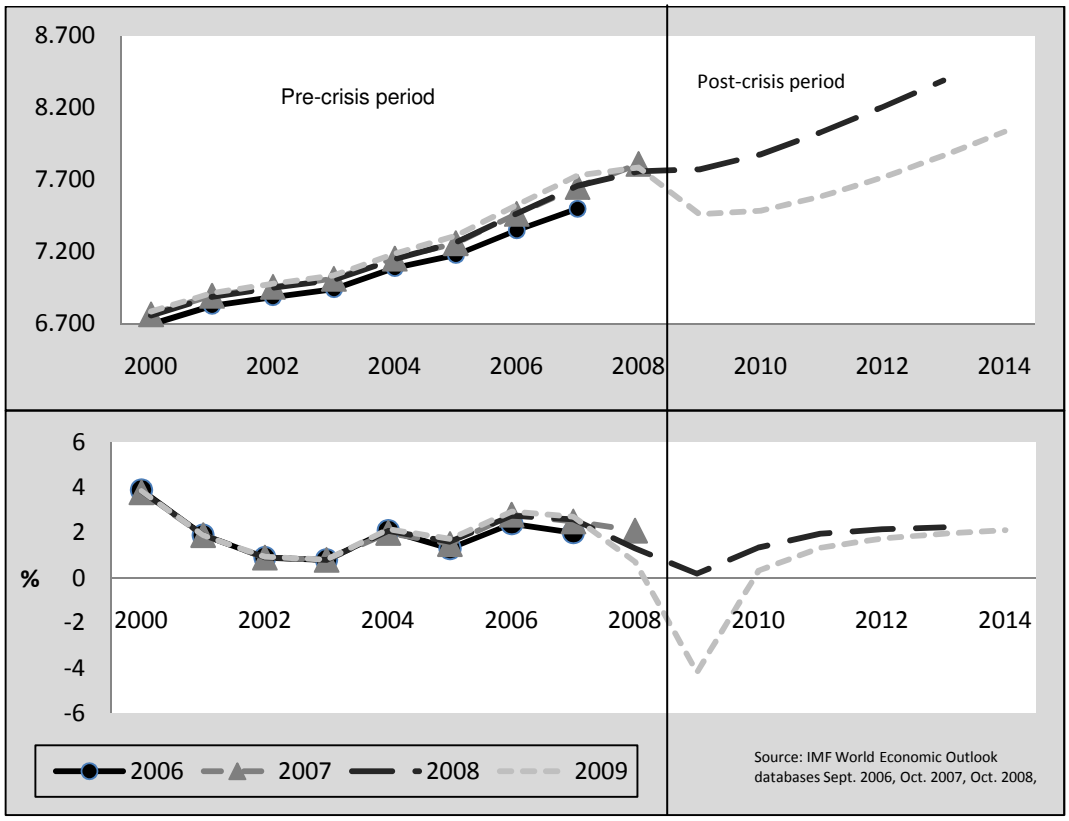

Figure 11: Level (upper panel) and growth (lower panel) forecasts of real GDP available at different years (2006-2009) for the euro area

Using the HP-filter the GDP series is split into a cyclical and a trend component whereas the latter is used as estimates for potential output. The estimated output

growth is represented in Figure 12. Using the dataset of 2008 potential output growth is only slightly decreasing in the aftermath of the crisis. In contrast, the current estimates of 2009 show a huge downward revision of potential growth. Taking the HP-filter method for estimating potential growth there is only a very small upward trend in the post-crisis years. In contrast to the forecast of the three institutions a convergence to the pre-crisis growth rates is not visible. Due to the lower growth rates in the post-crisis period the losses in the level of potential output will become larger. Thus the results of potential output gained by using the HP filter would correspond to the third theoretical case, potential output loss increasing over time, in Figure 1.

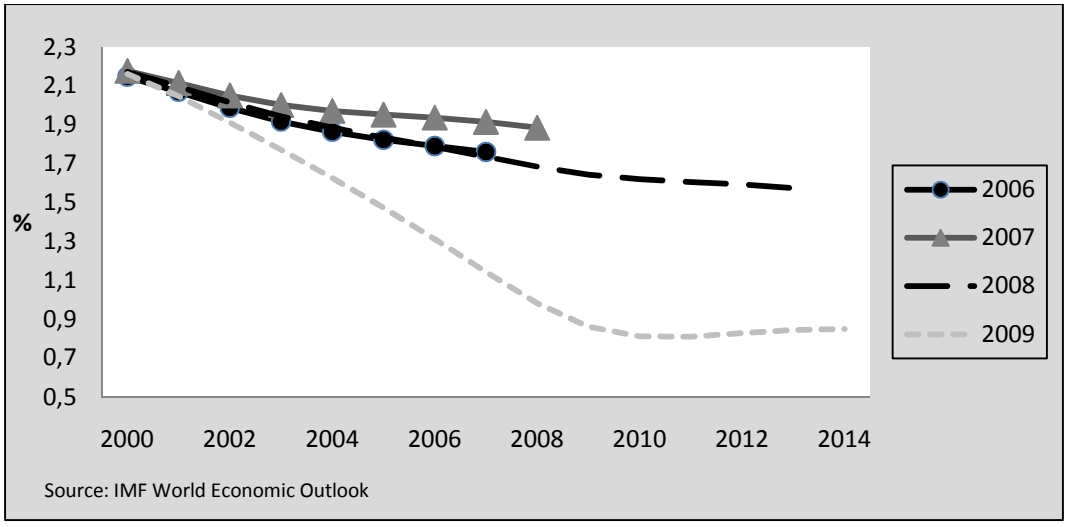

Figure 12: Estimates of potential GDP growth (upper panel) using the HP-filter and using real GDP data available at different years (2006-2009)

The short-term forecasts (until 2011) of potential output growth when using the HP-filter are similar to the forecast of the other three institutions, IMF, OECD and European Commission (see Table 1). However, relatively large deviations in the medium-term forecasts (all three institutions estimated that there will be a convergence to the pre-crisis growth rate) is attributed to the end-point problem of the filtering methods. To overcome this problem longer forecast series of real GDP would be necessary. Such long-term forecasts are, however, not available.

However, it also has to be mentioned that the forecasts of these institutions are to a largely extent based on judgment rather than on purely statistical approaches. This is particularly the case in times of vague economic times as the current one.

Current measures of potential output growth in the euro area annual percentage changes; in percentage points

Source: IMF, OECD, EC and own calculations

	2006	2007	2008	2009	2010	2011
IMF	1.54	1.66	1.32	-0.14	0.45	0.71
EC	1.54	1.53	1.26	0.72	0.78	1.02
OECD	1.61	1.79	1.72	1.19	0.91	0.97
HP filter	1.31	1.14	0.98	0.86	0.81	0.81

Table 1: Comparison of own potential growth results with the estimates of the IMF, OECD and the European Commission

As mentioned at the beginning of the chapter the forecasts of potential output growth using the HP-filter depend on the quality of the forecast of real GDP. As these forecasts have to be regarded with suspicion also the forecasts of potential growth are of great uncertainty. The difficulty to give the right predictions can also be seen by comparing the current measures of potential growth of the different institutions. Normally the estimates of the institutions of the same years converge. For the two years (2009 and 2010) following the severe downturn, however, the estimates differ substantially (primarily between the IMF and the other two institutions) compared to the pre-crisis period.

4.2 Production Function (PF) method

4.2.1 Production function

In addition to the HP-filter method, which is only based on a statistical filtering technique, the PF-function approach, that is also based on real economic variables, should be used for the estimation of potential output growth. As a first step, a form of the production function has to be chosen. Like most important international organizations (OECD, IMF, EC, ECB) and like the majority of literature dealing with this topic, the Cobb Douglas form is used in this work[25].

The Cobb Douglas case is

$$Y_t = F(K_t, L_t) = A_t * L_t^{\alpha} * K_t^{(1-\alpha)} ,$$

where A_t is total factor productivity (technological progress), L_t is the labor input, K_t is the capital stock and α is the partial elasticity of production with respect to labor and the capital stock.

4.2.2 Defining the potential input factors and potential output

The first input factor, potential employment, is derived by using labor force data and estimations of the NAWRU (non-accelerating wage-inflation rate of unemployment). Similar to the NAIRU described at the beginning of the work, the NAWRU is defined as the unemployment rate consistent with stable nominal wage inflation. So potential labor input is defined as

$$L_t^{pot} = LF_t^{*} * (1\text{-NAWRU}), \qquad (1)$$

where LF_t^{*} is the HP-filtered labor force of the total economy.

[25] *an alternative concept is the CES production function used for example by Dimitz (2001)*

The potential capital stock is assumed to be equal to the full utilization of the actual capital stock. As this series is already quite smooth there is no kind of filtering method necessary. That means:

$$K_t^{pot} = K_t \, . \qquad (2)$$

Finally the third and last potential input factor that has to be calculated is total factor productivity (A_t), which is determined as the residuals of the production function estimation. It is the part of the production function that cannot be explained by the two other input factors labor and capital. After rewriting the Cobb Douglas production function in the log-form, total factor productivity can thus be estimated by solving the following equation:

$$a_t = y_t - \alpha * l_t - (1-\alpha) * k_t \, , \qquad (3)$$

where y_t, l_t, k_t and a_t are the logs of GDP (Y), actual employment (L), capital stock (K) and technological progress (A). The parameter α is equated with the average labor share and according the EC[26] set to 0.35. In order to get rid of measurement errors this achieved series is being smoothed using the HP-filter (A_t^* being the smoothed series).

The final step to get estimations of potential output is to insert the potential input factors described above in the Cobb Douglas production function:

$$y_t^{pot} = a_t^* + \alpha * l_t^{pot} + (1-\alpha) * k_t^{pot} \, , \qquad (4)$$

with a_t^* being the log of the smoothed (HP-filter) total factor productivity series, l_t^{pot} being the log of potential labor input and k_t^{pot} being the log of potential/actual capital input.

[26] *See: European Commission (2006)*

4.2.3 Description of the data

All the data used for the estimation process are taken from the AMECO database (Last update 22 October 2009) of the European Commission. This paper focuses on the euro area which actually consists of 16 countries (EA 16)[27]. Unfortunately, capital stock data is only available for the former euro area of 12 countries (EA 12)[28]. Therefore, the following estimations could only be performed for the EA 12. The starting point of the data set is 1991 as earlier observations are not available. The database also provides forecasts of all relevant series till the year 2011. In the basic estimation of potential output only the original series, ranging from 1991 to 2011, are taken and potential output is estimated for this period. In a next step the data set is extended till the year 2016, making assumptions about the development of the input factors, in order to get different scenarios of the possible medium term trend of potential output.

For the calculation of total factor productivity the real GDP series, the civilian employment series for labor input and the net capital stock for capital input were inserted. For the potential values of the input factors the following data series were used: Potential capital input is described by the data series of actual net capital stock (for explanation see above). To determine potential labor input data series of the NAWRU and of civilian labor force – in order to coincide with the data series of civilian employment which was used for the estimation of TFP – were taken. Thereby, civilian labor force is equal to civilian employment plus total unemployment. The difference to the total labor force data set is that the ones currently serving in the armed force are not included in the civilian labor force (for a detailed definition see explanation to the AMECO database).

In order to get rid of measurement errors, the data series of civilian labor force and total factor productivity are smoothed using the HP-filter. Therefore all the

[27] *Austria, Belgium, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, Malta, the Netherlands, Portugal, Slovakia, Slovenia, Spain and Cyprus*

[28] *Austria, Belgium, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, the Netherlands, Portugal and Spain*

problems concerning the filtering techniques (endpoint problem, quality of forecasts), mentioned above, are also crucial for the production function method.

For detailed information about the input factors and the development over time consider the Annex 2 and 3.

4.2.4 Basic estimation of potential output

In a first step the relevant data described in the previous chapter is inserted in equation one in order to get an estimation of potential TFP. Figure 13 shows the growth rate of total factor productivity between 1992 and 2011. After the theoretical analysis of the possible impacts of crises on the input factors, it is not very surprising that in the years 2008 and 2009 there is a negative growth of TFP, whereby in the latter year there was a huge decline of more than 4%.

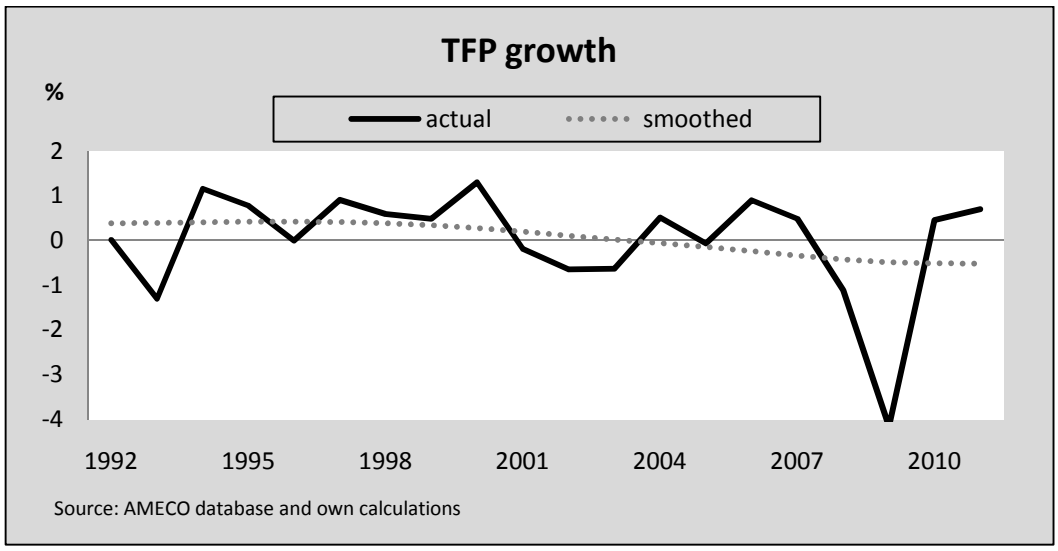

Figure 13: Basic estimation –TFP growth

Another important thing one can see on the basis of this figure is the problematic end point problem when using the HP-filter. Although the growth rates of potential TFP are supposed to be positive and rising in the years 2010 and 2011, the HP-filtered series still plots a negative trend. Hence, the subsequent revisions of the trend are not taken into account. In order to get rid of this problem, forecasts can

be added at the end of the sample. In the next part of the paper, when different scenarios for the medium term are performed, one can remark the difference between the slopes of the HP-filtered TFP growth.

The estimation of potential output is finally achieved by inserting the potential input factors (also see the Annex 2 and 3) into equation 4. Figure 14 presents the results for the growth of potential output. Between 2002 and 2011 the growth of potential GDP for the euro area is positive in all the years. However, it is important to mention that since the year 2000 there is a clear downward trend observable. In the crisis years of 2008 and 2009 there is a huge decline in potential growth which certainly derives from a decline in all the potential input factors.

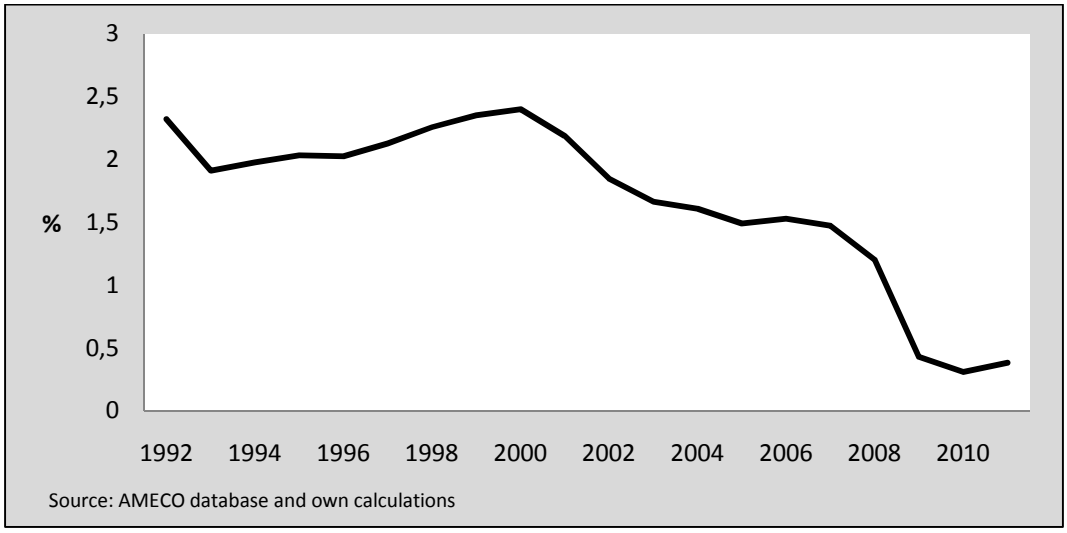

Figure 14: Potential output growth for the euro area (PF-method)

As Table 2 shows that out the results of the production function estimation process go in line with the results of the European Commission for the pre-crisis period. This is not very surprising, because in this paper the data used is solely taken from the AMECO database of the European Commission. The deviation from the EC which begins in the year 2009 can partly be explained with the end point problem when using the HP-filter for TFP and labor force. The European

Commission gets rid of this by adding internal projections to the series or simply by judgment. Therefore the expected uptrend of the potential input factors in the medium and long term becomes also apparent in the HP-filtered series. The fact that estimations of potential growth of the current years are revised when projections are added to the data sample becomes apparent in the next chapter of the work. It must also be mentioned that the difference in the results can also stem from the slightly different method in calculating potential labor input[29].

Current measures of potential output growth in the euro area annual percentage changes; in percentage points

Source: IMF, OECD, EC and own calculations

	2006	2007	2008	2009	2010	2011
IMF	1.54	1.66	1.32	-0.14	0.45	0.71
EC	1.54	1.53	1.26	0.72	0.78	1.02
OECD	1.61	1.79	1.72	1.19	0.91	0.97
HP filter	1.31	1.14	0.98	0.86	0.81	0.81
PF-method	1.53	1.47	1.20	0.43	0.31	0.38

Table 2: Comparison of the own results with the results of different institutions

4.2.5 Three scenarios of medium potential output growth

In this part of the paper three different developments of potential output in the medium term (till 2016) are analyzed. In order to get such projections, assumptions about the input factors have been made. The scenarios vary uniquely in the assumptions about total factor productivity. In scenario one TFP is assumed to grow at the average pre-crisis growth rate. In scenario two TFP growth is permanently lower and in scenario three TFP growth is permanently higher than in the pre-crisis period between the years 2012 and 2016.

[29] *The EC now measures potential labor input in average hours worked. For further discussion see European Commission (2006)*

The other input factors are not varied among the scenarios and therefore the assumptions are equal. It has to be noted that the projections are based on the assumption that the economy is going to recover in the medium and long term and a further economic downturn is not going to arise. Between 2012 and 2016 the capital stock is expected to be on the average pre-crisis growth path again. As a major credit crunch has been avoided and investment growth is also expected to turn positive in the year 2011 (see chapter 3.2.4.2) in the medium and long term a return to the pre-crisis path is very likely. The fact that the growth rate is assumed to be constant in the projection period is not very problematic as the path of the capital stock is smooth anyway and there are no fluctuations (see Annex 3.1). Therefore the growth of capital stock is supposed to grow at the average pre-crisis rate of 2.21%.

For the projections of potential labor input assumptions about the NAWRU and the labor force have been made. For civilian labor force the growth forecasts of the European Commission (2009e) are used and so the series extended till the year 2016 (see Annex 2.1 and 2.2). The growth rate of labor force is constantly declining due to the problem of the quick ageing of the population. According to the European Commission (2009e) the growth rate of labor force will become negative in the euro area in the year 2020. Therefore, apart from the negative effects of the financial crisis on potential output growth, the European Commission predicts that in the long term potential GDP growth is going to decline[30].

Concerning the NAWRU no medium term forecasts that also account for the economic crisis are available. It is not that easy to predict the future development of the NAWRU as it normally has many ups and downs and depends very much on the effects of the policy measures taken. It has already been mentioned in chapter 3.2.4.1 that the policy programs taken by the members of the euro area bear some risk for a permanently higher level of the NAWRU. Therefore it is not assumed that the increase in the short run can be revised in the medium term. For the estimation of the three scenarios the NAWRU is held constant at the

[30] *For detailed information see: European Commission (2009e)*

latest available rate of 9.5% between the years 2012 and 2016 (see Annex 2.1 and 2.2).

With regards to total factor productivity, three different assumptions about the medium term development are made, leading to the following three scenarios.

4.2.5.1 Scenario 1: average pre-crisis TFP growth

In scenario 1 it is assumed that the actions taken to re-boost the economy will have a positive influence on TFP. Thus, spending on R&D will increase again and regain the pre-crisis level. However, the measures taken are not that effective to exceed the pre-crisis growth rates. Therefore there would still be room for a further restructuring of the economy to more productive industries or technologies and for more investments in R&D and education as described in chapter 3.2.4 of the paper. In scenario 1 TFP is supposed to grow at the average pre-crisis growth rate of 0.64% between 2012 and 2016 (see Figure 15).

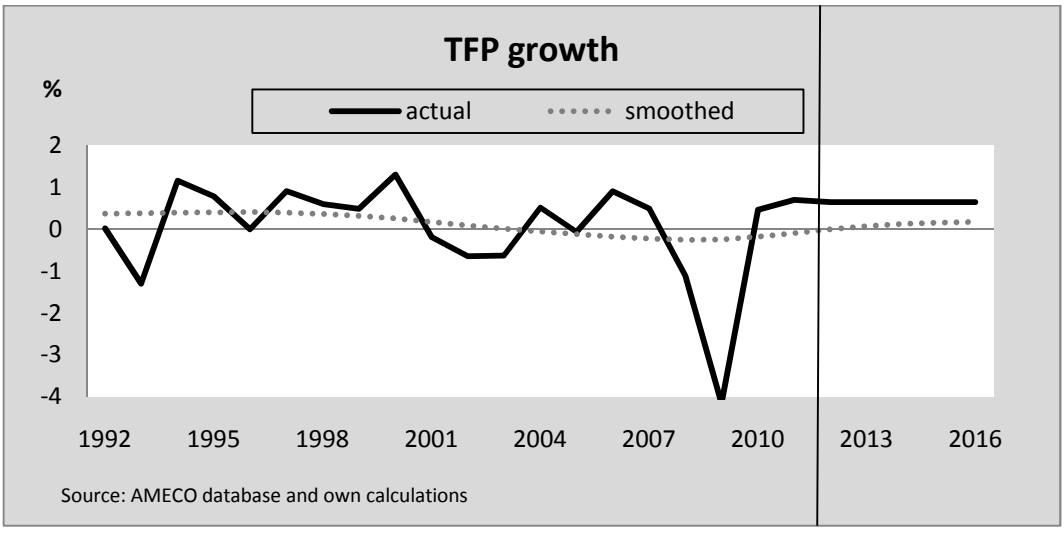

Figure 15: Scenario 1 – TFP growth

The black line in Figure 21 shows the growth rates of potential output for scenario one. In 2012 potential growth is 1.56%. In the following years the average pre-crisis rates (between 2000 and 2007: 1.78%) are slowly regained (in 2016: 1.71%). This development is also quite good to see in Figure 16 which compares the level of the estimated potential GDP with the long term pre-crisis trend. After

the drop in 2009 and 2010, the level of potential GDP runs parallel to the pre-crisis trend. The losses due to the crisis will not increase but also not be compensated in the medium term. Therefore this scenario is equal to the theoretical Case 2, permanent loss in potential output level, in Figure 1

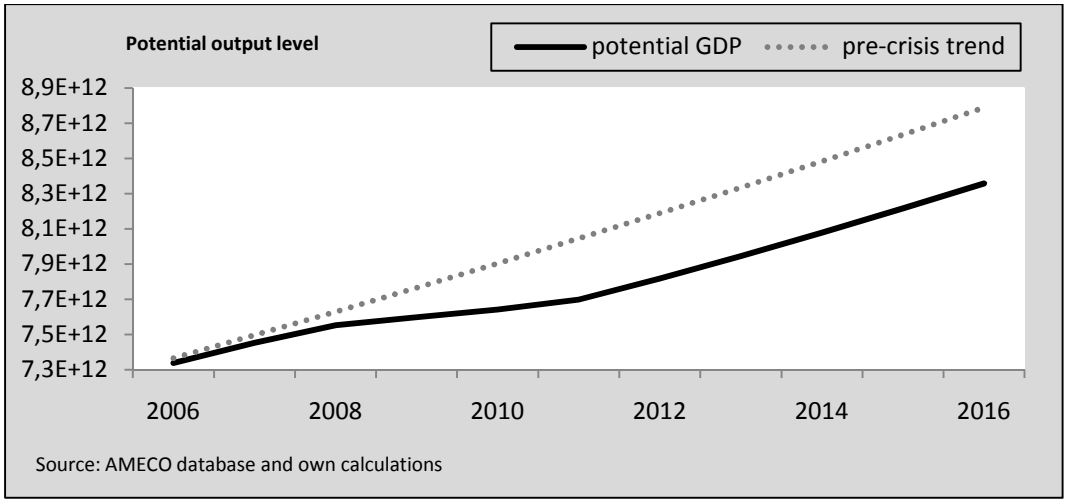

Figure 16: Scenario 1 – potential GDP level

4.2.5.2 Scenario 2: permanently lower TFP growth

The second scenario describes the case that the actions taken for a restructuring of the economy are not efficient enough to boost total factor productivity in the past-crisis period. Investments in R&D and education, essential for a strong recovery, fall short of unproductive and useless infrastructure projects. Although from today's point of view such a case is not that realistic (see chapter 3.2.4) possible effects of a permanently lower TFP growth in the past-crisis period on potential output growth should also be illustrated. For scenario 2 total factor productivity growth is fixed at the annual constant rate of 0.3% between 2012 and 2016 (see Figure 17).

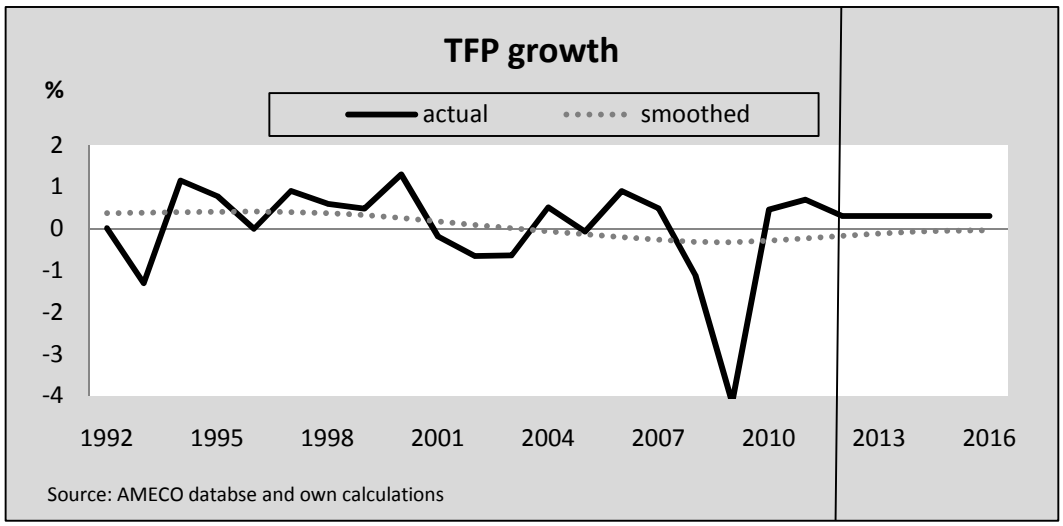

Figure 17: Scenario 2 – TFP growth

In this scenario potential growth is also increasing in the year 2012 and then slightly rising till 2016 (see Figure 21). This is due to the fact that the two other input factors (labor input and capital stock) are assumed to be equal in all three scenarios. However, in 2016 the growth rate of potential GDP is going to be 1.5%, which is smaller than the average pre-crisis rate of 1.78%. This means that in the medium term the losses in potential output level will increase. Figure 18 demonstrates this as the gap between the pre-crisis trend and the potential GDP line is slightly widening over time. Thus this scenario is consistent with the theoretical Case 3, potential output loss increasing over time, in Figure 1.

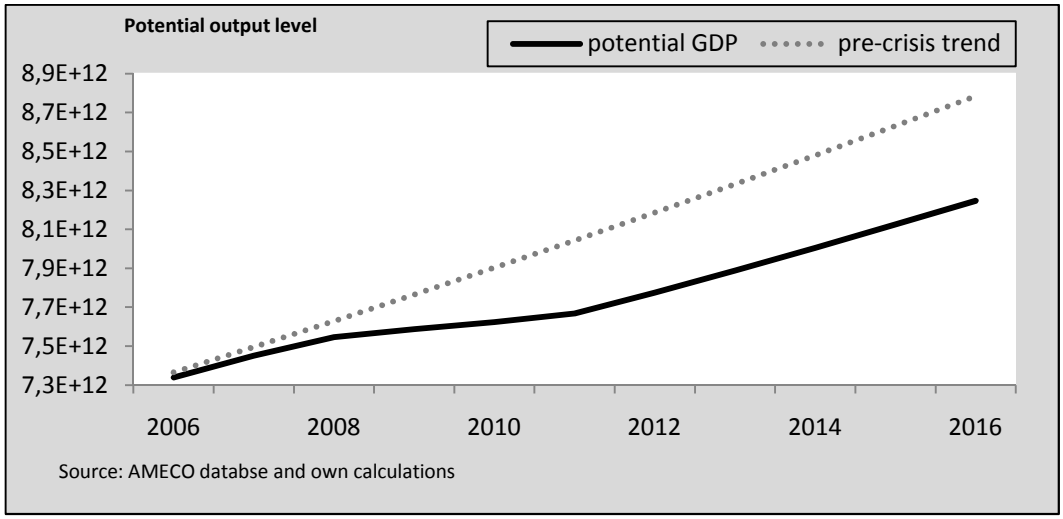

Figure 18: Scenario 2 – potential GDP level

4.2.5.3 Scenario 3: permanently higher TFP growth

Finally, in the third and last scenario the growth of TFP is assumed to exceed the pre-crisis rates and is set equal to an annual constant rate of 1% (see Figure 19).

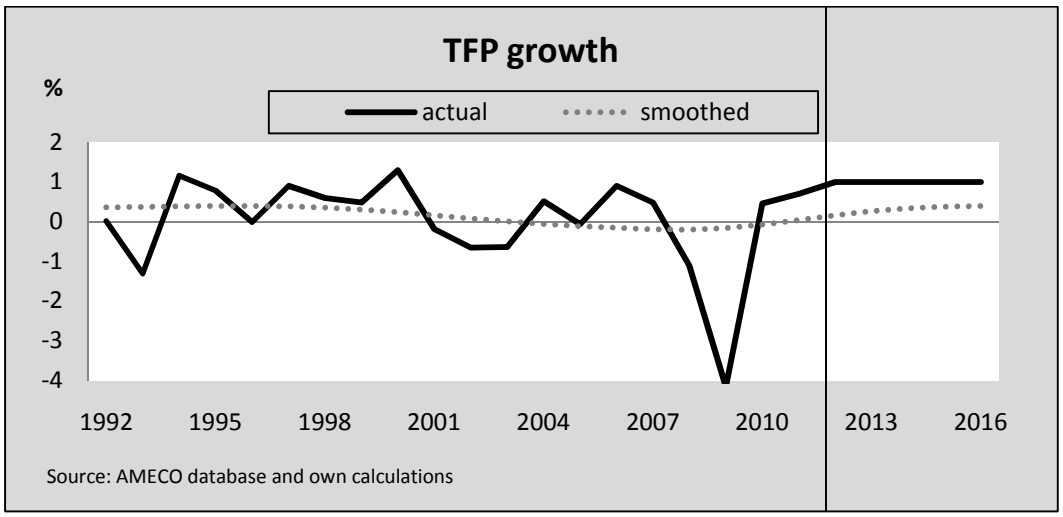

Figure 19: Scenario 3 – TFP growth

This case should somehow be the goal which should be achieved. Investments in R&D and education are not cut but extended during the crisis and in the aftermath. In many countries of the euro area the energy efficiency of buildings has been improved and the research in green technologies has been expanded. Therefore the restructuring of the economy to more productive and innovative industries has been performed. In addition, concerted actions in R&D within the euro area or, almost better, within the European Union would further increase the positive output of investments in these fields. If such a development is going to arise, a growth rate of TFP that is much bigger (also much bigger than the growth rate assumed in this scenario) then the average pre-crisis rate is very likely. However, to be honest such a scenario appears rather unlikely given the incomplete stage. For such concerted actions in specific fields that can bring countries advantages in their economic development, the European integration has progressed insufficiently.

The supreme line in Figure 21 depicts the growth of potential output until the year 2016. In 2012 the average pre-crisis growth rate of 1.79% are nearly regained with 1.74%. In the following years, as in the two other scenarios, the growth rate

is raising, finally achieving 1.95% in the year 2016. That means that the pre-crisis growth is exceeded and the short term losses of potential GDP level can slowly be compensated in the medium term. Figure 20 shows that in the third scenario the potential GDP line is converging to the pre-crisis trend line. This means that this scenario corresponds to Case 1, no loss in potential output after some time, in Figure 1.

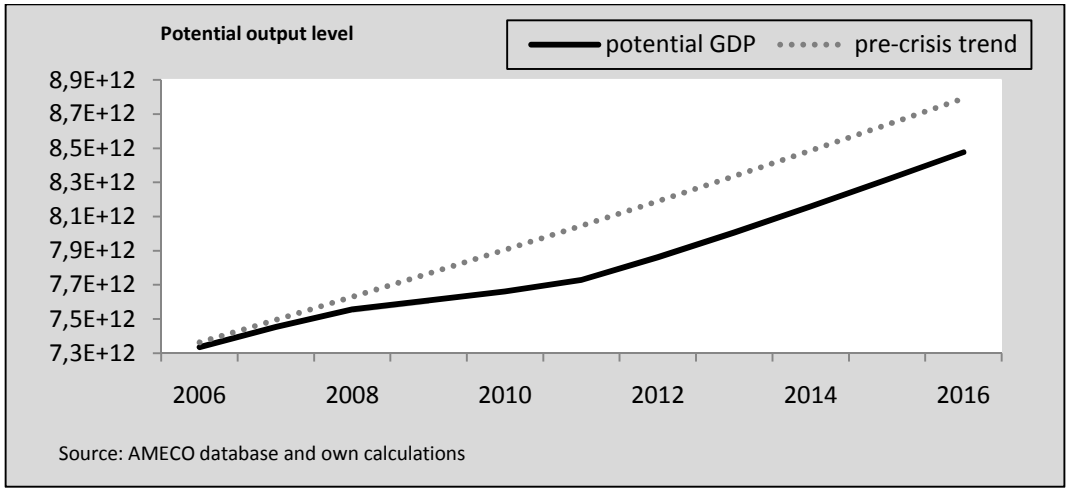

Figure 20: Scenario 3 – potential output level

To sum up, by varying only the assumptions about the medium term development of TFP growth, all three theoretical cases for the impact of a financial crisis on potential output could be estimated. The development of potential output in the medium-term will therefore heavily depend on the effects of the policy actions on total factor productivity.

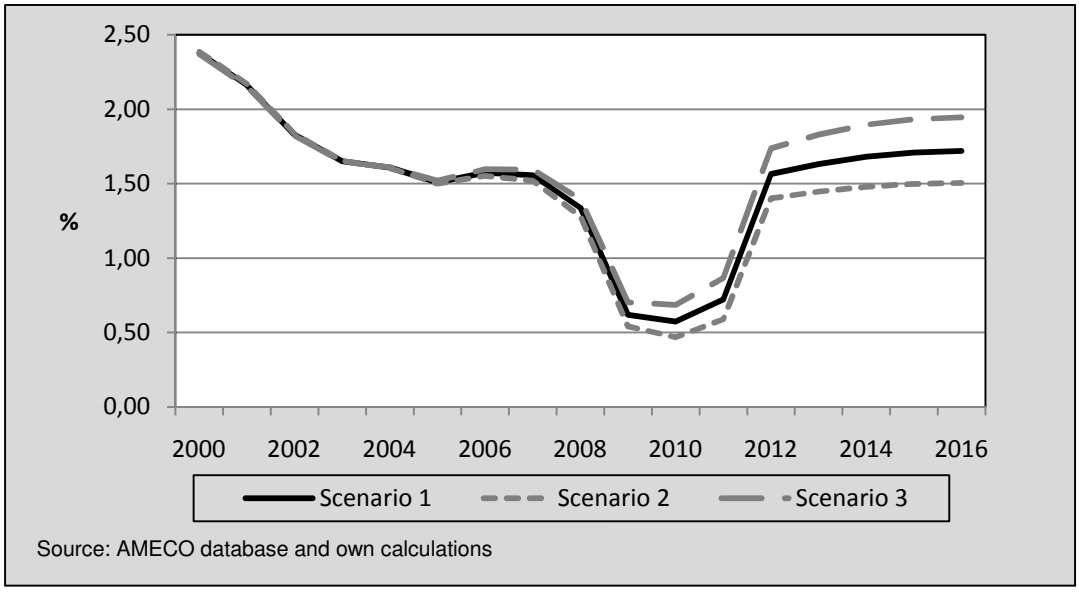

Figure 21: Potential GDP growth of the three scenarios

4.2.5.4 Some comments on the results

The three scenarios describe the effects of different assumptions about TFP growth on potential output growth in the medium term. However, again it has to be mentioned that the other input factors (potential labor input and capital stock) are the same in all three cases. That is of course quite a strong simplification of the model because a higher TFP growth would/could also imply a higher capital stock and/or a higher potential labor input. So the most realistic result would be the first case as the other potential input factor series are also extrapolated by adding the pre-crisis rates. For the case of permanently lower and permanently higher TFP growth the two other input factors would have to be adjusted too. However, further adjustments of the input factors go beyond the scope of this paper.

In chapter 4.2.4 of the work it was mentioned that the current estimation of potential GDP is biased, because of the end point problem when using the HP-filter. If we compare the results of the three scenarios with the results of the basic estimation in the years 2009-2011, we can identify the upward revisions of potential growth in all three scenarios (see Table 3). So if projections are added

to the series we can deal with the end point problem and get estimations that are more similar to that of the different institutions.

Current measures of potential output growth in the euro area annual percentage changes; in percentage points

Source: IMF, OECD, EC and own calculations

	2006	2007	2008	2009	2010	2011
IMF	1.54	1.66	1.32	-0.14	0.45	0.71
EC	1.54	1.53	1.26	0.72	0.78	1.02
OECD	1.61	1.79	1.72	1.19	0.91	0.97
HP filter	1.31	1.14	0.98	0.86	0.81	0.81
Basic estimation	1.53	1.47	1.20	0.43	0.31	0.38
Scenario1	1.57	1.56	1.34	0.62	0.57	0.72
Scenario2	1.55	1.52	1.28	0.54	0.47	0.59
Scenario 3	1.60	1.59	1.40	0.70	0.68	0.87

Table 3: Comparison of the results

5 Summary and conclusion

According to the European Commission (2009a) three possible scenarios of the development of potential output in the post-crisis years are possible: no loss in potential output level after some time, permanent loss in potential output level and potential output level increasing over time. In this thesis the effects of the current economic crisis on potential output in the euro area are analyzed and by taking different assumptions about the future development of the input factors, three different scenarios are carried out.

After the short introduction to the concept of potential output and the estimation methods, the possible theoretical effects of crises on the input factors, labor, capital and total factor productivity are pointed out. As the impact on the input factors and therefore also on potential output depends very much on the policy responses of the countries, the main part of the thesis deals with the actions taken in the current crisis in the euro area. The European Commission has announced the European Economic Recovery Program (EERP) right after the start of the crisis which should ensure a strong recovery for the European economy. The actions taken by the members of the euro area differ from one country to another. A first assessment, however, tells that most of the actions taken are in line with the program announced by the European Commission.

In accordance with the policy actions finally in the last section of the paper, three different scenarios about the medium term development of potential output are carried out. The three scenarios differ in the assumptions about the future growth of total factor productivity which is theoretically seen as the main driving force for economic recovery. In the first scenario the pre-crisis rates are regained, in the scenario the post-crisis rates are lower and in the last one the post-crisis rates of TFP are higher than before the crisis. Thus all three possible theoretical scenarios pointed out by the European Commission could empirically be investigated. According to the policy actions taken it is most plausible that there will be a permanent loss in potential output due to the crisis.

Due to the actuality of the topic predictions about the medium term development of the potential input factors are of great uncertainty. In order to get estimations I took assumptions that are from today's point of view most likely. I am aware

about the fact that the assumptions about the medium term development of the potential input factors may be a bit strong as TFP, the NAIRU and capital stock may not grow at a constant rate between 2012 and 2016. However, given the uncertainty about the future development of the economy and the problem of data availability this is the best approach.

A further limitation is that the three scenarios only differ in the assumptions about TFP growth whereas the other input factors stay the same in all three scenarios. To get more realistic results capital input and labor input would also have to be adjusted as higher growth rates of TFP will also have positive effects on labor and capital. However, as an adjustment of the two other input factors would only intensify the effects already shown in the three scenarios it is not that problematic. The main conclusion that the development of TFP growth depends very much on the policy programs taken and that TFP growth in turn has a major impact on the long term growth path of potential output could be shown in a meaningful way.

Topics for further research would be the adjustment and variation of the other input factors. The rapid ageing of the population in connection with the financial crisis and their impact on potential growth would also be an interesting topic to analyze. The current budgetary problems of Greece – many other countries of the euro area also suffer from high public deficit – is a challenge for the whole euro area and could and will have a major impact on potential output. Due to the actuality of the economic crisis there will come future challenges for the countries of the euro area which could in various ways also have effects on the medium and long term development of potential output.

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List of figures

Figure 1: Three possible theoretical cases 10
Figure 2: Level in actual (Y) and potential (YP) output of Finalnd, Sweden and Japan 12
Figure 3 : Rising unemployment rate in the euro area 14
Figure 4: Monthly growth of loans to non-financial corporations in the euro area 19
Figure 5: GDP growth rate of Japan's "lost decade" 23
Figure 6: Finland's GDP growth rate, 1981 to 2000 25
Figure 7: Potential GDP growth Finland and Japan, 1981 to 2009 28
Figure 8: NAIRU of Finland and Japan 29
Figure 9: Measures of potential output growth in the euro area in the short-term 37
Figure 10: Level in actual and potential output for the euro area 39
Figure 11: Level (upper panel) and growth (lower panel) forecasts of real GDP available at different years (2006-2009) for the euro area 41
Figure 12: Estimates of potential GDP growth (upper panel) using the HP-filter and using real GDP data available at different years (2006-2009) 42
Figure 13: Basic estimation –TFP growth 47
Figure 14: Potential output growth for the euro area (PF-method) 48
Figure 15: Scenario 1 – TFP growth 51
Figure 16: Scenario 1 – potential GDP level 52
Figure 17: Scenario 2 – TFP growth 53
Figure 18: Scenario 2 – potential GDP level 53
Figure 19: Scenario 3 – TFP growth 54
Figure 20: Scenario 3 – potential output level 55
Figure 21: Potential GDP growth of the three scenarios 56

List of tables

Table 1: Comparison of own potential growth results with the estimates of the IMF, OECD and the European Commission..... 43
Table 2: Comparison of the own results with the results of different institutions . 49
Table 3: Comparison of the results 57

Abstract

The theoretical and empirical analysis in this thesis describes the effects of the current crisis on potential output and its input factors, focusing only on the euro area. By varying the assumptions about the medium-term development of total factor productivity it is shown that the recovery scenario of potential output in the post-crisis period heavily depends on this input factor. Dependent on the assumption all three theoretical cases (full recovery scenario, permanent loss in potential output level, increasing loss in potential output level) could be found. Regarding the policy actions taken the most plausible case is a permanent loss in potential output level.

Abstract (German) / Zusammenfassung

In dieser Diplomarbeit werden theoretisch und empirisch die Auswirkungen der aktuellen Krise auf das Potentialoutput und deren Inputfaktoren beschrieben, wobei sich die Analyse auf den Euroraum beschränkt. Dabei werden zuerst die Politikmaßnahmen, die die Euroländer eingeführt haben, beschrieben. Anhand dieser Programme werden Annahmen über die mittelfristige Entwicklung der totalen Faktorproduktivität getroffen und dabei drei Szenarien für die mittelfristige Entwicklung geschätzt. Es konnten dabei alle drei theoretischen Fälle (Vollständige Rückgewinnung des kurzfristigen Verlustes im Level, permanenter Verlust im Level und größer werdender Verlust im Level des Potentialoutputs) nachgewiesen werden. Am wahrscheinlichsten scheint es jedoch aus heutiger Sicht und bei Berücksichtigung der getroffenen Politikmaßnahmen, dass es einen permanenten Verlust im Level vom Potentialoutput geben wird.

Annex

Overview of policy responses and detailed Statistical Annex

Annex 1

Overview of policy responses to the economic crisis in the euro area (from: European Commission, "The EU's response to support the real economy during the economic crisis: an overview of Member States' recovery measures", 2009)

	Financial sector			Fiscal policy						Real economy												
										Labour Market				Investment			Business support					
	Guarantees	Recapitalisation	Total stabilisation	Change in fiscal balance (aggregate over 2008-10)	Discretionary stimulus (aggregate over 2009-10)					Encouraging flexible working time	Supporting employment by cutting labour costs	Retraining and activation	Supporting households purchasing power	Energy Efficiency	Physical infrastructure	R&D & innovation	Sectoral support			Easing access to finance		
					overall	measures aimed at households	increased spending on labour market	measures aimed at businesses	increased investment expenditure								automotive	tourism	construction			
	bn €	bn €	% GDP	p.p. change	% GDP	% GDP	% GDP	% GDP	% GDP													
AT	75	15	5-10%	-5.2	3.5	2.6	0.2	0.2	0.5	•			•	••	•		•			••	AT
BE	300	16.2	>10%	-4.9	1.8	0.9	0.5	0.1	0.3		•		••	•	•				•	••	BE
CY				-3.5	1.8	0	0	0	1.8						•		•	•	•		CY
DE	449.8	106.6	5-10%	-5.8	3.6	1.5	0.5	0.8	0.9	••	•	••	••	••	•	••	••			••	DE
EL	15	5	1-5%	-0.8	0.3	0.3	0	0	0			•	•					•		•	EL
ES	200	0	1-5%	-6	4	1.6	0.1	1.4	0.9		•	•	••	•	•	•	••		•	••	ES
FI	50	0	1-5%	-7.1	3.8	2.6	0	0.7	0.4			••		•	•				•	•	FI
FR	320	43	1-5%	-3.6	1	0.2	0.1	0.4	0.3		•	••		•	•	•	••		•	••	FR
IE	400	8.5	>10%	-8.5	1.4	0.8	0.2	0.4	0			••		•					•	•	IE
IT	0	20	1-5%	-2.1	1.2	0.2	0.4	0.5	0.1								••			•	IT
LU	0	2.876	5-10%	-5.4	n.a.	n.a.	n.a.	n.a.	1.7					•	•		•			•	LU
MT				1.5	1.2	0.4	0	0.2	0.6					•	•			•			MT
NL	200	36.8	>10%	-7.1	1.6	0.4	0.2	0.5	0.5	•	••	•		•	•	•	•			••	NL
PT	20	4	1-5%	-4	1.3	0.4	0.2	0.4	0.3				•	••	•		•	•		••	PT
SI	12	0		-5.5	2.2	0	0.8	0.2	1.2	•		•			•	•				••	SI
SK				-3.2	1.2	0.6	0.2	0.2	0.2	•		••		•			•	•		••	SK

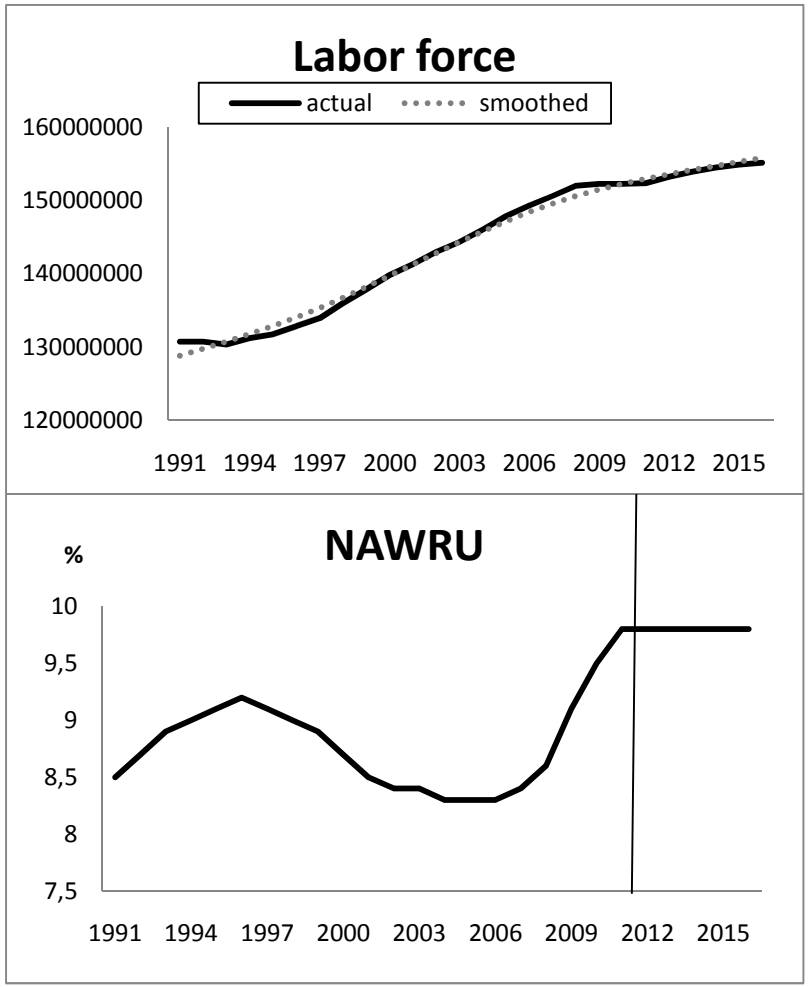
1) ECFIN/C4/REP/51326 18 March 2009 – Bank support measures and recent developments in financial markets (note for the EFC), p. 4.
2) Figures from Table 3 of the country fiches of May 2009
3) ECFIN/B3/GC-FP/D(2009) REP/51628 6 April 2009 – First preliminary assessment of employment and social policies to soften the impact of the crisis (note for the EPC), p. 9.

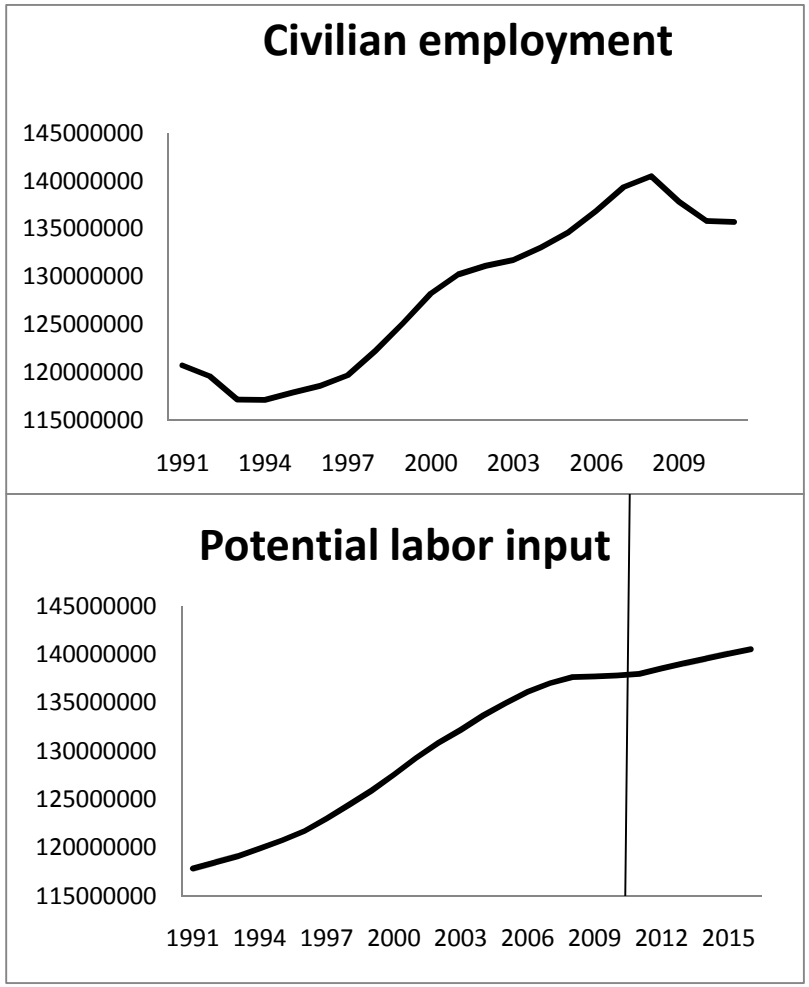
Annex 2.1

	Labor Input - euro area 12								
	Civilian employment	Civilian labour force; **(LF)**	smoothed LF (withou adding projections till 2016)	smoothed LF (adding the projections till 2016)	growth rate of civilian labor force (%)	NAWRU (%)	potential labor input (without projections till 2016)	potential labor input (adding projections till 2016)	Source: AMECO database and own calculations; for the projections till 2016: data from the Ageing report 2009 is used for the growth rate of civilian labor force; the NAWRU is assumed to remain at the level of 2011
		employed +unemployed	using the HP filter (λ= 100)	using the HP filter (λ= 100)			smoothed LF*(1-NAWRU)	smoothed LF*(1-NAWRU)	
1991	120748256	130762756	128869109.8	128840395.3		8.5	117915235.5	117888961.7	
1992	119615116	130769416	129813887.8	129796567.5	0.005	8.7	118520079.6	118504266.1	
1993	117202194	130369094	130777602.3	130771963.3	-0.306	8.9	119138395.7	119133258.6	
1994	117140908	131254208	131788744.9	131795534.8	0.679	9	119927757.9	119933936.7	
1995	117933693	131769593	132871722.4	132892205.5	0.393	9.1	120780395.7	120799014.8	
1996	118640046	132877246	134045596.1	134081485.3	0.841	9.2	121713401.2	121745988.7	
1997	119713511	133970311	135318405.9	135371658.4	0.823	9.1	123004430.9	123052837.5	
1998	122252095	136011895	136686508.3	136758966.3	1.524	9	124384722.6	124450659.4	
1999	125125042	137864442	138132779	138225637.2	1.362	8.9	125838961.7	125923555.5	
2000	128242759	139855959	139633347.3	139746428.6	1.445	8.7	127485246.1	127588489.3	
2001	130248486	141328986	141161659.2	141292485.8	1.053	8.5	129162918.2	129282624.5	
2002	131167250	142982850	142693387	142836049.7	1.170	8.4	130707142.5	130837821.5	
2003	131759819	144349219	144205876	144349726	0.956	8.4	132092582.5	132224349	
2004	133042333	146043833	145679366.4	145807588.5	1.174	8.3	133587979	133705558.7	
2005	134654841	147873041	147095531.5	147183706	1.253	8.3	134886602.4	134967458.4	
2006	136882045	149313145	148439689.6	148454509.6	0.974	8.3	136119195.4	136132785.3	
2007	139366017	150655317	149704933.9	149603323.8	0.899	8.4	137129719.5	137036644.6	
2008	140500330	152018330	150893092.3	150622059.4	0.905	8.6	137916286.3	137668562.3	
2009	137834896	152315396	152015496.2	151513147.3	0.195	9.1	138182086.1	137725450.9	
2010	135821462	152295162	153094729.8	152292981	-0.013	9.5	138550730.5	137825147.8	
2011	135737243	152397643	154156376.1	152985976.5	0.067	9.8	139049051.3	137993350.8	
2012		153238274.4		153616571.4	0.552	9.8		138562147.4	own projections
2013		153975549.6		154203320.4	0.481	9.8		139091395	
2014		154523311.8		154760994.9	0.356	9.8		139594417.4	
2015		154936770.2		155302088.6	0.268	9.8		140082483.9	
2016		155190341.8		155836718.6	0.164	9.8		140564720.2	

Annex 2.2

Labor input





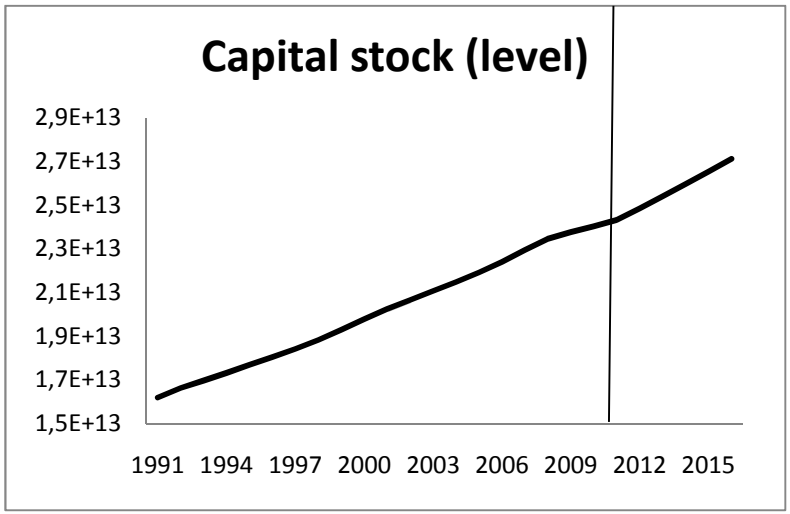
Source: AMECO database and own calculations

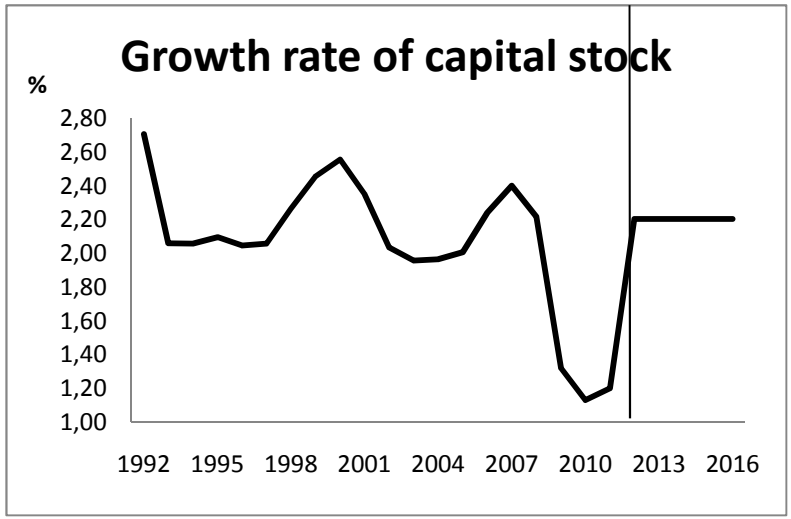
Annex 3

Capital stock - EA 12		
	level	growth rate (%)
1991	1.61921E+13	
1992	1.66305E+13	2.71
1993	1.69733E+13	2.06
1994	1.73228E+13	2.06
1995	1.76862E+13	2.10
1996	1.80483E+13	2.05
1997	1.842E+13	2.06
1998	1.88374E+13	2.27
1999	1.93002E+13	2.46
2000	1.97939E+13	2.56
2001	2.02595E+13	2.35
2002	2.0672E+13	2.04
2003	2.10768E+13	1.96
2004	2.14911E+13	1.97
2005	2.19226E+13	2.01
2006	2.24142E+13	2.24
2007	2.29528E+13	2.40
2008	2.34622E+13	2.22
2009	2.3772E+13	1.32
2010	2.4041E+13	1.13
2011	2.43298E+13	1.20
2012	2.48665E+13	2.21
2013	2.5415E+13	2.21
2014	2.59755E+13	2.21
2015	2.65485E+13	2.21
2016	2.71341E+13	2.21

Own projections

Source: AMECO database





Annex 4: Curriculum Vitae

Name:

Christoph Doleschal

Date of birth:

December 1st, 1984

Place of birth:

Linz, Austria

Education:

October 2005 to June 2010: Studies of Economics at the University of Vienna

Since October 2007: Studies of Business law at the Vienna University of Economics and Business

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