EUROPEAN ECONOMY

EUROPEAN COMMISSION
DIRECTORATE-GENERAL FOR ECONOMIC AND FINANCIAL AFFAIRS

ECONOMIC PAPERS

ISSN 1725-3187
http://europa.eu.int/comm/economy_finance

Number 247 March 2006

Calculating potential growth rates and output gaps
- A revised production function approach -

by
Cécile Denis, Daniel Grenouilleau,
Kieran Mc Morrow and Werner Röger
(Directorate-General for Economic and Financial Affairs)

Economic Papers are written by the Staff of the Directorate-General for Economic and Financial Affairs, or by experts working in association with them. The "Papers" are intended to increase awareness of the technical work being done by the staff and to seek comments and suggestions for further analyses. Views expressed represent exclusively the positions of the author and do not necessarily correspond to those of the European Commission. Comments and enquiries should be addressed to the:

European Commission
Directorate-General for Economic and Financial Affairs
Publications
BU1 - -1/13
B - 1049 Brussels, Belgium

ECFIN/REP 51705-EN

ISBN 92-79-01188-X

KC-AI-06-247-EN-C

CALCULATING POTENTIAL GROWTH RATES AND OUTPUT GAPS

- A REVISED PRODUCTION FUNCTION APPROACH -

CÉCILE DENIS, DANIEL GRENOUILLEAU, KIERAN MC MORROW AND WERNER RÖGER*

* The authors are economists in the Directorate-General for Economic and Financial Affairs (ECFIN) of the European Commission.

Acknowledgements : The authors would like to thank J. Kröger and the members of the EPC's Output Gaps Working Group for valuable comments on earlier inputs to the present paper. Sincere thanks is also extended to H. Rovers for excellent secretarial assistance.

Table of Contents

Annexes

Introductory Remarks

1. Concept of Potential Output : Any meaningful analysis of cyclical developments, of medium term growth prospects or of the stance of fiscal and monetary policies are all predicated on either an implicit or explicit assumption concerning the rate of potential output growth. Such pervasive usage in the policy arena is hardly surprising since potential output constitutes the best composite indicator of the aggregate supply side capacity of an economy and of its scope for sustainable, non-inflationary, growth.

Given the importance of the concept, the measurement of potential output is the subject of contentious and sustained research interest. Of course since it is an unobserved variable, before starting to measure it one must firstly clarify exactly what one means by the concept. It signifies different things to different people, especially when discussed over various time horizons, with the concept appreciated differently when placed in a short, medium or long term perspective :

- In the ***short run*** (i.e. less than one year), the physical productive capacity of an economy may be regarded as being quasi fixed and its comparison with the effective / actual output developments (i.e. in output gap analysis) shows by how much total demand can develop during that short period without inducing supply constraints and inflationary pressures.
- In the ***medium term*** (i.e. over the next five years), the expansion of domestic demand when it is supported by a strong upturn in the amount of productive investment may endogenously generate the productive output capacity needed for its own support. The latter is all the more likely to occur when profitability is high and either increased or supported by an adequate wage evolution with respect to labour productivity.
- Finally, in the ***long run*** (i.e. 10 years and beyond) the notion of full employment potential output is linked more to the future evolution of technical progress (or total factor productivity) and to the likely growth rate of labour potential. For the latter, the EU is paradoxically in a much better position than the US, thanks to its present very low employment rate (with respect to the population of working age) and its very high rates of structural and cyclical unemployment (as a proportion of the active population).

These medium and long run considerations should always be kept in mind when discussing potential output since the latter is often seen in an excessively static manner in some policy making fora, where the growth of capacity is often presented as invariant not only in the short run (where such an assumption is warranted) but also over the medium term as if the projection of fixed investment had no impact on productive capacity.

2. Measuring Potential Growth for Use as an Operational Surveillance Tool : Notwithstanding the importance of the concept, and the consequent desire for clarity, the measurement of potential growth is far from straightforward and, being unobservable, can only be derived from either a purely statistical approach or from a full econometric analysis. It is clear however that conducting either type of analysis requires a number of arbitrary choices, either at the level of parameters (in statistical methods) or in the theoretical approach and choice of specifications, data and techniques of estimation (in econometric work).

In other words, all the available methods have "pros" and "cons" and none can unequivocally be declared better than the alternatives in all cases. Thus, what matters is to have a method adapted to the problem under analysis, with well defined limits and, in international comparisons, one that deals identically with all countries. This was the approach which was adopted in our earlier 2002 paper on this topic[1] where it was stated clearly that the objective was to produce an economics based, production function, method which could be used for operational EU policy surveillance purposes.

The preference for an economic, as opposed to a statistical, approach was driven by a number of considerations. For example, with an economics based method, one gains the possibility of examining the underlying economic factors which are driving any observed changes in the potential output indicator and consequently the opportunity of establishing a meaningful link between policy reform measures with actual outcomes. An additional advantage of using an economic estimation method is that it is capable of highlighting the close relationship between the potential output and NAIRU concepts, given that the production function (PF) approach requires estimates to be provided of "normal" or equilibrium rates of unemployment. At a wider level, another advantage is the possibility of making forecasts, or at least building scenarios, of possible future growth prospects by making explicit assumptions on the future evolution of demographic, institutional and technological trends.

However, whilst economic estimation would appear to overcome, at least partially, many of the concerns in terms of appraising policy effectiveness which are linked to statistical approaches, on the negative side difficulties clearly emerge with regard to achieving a consensus amongst policy makers on the modelling and estimation methods to be employed. Policy makers are fully aware of these latter trade-offs which make any decision making process, regarding the specific details of the PF approach to calculating potential output, a difficult one to undertake in practice. The PF estimates must therefore be assessed in the light of these predetermined requirements and respect the difficult trade-offs involved.

Since the primary use of the methodology is as an operational surveillance tool in the assessment of the annual stability / convergence programmes of the EU's Member States, it is important that the agreed methodology respects a number of basic principles given the politically sensitive nature of the dossier. The 2002 version of the present paper stressed that the main requirements for the PF approach were :

- Firstly, it had to be a simple and fully transparent methodology where the key inputs and outputs are clearly delineated;

- Secondly, equal treatment for all of the EU's Member States needed to be assured; and

- Finally, given that the estimates are used for budgetary surveillance purposes, it was felt important to take a prudent view regarding the assessment of the past and future evolution of potential growth in the EU.

This third requirement of prudence was in fact one of the explicit demands made when policy makers called for a new method to be developed for assessing structural budget balances since it was felt that past surveillance exercises had on a number of occasions produced an

[1] ECFIN Economic Paper No. 176 "Production function approach to calculating potential growth and output gaps : Estimates for the EU Member States and the US"

excessively optimistic picture of the degree of budgetary improvement in the upswing phase of previous cycles. This optimism was linked to some extent with the cyclicality of the trend GDP estimates which had been calculated using the HP filter statistical method and via which the estimates of structural budget balances had been generated. Consequently one of the key objectives of replacing the earlier HP methodology was to reduce the degree of cyclicality of the trend growth estimates to an absolute minimum in order to avoid the mistakes of the past. As made clear in the 2002 paper, this bias towards a prudent or cautious view is evident in all aspects of the PF estimation process, including in the elaboration of the medium-term extension to the method.

3. Production Function as "Reference" Method : In terms of the application of the methodology, the July 2002 ECOFIN Council meeting endorsed the use of the production function (PF) approach as the reference method for the calculation of output gaps when assessing the stability and convergence programmes for a large number of the EU's Member States. The details of this approach were described in the earlier 2002 paper. Following the ECOFIN decision, the Commission services were given the operational responsibility for the application of this methodology to the individual Member States, starting with its Autumn 2002 forecasting exercise.

Reflecting the constantly evolving nature of work in this area, the overall PF methodology was further refined following a two stage work programme, carried out by the EPC's Output Gaps Working Group (OGWG) over the period May 2003 to June 2005.

Stage 1 of the work programme involved the following issues :

- ***firstly***, suggested improvements to the PF approach based on the experiences of the Member States with the application of the methodology since the Autumn 2002 forecasts, including some carryover work from the pre-July 2002 ECOFIN Council decision;

- ***secondly***, sorting out a number of country-specific problems which had delayed the use of the PF method in these respective countries; and

- ***thirdly***, extending the method to the new Member States.

This stage 1 work was largely completed by the OGWG at the start of 2004, with the formal EPC report on stage 1 endorsed by the ECOFIN Council on 11 May 2004.

The second stage of the EPC's work programme was completed in June 2005, with agreement being reached at the 27 June EPC meeting on ***firstly***, the use of new and updated budgetary elasticities for the 25 countries; ***secondly***, on the practical issues needed to resolve the country specific issues; and ***finally***, on a number of important modifications to the methodology (including the agreement to introduce hours worked and to use national accounts based employment data). Since all of the respective changes agreed during stage 2 have now been successfully introduced into the PF approach during the Commission services Autumn 2005 forecasts, it is now considered opportune to provide an update of the 2002 paper[2].

[2] The OGWG's two-stage work programme (May 2003-June 2005) resolved virtually all of the issues which had been raised by the different national delegates regarding the PF framework. The only real exception to this latter

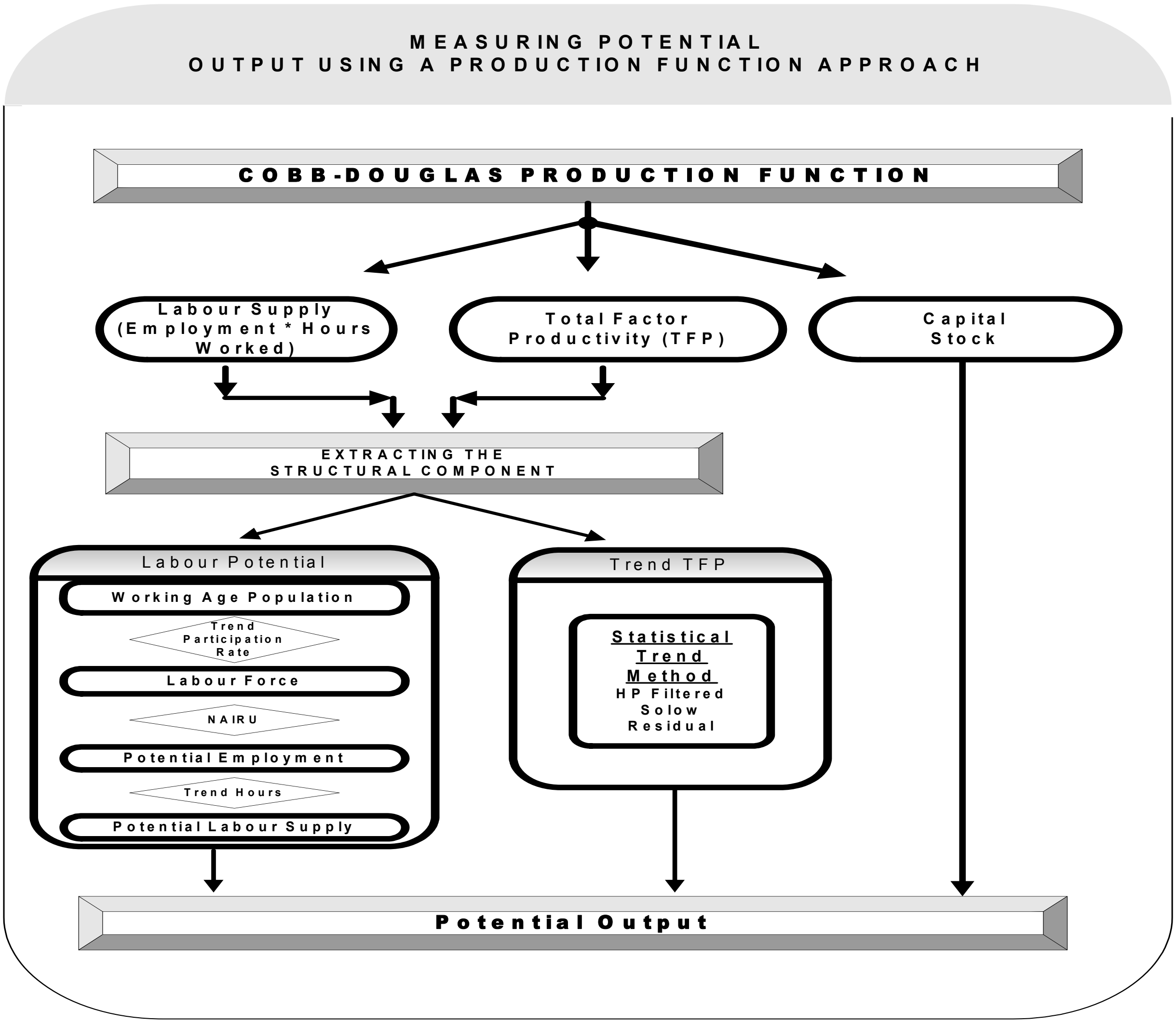
4. Structure of Paper : In terms of content, the paper is laid out as follows. Section 1 provides an overview of the PF methodology and of the modifications agreed to by the EPC / ECOFIN Council over the 2003-2005 period. Sections 2 and 3 then go on to provide a more detailed description of these latter modifications, with section 2 focussing on the NAIRU method and section 3 on the estimation of total factor productivity. In the concluding remarks section of the paper, the operating principles which had been adhered to in establishing the method in 2002 and which have inspired the modifications laid out in the present update are reiterated. Supplementary information is provided in annexes 1-6.

conclusion was the failure of the Group to agree on an approach which would have restricted the PF method to the estimation of potential growth rate developments in the business sector (as opposed to its estimation for the economy as a whole which is now the case). This failure was essentially due to an absence of comparable public sector employment data for the individual Member States. Since these statistical problems are unlikely to be resolved over the next 2-3 years, it is widely accepted that additional changes to the methodology over this period will be relatively limited. However, while the official version of the method may not change dramatically, given the amount of policy interest in this approach and the need for the Commission services to keep up-to-date with developments in the literature, work will of course continue into the effects of using alternative specifications in the method; to experimenting with new methodologies and to exploiting new data sources. This ongoing research work will be essential in building a consensus amongst the Member States of the need / benefits of possible changes to the approach over the longer run, based on the practical experience garnered from using the methodology in the annual budgetary surveillance exercises. In other words, the methodology described in the present paper should not be seen in purely static terms.

SECTION 1 : CALCULATING POTENTIAL GROWTH RATES USING A PRODUCTION FUNCTION APPROACH : OVERVIEW OF KEY FEATURES / RECENT MODIFICATIONS

1.1 Overview of Approach

Instead of making statistical assumptions on the time series properties of trends and their correlation with the cycle, the production function approach makes assumptions based on economic theory. This latter approach focusses on the supply potential of an economy and has the advantage of giving a more direct link to economic theory but the disadvantage, as explained earlier, is that it requires assumptions on the functional form of the production technology, returns to scale, trend technical progress (TFP) and the representative utilisation of production factors. As shown in the diagram below, with a production function, potential GDP can be represented by a combination of factor inputs, multiplied with the technological level or total factor productivity (TFP). The parameters of the production function essentially determine the output elasticities of the individual inputs. With the Cobb-Douglas specification, it is necessary to estimate the trend components of the individual production factors, except capital. Since the capital stock is not detrended, estimating potential output amounts therefore to removing the cyclical component from both labour and TFP.



COBB-DOUGLAS PRODUCTION FUNCTION[3] : In more formal terms, with a production function, GDP (Y) is represented by a combination of factor inputs - labour (L) and the capital stock (K), corrected for the degree of excess capacity (U_L, U_K) and adjusted for the level of efficiency (E_L, E_K). In many empirical applications, including the Quest II model, a Cobb Douglas specification is chosen for the functional form. This greatly simplifies estimation and exposition. Thus potential GDP is given by:

(1) $$Y = (U_L L\, E_L)^{\alpha}(U_K K E_K)^{1-\alpha} = L^{\alpha} K^{1-\alpha} * TFP$$

where total factor productivity (TFP), as conventionally defined, is set equal to :

(2) $$TFP = (E_L^{\alpha} E_K^{1-\alpha})(U_L^{\alpha} U_K^{1-\alpha})$$

which summarises both the degree of utilisation of factor inputs as well as their technological level. Factor inputs are measured in physical units. An ideal physical measure for labour is hours worked which we use as our labour input. For capital we use a comprehensive measure which includes spending on structures and equipment by both the private and government sectors.

Various assumptions enter this specification of the production function, the most important ones are the assumption of constant returns to scale and a factor price elasticity which is equal to one. The main advantage of these assumptions is simplicity. However these assumptions seem broadly consistent with empirical evidence at the macro level. The unit elasticity assumption is consistent with the relative constancy of nominal factor shares. Also, there is little empirical evidence of substantial increasing/decreasing returns to scale (see, e.g. Burnside et al. for econometric evidence).

The output elasticities of labour and capital are represented by α and $(1-\alpha)$ respectively. Under the assumption of constant returns to scale and perfect competition, these elasticities can be estimated from the wage share. The same Cobb-Douglas specification is assumed for all countries, with the mean wage share for the EU15 over the period 1960-2003 being used as the estimate for the output elasticity of labour, which gives a value of .63 for α for all Member States and, by definition, .37 for the output elasticity of capital. While the output

[3] **CHOICE OF PRODUCTION TECHNOLOGY – WHY USE COBB-DOUGLAS ?** One of the big advantages of using Cobb-Douglas is undoubtedly its simplicity, in that it is easy to make sense out of the coefficients imposed. The Cobb Douglas assumption greatly simplifies estimation of output elasticities, conditional on an assumption on returns to scale. With a high average degree of competition in the goods market, the output elasticities can be equated to their respective factor shares. Thus, there is only one parameter to estimate. While a large variety of views on alternative specifications to the Cobb-Douglas approach of constant factor shares are available, one needs to be aware of the implications associated with these alternatives. For example, if one chooses to adopt an elasticity of less than 1, one is left with the problem of explaining why wage shares have fallen recently. If one goes for the alternative assumption of using an elasticity of greater than 1, then the lack of econometric evidence to support using such a function needs to be taken into account. Consequently, given the difficulties associated with the alternatives, the Cobb-Douglas assumption of unity appears to be a reasonable compromise. In addition, of course, if one were to use a CES function with an elasticity of 0.8 or 1.2 the results would not differ very strongly from Cobb-Douglas. Finally, the aggregation problem associated with having a mixture of low and high skilled workers in the workforce would also appear to lend support to the Cobb-Douglas view. In this regard, if you aggregate over both sets of workers one would come close to Cobb-Douglas, with low skilled workers having a high elasticity of substitution (EoS) with capital (EoS > 1) balancing out the low EoS associated with high skilled workers (EoS < 1). High skilled workers have generally a low EoS since such workers are regarded as being more complementary to K. This view regarding the distinction between low and high skilled workers is supported by a paper by Krussell et al. published in *Econometrica* in September 2000.

elasticity for labour may deviate somewhat from the imposed mean coefficient in the case of individual Member States, such differences should not seriously bias the potential output results.

To summarise therefore, in moving from actual to potential output it is necessary to define clearly what one means by potential factor use and by the trend (i.e. normal) level of efficiency of factor inputs.

- **CAPITAL** : With respect to capital this task of defining potential factor use is straightforward since the maximum potential output contribution of capital is given by the full utilisation of the existing capital stock in an economy. Since the capital stock is an indicator of overall capacity there is no justification to smooth this series in the production function approach. In addition, the unsmoothed series is relatively stable for the EU and the US since although investment is very volatile the contribution of capital to growth is quite constant since net investment in any given year is only a tiny fraction of the capital stock figures. In terms of the measurement of the capital stock, the perpetual inventory method is used which makes an initial assumption regarding the size of the capital / output ratio.

- **LABOUR**[4] : The definition of the maximum potential output contribution of labour input is more involved since it is more difficult to assess the "normal" degree of utilisation of this factor of production. Labour input is defined in terms of hours. Determining the trend of labour input involves several steps. In defining the trend input we start from a maximum possible level, namely the population of working age. We obtain the trend labour force by mechanically detrending (using an HP filter) the participation rate. In a next step we calculate trend un/employment to be consistent with stable, non accelerating, (wage) inflation (NAWRU). Finally we obtain trend hours worked (potential labour supply) by multiplying trend employment with the trend of average hours worked. One of the big advantages of this approach is that it generates a potential employment series which is relatively stable whilst at the same time also providing for year-to-year changes to the series to be closely linked to long run demographic and labour market developments in areas such as the working age population, trend participation rates and structural unemployment.

- **TREND EFFICIENCY** : Within the production function framework, potential output refers to the level of output which can be produced with a "normal" level of efficiency of factor inputs, with this trend efficiency level being measured as the HP filtered Solow Residual.

Normalising the full utilisation of factor inputs as one, potential output can be represented as follows :

(3) $$Y^P = (L^P E_L^T)^\alpha (K E_K^T)^{1-\alpha} .$$

[4] Since Eurostat and the OECD have agreed that the national accounts (as opposed to the labour force survey) is the preferred source for labour input data, the production function approach now uses the national accounts for the labour input variables i.e. for hours worked and employment.

1.2 Medium-Term Extension

While the production function derived potential output estimates provide a good picture of the present output capacity of economies, they should not however be seen as forecasts of medium-term sustainable rates of growth but more as an indication of likely developments if past trends were to persist in the future. If, for example, a country's potential growth rate is 3% in 2005, it can only be sustained at that rate in future years if none of the underlying driving forces change. Any longer term assessment would need therefore to be based on a careful evaluation of the likelihood that present rates of growth for labour potential, productive capacity and TFP will persist over the time horizon to be analysed. In this context, annex 5, amongst other things, gives the results which emerge if one carried out a simple technical extrapolation for the three years following the end of the Commission services, Autumn 2005, forecasts (i.e. for the years 2008-2010). It is important to stress that this technical extension is in no way a forecast for these years, it is simply an attempt to illustrate what would happen if the trends of recent years were to continue on, using established and transparent ARIMA procedures.

It is in this context that the illustrative estimates for the years 2008-2010 shown in Annex 5 should be assessed, with the potential growth rates for those years being calculated using the following key inputs :

- **1. TREND TOTAL FACTOR PRODUCTIVITY (TFP) :** Trend TFP is modelled as the HP filtered Solow Residual. TFP can be calculated until the end of the short term forecast horizon, using the forecasts for GDP, labour input and the capital stock. From 2008 until 2010 a TFP forecast is generated with the use of a stochastic model, where current TFP is explained by a parsimonious ARIMA model. For most countries, TFP growth is explained by a random walk with drift specification. A further 3 years are added at the end of the series to limit the end point bias problem in 2010. The HP trend is then calculated on the whole series up to 2013.

- **2. KALMAN FILTER NAIRU'S :** The trend specification chosen for the NAIRU implies that the best prediction for the change in the NAIRU in future periods is the current estimate of the intercept. This basically implies that the slope of the NAIRU in 2007 should be used for the projection until 2010. Such a specification seems problematic for longer-term projections since it will eventually violate economic constraints (such as non-negativity of the NAIRU, for example). An alternative specification which is more consistent with the common notion of the NAIRU as a stable long run level of the unemployment rate would be a random walk without drift. This specification would imply a flat extrapolation of the last NAIRU value. Though this specification does not work well in estimation for European data where persistent trend changes of the unemployment rate can be observed, it may be a more plausible specification for the projections. The projections in practice constitute a compromise between these two concepts, with the NAIRU estimated according to the following rule:

$$NAIRU_{t+1} = NAIRU_t + .5 * (NAIRU_t - NAIRU_{t-1})$$

In forecasting the NAIRU we allow 50% of the most recent decline. This implies that the NAIRU is practically stable in 2010, because after 3 years the change in the NAIRU only amounts to 12.5% of the decline in 2007.

- **3. POPULATION OF WORKING AGE :** In terms of a projection for the population of working age for the three years 2008-2010, since Eurostat periodically produce long range population projections for all of the EU's Member States, it was decided that the most recent (i.e. 2005) Eurostat projections should be used for the extension to 2010.

- **4. PARTICIPATION RATE CHANGES :** While it would be more appropriate to split the overall participation rate into its male and female components, investigations into the feasibility of doing so suggested, at this stage at least, that without an improvement in data availability that this breakdown would not provide a significant degree of additional information over and above that provided by the total participation rate. The most significant problem was in terms of the timeliness of the data and the short sample length for the necessary series. Due to these data constraints it was decided to continue to work with the total participation rate series. On the basis of the forecasts by ECFIN's desk officers for the labour force and the population of working age for the individual countries, the implied total participation rate up to the end of the forecasting period (i.e. 2007) is produced and this latter series is extended to 2010 on the basis of simple autoregressive projections with an estimated time trend. A further 3 years are added at the end of the series to limit the end point bias problem in 2010. The HP trend is then calculated on the whole series up to 2013.

- **5. AVERAGE HOURS WORKED :** Labour input in the method is now decomposed into both the number of employees and the average hours worked per employee. The hours worked series is smoothed using an ARIMA process. The new approach provides a more meaningful measure for the rate of technical progress in the different countries since the TFP trend is now corrected for the trend in hours worked. In the past, TFP was biased downwards due to the secular decline in the average hours worked per employee. While the introduction of hours worked will in general not alter the overall growth rate of potential output for the Member States, it will however affect how potential growth is attributed to the various factors of production, especially labour and TFP (with TFP in general being boosted and with labour being correspondingly reduced).

- **6. INVESTMENT TO (POTENTIAL) GDP RATIO :** Since the purpose of the exercise is to get an estimate for potential output in 2010, the investment to potential GDP series is used as an exogenous variable. An AR process allowing for a constant and a time trend is specified and estimated until 2007. Notice, this makes investment endogenous. For a constant investment to GDP ratio, investment responds to potential output with an elasticity equal to one.

Technical Specification of the Model Used

The model used can be summarised as follows:

EXOGENOUS VARIABLES

- *POPW - (Population of Working Age)*
- *PARTS - (Smoothed Participation Rate)*
- *NAIRU - (Structural Unemployment)*
- *IYPOT - (Investment to Potential GDP Ratio)*
- *SRHP - (HP Filtered Solow Residual)*
- *HOURST – (Trend, average hours worked)*

ENDOGENOUS VARIABLES

- *LP - (Potential Employment)*
- *I - (Investment)*
- *K - (Capital Stock)*
- *YPOT -(Potential Output)*

1. POTENTIAL LABOUR INPUT

$$LP = (POPW * PARTS * (1 - NAIRU)) * HOURST$$

2. INVESTMENT AND CAPITAL

$$I = IYPOT * YPOT$$

$$K = I + (1 - dep)K(-1)$$ [5]

3. POTENTIAL OUTPUT

$$YPOT = LP^{.65} K^{.35} SRHP$$

4. OUTPUT GAP

$$YGAP = (Y / YPOT - 1)$$

[5] The depreciation rate is assumed to remain constant over the projection period.

1.3 : Summary of Recent Modifications (2003-2005)

Following the decisions taken at both the May 2004 ECOFIN Council and the June 2005 EPC meetings, the most important changes to note regarding the operation of the PF methodology are as follows :

- **PF methodology is now applicable to all 15 of the "old" Member States** : Following the resolution of the outstanding country specific issues pertaining to Germany, Austria and Spain, all of the 15 countries now accept the use of the PF approach as the reference method for the assessment of the stability and convergence programmes. The HP filter approach will only be used as a "back-up" method and only for a short (unfortunately still to be defined) transition period.

- **A modified PF methodology has been agreed which is applicable to all 10 of the "New" Member States - in parallel with the HP filter approach** : Due essentially to a number of serious statistical problems associated with the availability of only short time series for the new Member States, a modified PF framework had to be developed for these countries. A common starting date of 1995 was imposed for all 10 countries since too many transitional issues were biasing the pre-1995 data. The main modifications to the methodology, relative to that which applies to the EU15 countries, include firstly, a simpler NAIRU methodology based on wage elasticities (it was not possible to use the more sophisticated Kalman Filter based approach applied to the "old" Member States); secondly, trend TFP is estimated using a moving average based, stochastic trend, approach (as opposed to the random walk model used for the EU15 countries); and finally, the capital stock is estimated using a capital/output ratio which is fixed in the base year of 1995.

- **Improvement of NAWRU estimates** : Following requests from a number of delegates in the OGWG, additional work was undertaken in 2004 firstly to address the issue of whether it was appropriate to constrain the unemployment gap to have a mean of zero over the sample period; secondly, to better capture the specificity of the European labour market and thirdly, to help desk officers and the Member States to more easily interpret changes in the NAWRU / NAIRU estimates. In more concrete terms, it was agreed to remove the zero sample mean restriction; to include the wage share in the NAWRU estimation model as an additional explanatory variable; and to provide additional graphs giving a more intuitive understanding of the basic determinants of the NAWRU calculations. The overall NAWRU estimation methodology was discussed at the 8 November 2004 meeting of the OGWG, with all of the country delegates in broad agreement with the approach described in the present paper.

- **Estimation of trend total factor productivity (TFP)** : With the objective of reducing the mean reverting tendency of the trend TFP estimates, agreement was reached at the September 2004 OGWG regarding the use of a stochastic trend approach in the method in preference to the deterministic method which had been used previously[6].

[6] It should be stressed that the present move from a deterministic to a stochastic I(1) process for the calculation of trend TFP in the EU15 countries does not change the results for the vast majority of Member States in any meaningful way since mean reversion is a feature of

This change will have some additional positive benefits in terms of reducing the end of sample bias problem associated with using a HP filter to extract trend TFP, although the extent of the bias is limited since the method's medium term extension is already explicitly extended by 3 years to overcome this problem. In addition, in the context of our ongoing research to isolate the best method for extracting the cyclicality from trend TFP, the OGWG discussed a paper which experimented with using capacity utilisation indicators. This approach was however rejected by the Group because of the spurious results for some Member States linked with an absence of cointegration between the regression variables.

- **Introduction of hours worked** : Total hours worked is the preferred measure of labour input in the national accounts but its measurement has proved challenging due to the growing importance of service activities, self-employed jobs and the emergence of a range of new, often irregular, working patterns. Due to these measurement issues, its use in the PF methodology was delayed until the Autumn 2005 forecasts since there was an absence of datasets of sufficient quality for a large number of the Member States. While the ESA95 data transmission programme provides for the provision of hours worked series, not all EU countries have, as yet, officially provided the data. Eurostat (in close co-operation with the OECD) have however constructed data for total hours worked for most of those countries which were not yet in a position to provide it. Following the EPC agreement in June 2005 and the resolution of all the outstanding country specific data issues over the summer months, the hours worked series for the respective countries were successfully introduced in the Autumn 2005 forecasting exercise. In addition, given the associated joint OECD / Eurostat decision to use the national accounts (as opposed to the labour force survey) as the preferred source of labour input data, the method has been modified to take both the employment and hours worked input variables from this single source.

- **Amendment of standard tables and graphs and the setting up of the "Output Gaps" Circa website** : The standard output tables and graphs have been adapted to reflect the revisions discussed above. These are now available for all 25 Member States, the Euro Area and the US. In addition, with the objective of improving the transparency of the approach and facilitating its widest possible use by all interested parties, a Circa website has been set up (http://forum.europa.eu.int/Public/irc/ecfin/outgaps/library). This website is publicly available on the internet (i.e. no password is required for access). As can be seen from the copy of the "Homepage" given overleaf, it is split into 3 main sections :

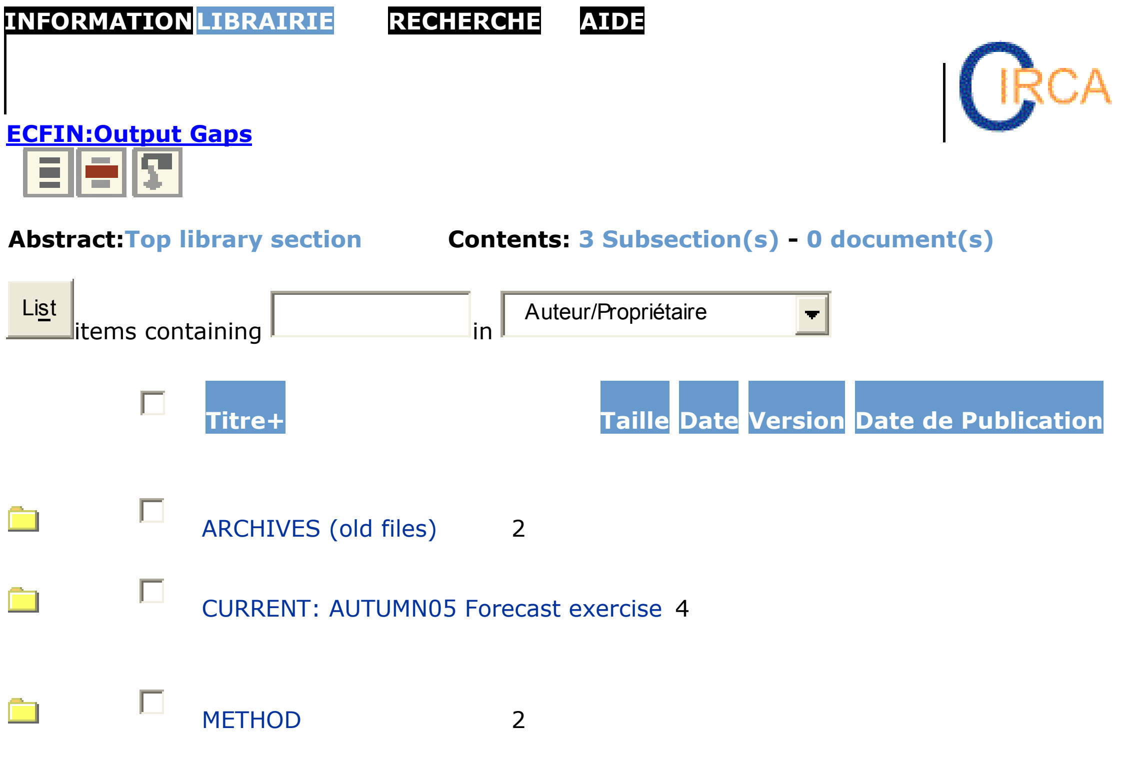
    - **1. Archives :** At the moment this section contains the detailed potential growth and output gap results from the Commission services Autumn 2004 and Spring 2005 forecasts.

    - **2. Current Autumn 2005 Forecast Exercise** : this section contains a) all the detailed information / latest modifications to the approach (eg introduction of hours worked / programme changes plus data sources); b) the NAIRU Kalman filter programme plus detailed spreadsheets per country giving the NAIRU specifications used for each country as well as the data series and a set of

both models. However, a move from an I(1) to an I(2) stochastic model could produce significant changes in terms of trend TFP, with the trend for the most recent past playing a much greater role.

NAIRU related graphs; c) the Rats programmes and data sets used to calculate the potential growth rates and output gaps for the 25 countries; d) detailed spreadsheets and sets of graphs per country.

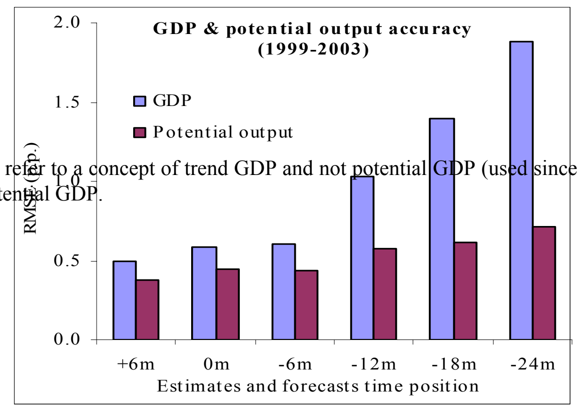
- **3. Method** : This section of the website is reserved for documents which describe the method and its operation. At present it contains ECFIN Economic Paper No 176 “Production Function Approach to Calculating Potential Growth and Output Gaps” and a first draft of a “Reference Manual” which provides a “hands-on” guide for users of the method. Given the extensive changes which have occurred to the approach over the last number of years, the present Economic Paper will replace No. 176 in due course.



Box 1 : Real Time Output Gap Estimates
(A production-function model for the output gap)

In the Monthly Bulletin of February 2005, the ECB concluded that real-time output gap estimates tend to be of low reliability and that business cycle analysis should therefore be based on a wider set of indicators. However, the low reliability of output gap estimates is mainly due to the inaccuracy of GDP estimates/forecasts in real time; in other words, potential output is more reliably estimated than GDP itself.

The assessment of the accuracy of output gap[7] real time estimation (or forecasts) involves the comparison of two estimates: a real time

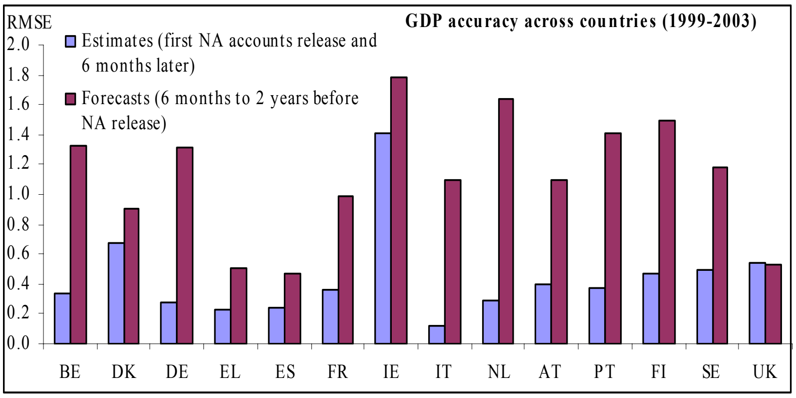


[7] Note that historic (i.e. pre-2002) DG ECFIN estimates of the output gap refer to a concept of trend GDP and not potential GDP (used since the Autumn 2002 forecasts). Final (benchmark) estimates are based on potential GDP.

estimate (or forecast) produced in the past and, as a benchmark, a final estimate (the most recently available one) that is supposed to be no longer revised in the future. The following equation immediately shows that part of the output gap error might be completely independent from the issue of model uncertainty (potential output) but simply accounted for by GDP revisions :

Output gap error = (Historic GDP - Final GDP) + (Final potential GDP – Historic trend/potential GDP)

An unbiased assessment of the output gap model performance requires disentangling errors due to potential output estimation and those due to GDP estimation. The following graph allows such a comparison of both components. The assessment based on these statistics contrasts with the ECB judgement. The potential output accuracy seems rather satisfactory with a RMSE (Root Mean Square Error) lower than 0.5 percentage points up to 6 months before the first release of national accounts data. Strikingly, its reliability is much better than the reliability of GDP forecasts even though forecasted data are necessarily used for potential output forecasts with a production function.



Note to the graph: The RMSE summarises differences between final estimates and estimates/forecasts produced respectively *x* months (*x*m) after(+)/before(-) the first release of national accounts data. The same sample (1999-2003) is used for potential output and GDP estimates/forecasts. As with previous statistics, estimates published 6 months after the first release of the national accounts (NA) are taken from the Autumn forecasts of the subsequent year. Forecasts published 6 months before the first release of the NA are taken from the Autumn forecasts of the current year and forecasts published 24 months before the first release of the NA are taken from the Spring forecasts of the year before.

The conclusion with respect to output gap model uncertainty is unambiguously that the model is robust enough to cancel out part of the data inaccuracy. Model uncertainty does not seem to be the main issue. Conversely, the bad quality (see graph) of GDP estimates for some countries and forecasts (in fact, for most countries) is the main source of the errors.

Against this background, other indicators than the output gap might provide valuable information for business cycle analysis only if those indicators are not as much revised as GDP.

SECTION 2 : MODIFICATIONS TO THE NAIRU METHODOLOGY

The so called "Non-Accelerating Inflation Rate of Unemployment" or NAIRU is widely accepted as an equilibrium concept of the labour market. The NAIRU is implicitly defined as the equilibrium point of a dynamic system of labour supply and labour demand equations. This equilibrium concept is linked to the Phillips curve debate which is crucial in monetary policy discussions. Since the famous Phelps (1967) and Friedman (1968) contributions in the late 1960s a consensus has emerged that with long run flexible prices and wages, there should be no long run trade off between the rate of inflation and the rate of unemployment. Consequently, wage and price dynamics must be formulated in terms of changes in wage and price inflation. With this formulation it is assured that the unemployment rate will always return to its equilibrium value, regardless of the level of the long run (wage) inflation rate. This is the rationale behind the NAIRU concept.

Using a standard bargaining model of the labour market under the assumption of static or adaptive expectations (see annex 1 for a more detailed discussion of the model), a relationship between the change in nominal wage inflation and the unemployment gap can be derived which is controlled for by the change in the growth rate of labour productivity, the wage share and the terms of trade[8].

The dynamics of the Phillips curve reflects the process in which wages adjust to economic conditions. Wage adjustment can be delayed because of limited information in the formation of expectations or because of institutional rigidities. For modelling expectations we use a backward looking framework, in particular we distinguish between static and adaptive expectations. Different expectations schemes generate different dynamics of the Phillips curve and it turns out that we can capture the heterogeneity of the Phillips curve dynamics in the EU with these two schemes.

Static (Moving average) vs Adaptive Expectations

Static expectations is the simplest expectation scheme (see Blanchard and Katz (1999)). Under this scheme expectations for period t are simply equal to the realisation of the respective variable in period t-1. This scheme appears reasonable for quarterly data. Applying such a scheme to annual data requires a slight modification, namely a moving average scheme over current and lagged inflation. Such a scheme can also approximate an overlapping contracts specification. Concerning wage formation, the two crucial variables for which expectations must be formed are inflation (π) and labour productivity (*pr*)

$$\pi_t^e = a\pi_t + (1-a)\pi_{t-1} \quad (1a)$$

$$\Delta pr_t^e = c\Delta pr_t + (1-c)\Delta pr_{t-1}. \quad (1b)$$

The degree of nominal rigidity is proportional to (1-a) while the degree of real rigidity is proportional to (1-c). Combining these expectations schemes with the structural model of the labour market yields the following Phillips curve :

[8] Because of data availability a simpler model and a different estimation technique is used for estimating the NAIRUs for the new member states.

$$\Delta^2 w_t = \phi^{pr}\Delta^2(pr_t) + \phi^{ws}\Delta^2 ws_t + \phi^{tot}\Delta^2 tot_t - \beta(u_t - nairu_t) + v_t^w \quad (2)$$

where w is the log of nominal wages, pr is the log of labour productivity, ws is the log of the wage share, tot is the log of the terms of trade, and u is the unemployment rate.

The Phillips curve shows the short run response of nominal wages to labour productivity, labour demand shocks and the unemployment gap. The response to the unemployment gap is intuitively plausible. Whenever unemployment is above the NAIRU, nominal wage growth will decelerate and vice versa. However, this link is not perfect but is disturbed by observed and unobserved shocks to the wage rule and the labour demand equation. How nominal wage growth responds to productivity and labour demand shocks (here approximated by changes in the growth rate of the wage share) depends on a variety of factors. This is discussed in more detail in annex 1.

The above specification applies to the majority of countries in the EU (see Table 2.1) and in particular to the euro area aggregate as well as to the US. However in some countries, in particular Belgium, France, Italy, Spain, Sweden and the UK, the unemployment gap appears with a quasi first or second difference in the Phillips curve. This cannot be generated with the static expectations scheme, one needs to assume adaptive expectations of the following form

$$\pi_t^e = a\pi_{t-1} + (1-a)\pi_{t-1}^e \quad (3a)$$

$$\Delta pr_t^e = c\Delta pr_{t-1} + (1-c)\Delta pr_{t-1}^e . \quad (3b)$$

or a combination between adaptive and static expectations. Adaptive inflation and static productivity expectations yields

$$\Delta^2 w_t = \sum_{i=0}^{1}\phi_i^{pr}\Delta^2 pr_{t-i} + \sum_{i=0}^{1}\phi_i^{ws}\Delta^2 ws_{t-i} + \sum_{i=0}^{1}\phi_i^{tot}\Delta^2 tot_{t-i} - \beta\left[(u_t - nairu_t) - (1-a)(u_{t-1} - nairu_{t-1})\right] + v_t^w \quad (4)$$

Adaptive inflation and adaptive productivity expectations yield

$$\Delta^2 w_t = \sum_{i=0}^{2} c_i\Delta^2 pr_{t-i} + \sum_{i=0}^{2} c_i\Delta^2 ws_{t-i} + \sum_{i=0}^{2} c_i\Delta^2 tot_{t-i} - \beta\left[(u_t - nairu_t) - (2-a-c)(u_{t-1} - nairu_{t-1}) + (1-c)(u_{t-2} - nairu_{t-2})\right] + v_t^w \quad (5)$$

The following table shows the Kalman Filter estimates for the old member states, EU15 and the US. Due to data limitations this approach cannot be applied to the new member states. The approach adopted for the new member states is described in the next section.

Table 2.1: Phillips Curve Estimates

	$\Delta^2 PROD$	$\Delta^2 TOT$	$\Delta^2 TOT(-1)$	$\Delta^2 WS$	***U-GAP***	***U-GAP(-1)***	***U-GAP(-2)***	ΔU	***R**2***	***Q-Statistic, p-value***
BE	0.48 (3.24)	0.30 (1.05)			-1.49 (2.97)	1.05 (2.08)			0.37	0.59
DE	0.85 (6.78)		0.21 (1.57)	1.20 (UB)	-0.35 (2.03)				0.80	0.29
DK	0.47 (3.31)		0.21 (1.56)	0.89 (8.35)		-0.59 (2.46)			0.64	0.62
ES	0.44 (2.51)		0.76 (3.34)	0.41 (2.48)	-1.18 (3.76)	0.89 (2.72)			0.44	0.68
FR	0.55 (1.92)	0.29 (1.86)	0.51 (3.32)	1.03 (6.54)	-1.54 (2.71)	2.49 (2.32)	-1.63 (2.41)		0.66	0.87
GR	0.32 (1.80)				-0.64 (2.20)				0.25	0.75
IR	0.04 (0.30)		0.53 (4.26)		-0.72 (1.54)				0.45	0.61
IT	0.09 (0.35)		0.43 (1.04)		-2.46 (1.57)	5.23 (2.60)	-0.97 (1.59)		0.08	0.68
LX	0.24 (2.22)				-1.30 (3.28)				0.31	0.04
NL	0.59 (3.48)			0.79 (6.10)		-0.52 (1.67)			0.58	0.76
OS	0.57 (3.75)		0.10 (0.71)	0.86 (7.54)	-1.28 (2.83)				0.68	0.30
PO			0.09 (0.19)		-0.95 (2.98)				0.19	0.98
SF	0.09 (0.38)		0.25 (1.21)		-0.35 (1.13)			-0.76 (2.29)	0.34	057
SW	0.36 (2.01)			0.76 (6.43)	-0.63 (1.47)	0.55 (1.18)			0.58	0.82
UK	0.40 (1.64)		1.21 (4.29)		-3.09 (3.51)	1.88 (2.23)			0.42	0.81
EURO AREA (EU12) and the US										
EU12	0.82 (4.68)	0.03 (0.17)	0.31 (1.74)	0.99 (5.99)	-0.69 (3.10)				0.52	0.85
US	0.76 (9.10)	0.26 (1.60)	1.04 (5.56)	0.79 (8.18)	-0.53 (4.02)				0.70	0.59

Notes : Kalman filter estimates over the period 1965-2006. Estimation is performed with annual data, including the short term forecast of DG ECFIN. See C. Planas et al (2004) for a description of the program used.

NAIRU Estimation for the new member states

We essentially use the same theoretical specification as described earlier. However, we make some simplifying assumptions in order to facilitate the estimation.

For calculating the NAIRU for the new Member States a methodology proposed by the OECD is used (i.e. the "Elmeskov" method[9]). However, instead of applying the methodology to nominal wages we apply it to nominal unit labour costs. This gives a specification for the Phillips curve which is close to the model with static expectations

$$\Delta^2 w_t = \Delta^2 (pr_t) - \beta(u_t - nairu_t) + v_t^w \quad (6a)$$

$$\Delta^2 ulc = \Delta^2 w_t - \Delta^2 (pr_t) = \beta(u_t - nairu_t) + v_t^w \quad (6b)$$

This formulation indicates that unemployment is below the NAIRU whenever the growth rate of unit labour costs increases.

The following table presents the estimates for β .

Table 2.2 : Estimates of the Wage Elasticity Parameter

	Cyprus *	Czech Republic	Estonia	Hungary	Latvia	Lithuania	Malta	Poland**	Slovakia	Slovenia
β_W	21.99	-2.47	2.75	7.75	7.19	5.01	10.5	-.83	5.33	2.28
β_{ULC}	75.10	0.93	1.51	1.86	3.65	2.66	10.9	0.04 (2.00)	3.12	-1.80

* *For Cyprus, data on the acceleration of wage inflation is only available since 1997 in DG ECFIN's AMECO database. Since the elasticity estimates are consequently unreliable, a HP Filter is used for calculating the NAIRU.*

** *The elasticity estimate for Poland is extremely small (and has the wrong sign for β_W). In this case a value for the elasticity close to the average for the new Member States was chosen in order to obtain a reasonable path for the NAIRU.*

The parameter estimates show orders of magnitude close to those obtained for the EU15 member states in the unit labour cost case. Therefore these parameters are used for calculating the NAIRU in the new Member States.

The results for four countries merit special attention. These countries are the Czech Republic, Estonia, Latvia and Lithuania. In these countries we obtain a marked positive unemployment gap at the beginning of the data set which translates into negative output gaps. This phenomenon arises due to the fact that the deceleration in unit labour costs was very strong.

Does the Phillips equation imply any long run restrictions for the unemployment gap ?

With the unemployment gap entering the calculation of the output gap, the question arises whether an unemployment gap generated via a Phillips curve specification will have a zero mean property over the sample period. Here it is shown that the standard labour market model does not impose a specific restriction on the unemployment gap. This is revealed by calculating the unconditional mean of the unemployment gap from the Phillips curve. A mean of zero is a possible outcome, however, and would result if the economy under study evolved

[9] J. Elmeskov (1993)

around a constant growth rate of wage inflation, productivity and the terms of trade and if the trend of the wage share would have been constant over the sample. Though these conditions are closely fulfilled in most European economies, it is nevertheless likely that the sample might include a trend break in productivity growth or a permanent change in the inflation rate. Suppose, for example, the Phillips curve is estimated over a period of disinflation, i.e. with $E(\Delta^2 w_t) < 0$ and with stable trends in productivity $E(\Delta^2 pr)_t = 0$, the wage share $E(\Delta^2 ws_t) = 0$ and the terms of trade $E(\Delta^2 tot_t) = 0$. Retaining the assumption of a zero mean unemployment gap would mean that the Phillips curve would have to be estimated with a constant (*const*= $E(\Delta^2 w_t) < 0$) in order to capture the mean disinflation that occurred over the sample. However, estimating the Phillips curve with a constant term implies that in the absence of shocks and when the unemployment rate is equal to the NAIRU, the change in wage inflation is negative. This would be inconsistent with the NAIRU hypothesis. Therefore it was decided to remove the zero mean constraint on the unemployment gap which was initially imposed. In terms of the NAIRU estimates, removing the zero mean constraint results in a slight downward adjustment of the NAIRU for most countries in the range between 0.1 and 0.4% points. In some countries, notably Italy, the NAIRU is adjusted upwards by 0.1% points.

SECTION 3 : TOTAL FACTOR PRODUCTIVITY (TFP) : CHOICE OF SPECIFICATION FOR CALCULATING MEDIUM-TERM TFP TRENDS

In the framework of the production function approach for calculating potential growth, medium-term projections require estimates for key inputs, including trend total factor productivity (TFP). Trend TFP is modelled as the HP filtered Solow residual. The trend TFP projection in the past was based on TFP forecasts computed with a deterministic trend model. Several discussions in the output gap working group led to a revision of the model used for calculating the TFP trend (see annexes 3 and 4 for additional details).

The output gap working group in October 2003 first discussed the methodology of the Dutch Central Planning Bureau (CPB Memorandum 51, 2002). The CPB method consists of estimating a moving average model for the growth rate of TFP. This specification predicts a constant growth rate after two years (related to the order of the MA term) and therefore gives a clear guidance for the HP trend. However the CPB method not only introduces a new way of dealing with the end point bias problem but it is also based on a stochastic trend specification. When using this method it was noticed that the stochastic trend model has consequences for the most recent TFP trend in some member states. Given the large implicit weight given to the last TFP observation (which is in fact a two-year ahead projection), the choice of this particular model might not be the most robust for GDP projections.

When deciding on the appropriate specification for TFP, three types of issues are broadly involved :

- Firstly, is the trend of the economic series deterministic (correlated with time periods) or stochastic ?

- Secondly, what is the order of integration of the series, i.e. how many times should it be differenced in order for it to become stationary ?

- Thirdly, what is the best parsimonious ARIMA model specification for the series transformed in order to become stationary ?

Some econometric tests (in particular unit root tests) provide some answers to these questions and might help to inform the choice of model specification for TFP. The note reproduced in annex 4 introduces econometric evidence based on standard available tests and evaluates empirically which of the two trend specifications is more consistent with the data. Only the main results are summarised in the subsequent paragraph and one should refer to the annex for detailed analyses.

In the first step, the TFP series are checked for stationarity with panel unit root tests as well as standard augmented-Dickey-Fuller (ADF) tests on the individual series. It appears that the TFP series for all of the Member States are not stationary, irrespective of the inclusion of a time trend. An important conclusion is that a deterministic trend is in principle ruled out by panel unit root tests. Only TFP growth might be stationary. The tests are then applied a second time on the first difference of TFP. For a few Member States at least, tests suggest that TFP growth is stationary. However, it cannot be ruled out that for other Member States only the second difference of TFP is stationary (for individual series, unit root tests are not very robust to the number of lags used and do not necessarily support clear-cut conclusions). The main result of this part of the analysis is that TFP series have a stochastic trend and not a deterministic trend. In addition, most seem I(1) - integrated of order 1.

In the second step, the Box-Jenkins methodology is applied to determine parsimonious ARIMA models for the stationary series. The out-of-sample forecasting performance of the stochastic model is then compared to those of the deterministic trend model.

Finally, an analysis is made of the consequences of moving to a stochastic trend model for the calculation of potential growth and output gaps country by country. The results suggest that the differences between the two specifications in terms of potential growth are small but not negligible, at least for some countries. For Belgium, Spain, Italy, Greece and Finland we obtain higher potential growth rates, while for Germany, the Netherlands, Portugal, Ireland, Luxembourg and Sweden potential growth is slightly reduced. No significant changes occur for Denmark, France, Austria and the UK.

Another interesting comparison can be made concerning the HP filter output gap difference between the deterministic and the stochastic trend specification. Since the HP output gap is based on a stochastic trend model one would a priori expect that the output gap calculations using the stochastic trend model would become more similar. This seems to be the case in general. The only exceptions are Belgium, Denmark, Italy and Finland. For all of the other countries the differences between the two gaps have narrowed or stayed the same.

As a conclusion, it should be recalled that the choice of an I(1) specification is not neutral in terms of projections for the future. This specification implies that TFP growth reverts to its sample mean (which for many countries is higher than the TFP growth rates observed over recent years), whereas an I(2) specification, such as that suggested by the CPB, implies that the best forecast for future TFP growth is to use the last sample observation. Where econometric tests do not necessarily provide clear-cut conclusions on a country by country basis, an alternative choice of specification could also be based on economic scenarios for the medium-term.

CONCLUDING REMARKS

KEY GUIDING PRINCIPLES USED IN ESTABLISHING AND MODIFYING THE PRDOUCTION FUNCTION METHODOLOGY : Since the PF method is the reference to be used by the Commission services for calculating structural budget balances it is clear that the pressure for changing particular aspects of the approach will continue to be intense over a medium to long term time horizon. It is important in this respect that any changes to the methodology are assessed on the basis of some fundamental operating principles, with the following the most important ones to be retained :

- **SIMPLICITY** : while many academically more complex suggestions could be put forward for changing the present PF methodology, the simplicity of the approach, where the key inputs and outputs are clearly delineated, is something which should be retained in the future given the possible use of these figures in an operationally sensitive area such as structural budget balance calculations.

- **TRANSPARENCY / EQUAL TREATMENT FOR ALL MEMBER STATES** : This principle is closely linked with the first principle of simplicity, since individual Member States must be happy that any methodology which would be used for policy surveillance purposes is fully transparent and replicable as well as being as judgement free and automated as possible. In addition it must be accepted that any changes to the methodology should only occur following an open and fair consultation process with all of the Member States. Furthermore, adjustments for individual country specificities should be kept to an absolute minimum in any future revisions, with equal treatment for all countries being a principle which should be assiduously respected.

- **PRUDENCE** : One of the guiding principles which was adhered to in drawing up the original and present versions of the PF method was the need to take a "prudent" view regarding changes to the methodology in terms of assessing the past and future evolution of potential growth in the EU. In this regard the cyclicality of the estimates produced is a very serious issue, with the ideal PF method being one which produced a potential growth series which was less cyclical than the commonly used HP filter method, with output gaps growing quickly in the downswing and closing rapidly in the upswing. In this regard while it is accepted that at present the differences in terms of cyclicality between the PF and HP filter methods may be small, nevertheless reducing the cyclicality of the PF estimates to an absolute minimum should be actively striven for in any future changes to the method. This cyclicality issue is particularly important in avoiding the generation of an excessively optimistic picture for potential growth, and by implication structural budget balance positions, in the upswing stage of the cycle. Consequently any future changes to the estimation methodology must be biased towards taking a prudent view.

FUTURE RESEARCH AGENDA : While a lot of work has already been done in this area, it is clear that this is an ongoing research topic, with future research likely to be concentrated on the following themes :

- ongoing experimentation with new methodologies, most notably Kalman Filters, where consideration will be given to their use in areas other than for the NAIRU estimation;

- looking again at the issue of the cyclicality of the overall methodology and experimenting, in this context, with model simulations to estimate the size of any pro-cyclical estimation bias which may exist;

- and finally, a range of other issues will need to be looked at including, use of the capital services versus the perpetual inventory method in evaluating the capital component of potential growth; business sector potential growth versus total economy estimates; and finally, extending and deepening the analysis of "new" economy influences on potential growth developments.

REFERENCES

AGHION, P. AND P. HOWITT (1998), "Endogenous Growth Theory", the MIT Press, Cambridge, Mass.

APEL, M. AND P. JANSSON (1999A), "A Theory-Consistent Approach for Estimating Potential Output and the NAIRU", Economics letters 64.

APEL, M. AND P. JANSSON (1999B), "System Estimates of Potential Output and the NAIRU", Empirical Economics 24.

BARRO, R. AND X. SALA-I-MARTIN (1995), "Economic Growth", McGraw-Hill.

BASSANINI, A., SCARPETTA, S. AND I. VISCO. (2000), "Knowledge, Technology and Economic growth: Recent Evidence from OECD Countries", OECD Working Paper No. 259.

BANCA D'ITALIA (1999), "Indicators of Structural Budget Balances", Research Department, Public Finance Workshop.

BAXTER M. AND R.G. KING (1995), "Measuring business cycles: approximate band-pass filters for economic time series", NBER Working Paper, No. 5022.

BEVERIDGE S. AND C.R. NELSON (1981), "A new approach to the decomposition of economic time series into permanent and transient components with particular attention to measurement of the business cycle", Journal of Monetary Economics, Vol. 7.

BLANCHARD O.J. (1990), "Suggestions for a new set of fiscal indicators", OECD Working Paper, No. 79.

BLANCHARD O.J. AND D. QUAH (1989), "The dynamic effect of aggregate demand and supply disturbances", American Economic Review, No. 79.

BLANCHARD, O. AND L. F. KATZ (1999), "Wage Dynamics : Reconciling Theory and Evidence", American Economic Review 89, pp. 69-74.

BURNSIDE, C., EICHENBAUM, M. AND S. REBELO (1995), "Capital Utilisation and Returns to Scale", in NBER Macroeconomics Annual 1995, Edited by B. Bernanke and J. Rotemberg, MIT Press, pp 67-109.

CANOVA F. (1999), "Does detrending matter for the determination of the reference cycle and the selection of turning points?", The Economic Journal, No. 109.

CECCHETTI, S. (2000), "Early warning signs of the U.S. productivity pickup: Implications for Europe", Mimeo, Ohio State University, August 2000.

CERRA, V. AND S.C. SAXENA (2000), "Alternative Methods of Estimating Potential Output and the Output Gap: An Application to Sweden", IMF Working Paper.

CLAUS, I. (2000), "Is the output gap a useful indicator of inflation", Reserve Bank of New Zealand, Discussion Paper Series.

DAVERI, F. (2000), "Is growth an information technology story in Europe too? *IGIER Working Paper*, September.

DE MASI, P (1997), "IMF Estimates of Potential Output: Theory and Practice", Staff Studies for the World Economic Outlook, December.

DENIS,C., MC MORROW, K. AND W. RÖGER (2002), "Production function approach to calculating potential growth and output gaps – estimates for the EU Member States and the US", *Economic Papers* 176, European Commission (Sept).

DIEBOLD F. X. AND R. S. MARIANO (1995), "Comparing predictive accuracy", *Journal of Business and Economic Statistics*, Vol. 13, 253-263, 3 (July).

DOMAR, E. (1961), "On the measurement of technological change" Economic Journal, Vol. 71, No.284.

EASTERLY, W. AND R. LEVINE (2000), "It's not factor accumulation: Stylized facts and growth models", World Bank, University of Minnesota, Mimeo.

ELMESKOV, J. (1993), "High and persistent unemployment : Assessment of the problems and causes", OECD Economics Department Working Papers, No.132.

EUROPEAN COMMISSION (1995), "Technical note: The Commission services' method for the cyclical adjustment of government budget balances", European Economy, No.60, November.

EUROPEAN COMMISSION (2000), "The EU Economy - 2000 Review"

EUROSTAT (1999), "Volume measures for computers and software", Report of the Task Force, Luxembourg.

FORNI M. AND L. REICHLIN (1998), "Cyclical adjustment of government budget balances: evaluation of alternative trend estimation methods and of the cyclical sensitivity of budgetary components", Internal Study for the DG ECFIN, July.

GERLACH, S. AND F. SMETS (1999), "Output Gaps and Monetary Policy in the EMU area". European Economic Review 43.

GIORNO C., RICHARDSON P., ROSEVEARE D. AND P. VAN DEN NOORD (1995), "Estimating potential output, output gaps and structural budget balances", OECD Working Paper, No. 152.

GIORNO C., RICHARDSON P. AND W. SUYKER (1995), "Technical Progress, Factor Productivity and Macroeconomic Performance in the Medium Term", OECD Working Paper, No. 157.

GORDON, R. J. (1990), "US Inflation, Labor's Share and the Natural Rate of Unemployment", in "Economics of Wage Determination", edited by H. Koenig, Berlin and New York: Springer Verlag, 1-34.

GORDON, R. J. (1997), "The Time-Varying NAIRU and its Implications for Economic Policy", Journal of Economic Perspectives (Winter).

GORDON, R. J. (1999), "Has the New Economy rendered the productivity slowdown obsolete?", mimeo, Northwestern University, April 1999.

GORDON, R. J. (2000), "Does the 'new economy' measure up to great inventions of the past?", NBER working paper, No 7873.

GRANGER AND NEWBOLD (1974). "Spurious regressions in econometrics", *Journal of Econometrics,* vol. 2 (2), 111-120.

GRILICHES, Z. (1994), "Productivity, R&D and the Data Constraint", American Economic Review, Vol. 84.

GRILICHES, Z. (1997), "Education, human capital and growth: a personal perspective", Journal of Labour Economics, Vol.15.

HAMILTON, J. D. AND J. MONTEAGUDO (1998), "The augmented Solow model and the productivity slowdown", Journal of Monetary Economics, Vol. 42, pp. 495-509.

HARVEY, A. C. (1989). "Forecasting, Structural Time Series Models and the Kalman Filter." Cambridge University Press, Cambridge.

HARVEY, A. C. AND A. JAEGER (1993). "Detrending, Stylized Facts and the Business Cycle." Journal of Applied Econometrics 8, pp. 231-47.

HARVEY D., S. LEYBOURNE AND P. NEWBOLD (1997), "Testing the equality of prediction mean squared errors", *International Journal of Forecasting* 13, 281-291.

HODRICK R.J. AND E.C. PRESCOTT (1980), "Post-war U.S. business cycles: an empirical investigation", Carnegie-Mellon University discussion paper, No 451.

HULTEN, C. (2000). "Total Factor Productivity :A Short Biography", NBER Working Paper, No. 7471.

IM, PESARAN AND SHIN (1997), "Testing for unit roots in heterogeneous panels", *mimeo*, University of Cambridge.

IMF (1993), "Structural Budget Indicators for the major industrial countries", World Economic Outlook, October.

JORGENSEN, D.W. AND K. STIROH (1995), "Computers and growth", Economics of Innovation and New Technology, Vol. 3, No 3-4, pp. 295-316.

JORGENSEN, D.W. AND K. STIROH (2000a), "Raising the Speed Limit: U.S. economic growth in the Information Age", Brooking Papers on Economic Activity, pp. 125-235.

JORGENSEN, D.W. AND K. STIROH (2000b), "U.S. economic growth at the industry level", American Economic Review, Vol. 90, No 2.

KING R.G. AND S.T. REBELO (1993), "Low frequency filtering and real business cycles", Journal of Economic Dynamics and Control.

KUO AND MIKKOLA (2001), "How sure are we about purchasing power parity? Panel evidence with the null of stationary real exchange rates", *Journal of Money, Credit and Banking* 33-3, 767.

KYDLAND F.E. AND E.C. PRESCOTT (1989), "A Fortran subroutine for efficiently computing Hodrick-Prescott-filtered time series", Federal Reserve Bank of Minneapolis, research memorandum.

KRUSELL, P., OHANIAN, L.E, RIOS-BULL, J-V. AND G. VIOLANTE (2000), 'Capital skill complimentarity and inequality: A macroeconomic analysis', Econometrica*,* Vol. 68, No.5.

KUTTNER, K. N. (1994). "Estimating Potential Output as a Latent Variable." Journal of Business & Economic Statistics 12, pp. 361-68.

LEVIN AND LIN (1992), "Unit root tests in panel data: Asymptotic and finite-sample properties", *mimeo*, University of California, San Diego.

MADDALA AND IM (1998), "*Unit roots, cointegration and structural changes"*, Cambridge University Press.

MANKIW, N. G., ROMER, D. AND D. N. WEIL (1992), "A contribution to the empirics of economic growth", Quarterly Journal of Economics, Vol. 107, pp. 407-437.

MARAVALL, A. (1996). "Unobserved Components in Economic Time Series." Banca de Espana, Working Paper No. 9609.

MC MORROW, K. AND W. ROEGER (2000), "Time-Varying NAIRU / NAWRU Estimates for the EU's Member States " ECFIN Economic Paper No. 145.

MC MORROW, K. AND W. ROEGER (2001), "Potential Output : Measurement Methods, "New" Economy Influences and Scenarios for 2001-2010 – A Comparison of the EU15 and the US" ECFIN Economic Paper No. 150.

NELSON, C. AND C.I. PLOSSER (1982), "Trends and random walks in macroeconomic series", Journal of Monetary Economics, No.10.

NORDHAUS, W. (2001), "Alternative Methods for measuring productivity growth", NBER Working Paper No. 8095.

NORDHAUS, W. (2001), "Productivity Growth and the New Economy", NBER Working Paper No. 8096.

OECD (2000), "The Concept, Policy Use and Measurement of Structural Unemployment. Annex 2. Estimating Time varying NAIRU Across 21 OECD Countries", Paris.

OECD (2000), "A new economy ? The role of innovation and information technology in recent OECD economic growth", OECD, Paris.

OLINER, S.D. AND D.E. SICHEL (1994), "Computers and output growth revisited: how big is the puzzle?", Brookings Papers on Economic Activity, Vol. 2, pp. 273-317.

OLINER, S.D. AND D.E. SICHEL (2000), "The resurgence of growth in the late 1990's: is information technology the story?", US Federal Reserve Board.

ONGENA H. AND W. RÖGER (1997), "Les estimations de l'écart de production de la Commission européenne", Economie Internationale, No. 69.

ORLANDI, F. AND W. RÖGER (1999), "The unobserved Components Method for Calculating Output Gaps", Technical Note for the EPC Working Group on Output Gaps, DG ECFIN, mimeo.

ORLANDI, F. AND K. PICHELMANN (2000), "Disentangling Trend and Cycle in the EUR11 Unemployment Series - An unobserved Component Modelling Approach", ECFIN Economic Paper No. 140.

PEDRONI (1999), "Critical values for cointegration tests in heterogeneous panels with multiple regressors", *Oxford Bulletin of Economics and Statistics*, special issue 653-670.

PEDRONI (2004). "Panel cointegration: asymptotic and finite sample properties of pooled time series tests with an application to the PPP hypothesis", *Econometric Theory* 20, 597-625.

PERRON P. (1989), "The big crash, the oil shock and the unit root hypothesis", *Econometrica*.

PERRON P. (1997), "Further Evidence on breaking trend functions in macroeconomic variables", Journal of Econometrics, No. 80.

PESARAN AND TIMMERMANN (2004), "Real Time Econometrics ", *CEPR discussion paper* 4402.

PHILLIPS (1986), "Understanding spurious regressions in econometrics", *Journal of Econometrics*, vol. 33(3), 311-40.

PISSARIDES, C. A. (1998), "The Impact of Unemployment Cuts on Employment and Wages: The Role of Unemployment Benefits and Tax Structure", European Economic Review 42, 155-84.

PRESCOTT E.C. (1986), "Theory ahead of Business-Cycle measurement", Carnegie-Rochester Conference on Public Policy, No. 25.

RÖGER W. (1994). "Total Factor Productivity in West German Manufacturing: Is there Investment Induced Technical Progress?", Allgemeines Statistisches Archiv, 78, pp. 251-61.

RÖGER, W (2001), "The Contribution of Information and Communication Technologies to Growth in Europe and the US: A Macroeconomic Analysis", DG ECFIN Economic Papers, No 147.

RÖGER W. AND J. IN 'T VELD (1997), "Quest II - A multi country business cycle and growth model", DG ECFIN, Economic Papers, No 123.

ROMER, P. (1986), "Increasing returns and long-run growth", Journal of Political Economy, Vol. 94, pp. 1002-1037.

SCHREYER, P. (2000), "The contribution of information and communication technology to output growth. A study on the G7 countries", OECD STI Working Papers No. 2000/2.

SCOTT, A. (2000), "Stylised facts from output gap measures", Reserve Bank of New Zealand, Discussion Paper Series.

SOLOW, R. (1956), "A contribution to the theory of economic growth", Quarterly Journal of Economics, Vol. 70, No 1, pp. 65-94.

STIROH, K. (1999), "Is there a new economy?", Challenge, July/August, pp. 82-101.

STIROH, K. (2000), "What drives productivity growth?", Mimeo, Federal Reserve Bank of New York, July 2000.

TEMPLE, J. (2000), "Summary of an Informal Workshop on the Causes of Economic Growth", OECD Working Paper, No. 260.

TRIPLETT, J. E. (1999), "Economic statistics, the new economy and the productivity slowdown" forthcoming in Business Economics.

TURNER, D., RICHARDSON, P. AND S. RAUFFET (1996), "Modelling the Supply side of the seven major OECD economies", OECD Working Paper, No. 167.

UK TREASURY (1996), "How fast can the economy grow ? A special report on the output gap", Panel of Independent Forecasters, June.

VAN ARK, B. (2000), "Measuring Productivity in the "New Economy: Towards a European Perspective", De Economist, No 1.

VAN DER WIEL, H. (2000), "Is ICT important for growth", CPB report, No 2.

WEISS, A (1995), "Human Capital vs. Signalling Explanations of Wages", Journal of Economic Perspectives, Vol. 9, No 4.

WHELAN, KARL (2000), "Computers, Obsolescence, and Productivity", Federal Reserve Board Finance and Economics Discussion Paper, No. 2000-6.

WOLFF E.N. (1996), "The Productivity Slowdown: The Culprit at Last?", American Economic Review, 86, pp. 1239-55

LIST OF ANNEXES

Note : All figures presented in annexes 5 and 6 are based on data available in early November 2005 in DG ECFIN's AMECO databank and using the Commission services final Autumn 2005 forecasts.

ANNEX 1 : KALMAN FILTER BASED NAIRU ESTIMATION METHOD

This annex discusses various issues related to the NAIRU. First of all, it provides a description of the theoretical framework underlying the NAIRU estimates. It starts from a standard model of the labour market with explicitly formulated wage and labour demand equations. In particular it is shown how the Phillips curve, which links the change of wage inflation to the unemployment gap, is shifted by observed and unobserved shocks to the wage rule and the labour demand equation. Within this context the concept of structural unemployment or NAIRU can be discussed more clearly. This derivation also allows one to provide an economic interpretation for differences between the Euro Area and US labour markets.

1. The Labour Market Model

Following standard textbooks, there are broadly four different hypotheses trying to describe the labour market: the neoclassical view, the efficiency wage approach, the wage bargaining theory and the search model. A generic wage rule covering all four hypothesis can be formulated as follows.

$$w_t - p_t^e = a_0 + (1-\mu)b_t^e + \mu pr_t^e - \beta u_t + a_t^w \qquad (1)$$

Workers/trade unions negotiate a nominal wage w_t at time t conditional on the price expectation p_t^e, on the expected level of the reservation wage b_t, on expected productivity $pr_t = y_t - l_t$ [10] and on the unemployment rate u_t. The term a_t^w is a shock to the wage-setting rule that can be autocorrelated. As shown by Pissarides (1999), the four macroeconomic theories imply certain restrictions on the parameter values of equation (1) : both the neoclassical and the efficiency wage models imply $\mu = 0$, i.e. wages are not directly linked to productivity. The wage bargaining and the search model allow instead for productivity to play a role. Within this latter class of models, the magnitude of productivity indexation depends crucially on the bargaining strength of workers. In an atomistic labour market without any market power for workers such as in the neoclassical model, wages would be equal to the reservation wage. By contrast, in a highly unionised labour market, μ would approach unity.

Theories also differ in the specification of the reservation wage. In the neoclassical model the reservation wage would be the value of leisure, a concept derived from a utility function for workers which is defined in terms of consumption and leisure. Consequently, in the neoclassical model, consumption and leisure time would be the arguments of b_t. While the value of leisure could also play a role under the other hypotheses, these generally stress a non-market wage as an alternative. The non-market wage could be for instance unemployment benefits, the value of home production or the income earned in the shadow economy.

Another important element is the concept of productivity entering the wage equation, namely either average labour productivity or "marginal productivity[11]". Under the neoclassical model, the search and efficiency wage hypothesis, the relevant concept seems to be "marginal

[10] The notion of productivity entering the wage equation will be discussed in more detail later.

[11] Marginal productivity and the demand wage for labour are used interchangeably. The term marginal productivity is not entirely correct. Marginal productivity corrected for the mark-up of prices over marginal cost would be the correct expression.

productivity” while in bargaining models an average productivity concept applies. As will be shown below in situations where average and marginal productivity diverge, the two productivity concepts have implications for the structural unemployment rate and also for the short run adjustment of wages. This wage rule as expressed in eq (1) is very similar to the rule formulated by Blanchard and Katz (1999). Here two generalisations are introduced, first it is assumed that expectations not only have to be formulated about prices but also about the reservation wage and productivity and we allow for slightly more general expectation formation schemes. The second generalisation concerns the concept of productivity which enters the wage rule. We will explicitly distinguish between the average and marginal product of labour.

In order to close the model, labour demand must be specified. It is assumed that firms set labour demand at its profit maximising level by equating the marginal revenue product of labour to the real wage. The resulting first order condition of the optimisation problem is given by equation (2).

$$w_t - p_t = (y_t - l_t) + x_t \tag{2}$$

It can be interpreted in two directions. Starting from the right hand side, eq. (2) determines the “demand wage for labour”, which is the wage the firm is willing to pay for a given level of marginal productivity. Alternatively, for given real wages it determines the marginal product of labour the firm is aiming for. Notice, marginal and average productivity are not always proportional. The term x can drive a wedge between marginal and average productivity. One can think of the variable x as a shock to a (long run) labour demand equation (as implied by the underlying Cobb Douglas PF) by simply rewriting (2) as

$$l_t = y_t - (w_t - p_t) + x_t \ . \tag{2'}$$

The variable x can itself be a function of various factors and it is useful to distinguish between a structural (x*) and a cyclical/transitory component (ρ)

$$x_t = x_t^* + \rho_t \, . \tag{3}$$

After having determined the demand wage of firms one can ask the question what is the productivity concept used by workers in their wage schedule. In particular, do they take into account shocks to labour demand, when setting wages ? We are not imposing an a priori restriction about the concept of productivity used by workers in setting wages and define the concept of productivity entering the wage rule as

$$pr_t = (y_t - l_t) + \psi x_t, \quad 0 \le \psi \le 1 \, . \tag{4}$$

We also express the reservation wage as a fraction of a combination of productivity and x,

$$b_t = b_t^0 + (y_t - l_t) + \psi x_t \tag{5}$$

where b_t^0 is the logarithm of the replacement rate. Notice that as b_t^0 is allowed to vary over time, equation (5) is not restricting the dynamics of the reservation wage.

Adjustment of wages to inflation and productivity *:* Adjustment of wages to economic conditions can be delayed because of limited information in the formation of expectations or because of institutional rigidities (e.g. a fixed contract length). With the annual data used here we try to capture two extremes. Either instantaneous adjustment of wages to both inflation and productivity, i.e. adjustment within the same period (one year) or completely backward looking behaviour where wages only respond with a lag of one year. Such an extreme case could occur for example if wage contracts were negotiated at the beginning of each year with a duration of one year and where workers/trade unions would simply extrapolate inflation or productivity trends from the previous year. Any parameter setting between these two extremes is of course possible and is determined by the coefficients a and c in the following expectation formulas

$$\pi_t^e = a\pi_t + (1-a)\pi_{t-1} \tag{6a}$$

$$\Delta pr_t^e = c\Delta pr_t + (1-c)\Delta pr_{t-1}\,. \tag{7a}$$

The degree of nominal rigidity is proportional to (1-a) while the degree of real rigidity is proportional to (1-c). However, for some countries the unemployment gap appears in the Phillips curve as a quasi difference. This cannot be generated with the moving average scheme, therefore we also allow for adaptive expectations schemes of the following form

$$\pi_t^e = a\pi_{t-1} + (1-a)\pi_{t-1}^e \tag{6b}$$

$$\Delta pr_t^e = c\Delta pr_{t-1} + (1-c)\Delta pr_{t-1}^e\,. \tag{7b}$$

We also allow for combinations between (6,7a) and (6,7b) in the regressions. Equations (1) to (7) determine the structural unemployment rate which is defined as the level of unemployment when there are no expectation errors, i.e. $p_t^e = p_t$, $pr_t^e = pr_t$ and where the wage share is equal to its long run level, i.e. $x_t = x_t^*$. Under these conditions, the equilibrium unemployment rate is given by

$$u_t^* = [a_0 + (1-\mu)b_t^0 + (\psi - 1)x_t^*]/\beta \tag{8}$$

Equation (8) shows that the equilibrium level of unemployment depends positively on the reservation wage (which itself is a function of labour taxation, unemployment replacement rate etc.), and negatively on the trend value of the labour demand shock, if workers do not completely take into account x*. This sounds intuitively plausible. Imagine, for example, an increase in the average training costs for workers. This obviously is a cost component for firms related to individual workers. In determining labour input, the firm must take these costs into account. If wages do not respond to an increase in training costs then effective labour costs increase and firms respond with a decline in labour demand. If the increase in training costs is permanent then the equilibrium level of unemployment will be higher. If training costs are borne by workers in the form of lower wages ($\psi = 1$), equilibrium unemployment will not be affected.

A relationship between the change in nominal wage inflation and the unemployment gap can be derived, with shocks to labour productivity, labour demand and the terms of trade as additional explanatory variables.

$$\Delta^2 w_t = \phi^{pr} \Delta^2 (y_t - l_t) + \phi^{ws} \Delta^2 ws_t + \phi^{tot} \Delta^2 tot_t - \beta(u_t - nairu_t) + v_t^w \qquad (9)$$

and the reduced form coefficients of the Phillips curve linked to the structural coefficients as follows

$$\phi^{pr} = \frac{(c-a)}{(1-a)}$$

$$\phi^{ws} = \frac{(c-a) + (\psi - 1)(c-1)}{(1-a)}$$

$$\phi^{tot} \geq 0 .$$

The error term v_t^w is a function of a_t^w, ρ_{t-i} and Δx_{t-1}^*.

The Phillips curve shows the short run response of nominal wages to labour productivity, labour demand shocks and the unemployment gap. The response to the unemployment gap is intuitively plausible. Whenever unemployment is above the NAIRU, nominal wage growth will decelerate and vice versa. However, this link is not perfect but is disturbed by observed and unobserved shocks to the wage rule and the labour demand equation. How nominal wage growth responds to productivity and labour demand shocks (here approximated by changes in the growth rate of the wage share) depends on a variety of factors.

Short run nominal wage response to productivity shocks *:* Nominal wages respond to a shock in productivity via two channels, a productivity channel and an inflation channel. The strength of the response depends on how strongly inflation and productivity expectations respond to the productivity shock within the first year. Everything else equal, wages respond positively to productivity (with an elasticity of c) but they respond negatively to the extent that productivity affects inflation (with an elasticity equal to –a). Whether the response is positive or negative actually depends on the relative magnitude of c and a.

Short run response of nominal wages to changes in labour demand shocks : A similar consideration applies to labour demand shocks. The wage rule implies that wages respond positively to labour demand shocks (to the extent they are taken into account by workers (namely by the size of ψ)). The difference compared to the productivity response comes from the parameter ψ. If wages only respond to productivity but not to the demand wage for labour ($\psi = 0$) then there will be no positive transmission of a labour demand shock. Turning to the other extreme case, with wages responding fully to the labour demand shock, then the elasticity of wages w. r. t. labour demand shocks will be equal to the productivity response of wages. However, in general, the magnitude of the positive response of wages to labour demand shocks will be smaller compared to labour productivity shocks. Also notice from the inflation rule that labour demand shocks have a negative effect on inflation. Therefore to the extent wages respond to current inflation (negatively) they also respond negatively to labour demand shocks via the inflation channel.

Short run response of nominal wages to terms of trade (TOT) shocks : The theoretical derivation of the wage equation was done in a closed economy context. Obviously open economy aspects are likely to play a role in wage setting, especially if there is a divergence between domestic and import prices and if wages are linked to the consumer price deflator. To the extent that these conditions are fulfilled one would also expect that nominal wages respond positively to the wedge between consumer price and GDP inflation. In order to capture this open economy aspect, a TOT variable is added to the Phillips curve.

2. Comparing the Euro Area and US Phillips Curves

The Phillips curve estimates (Table 1) appear fairly similar for the Euro Area and the US, both in terms of the absolute size of the parameter estimates as well as the statistical fit. The response of nominal wages to the unemployment gap is practically identical. Also labour productivity has a quantitatively similar effect on wages. This result suggests that there is a positive short run response of nominal wages to labour productivity growth. The elasticity within a year is about 0.8 in both regions. This suggests that the productivity response by far exceeds the inflation response. This seems plausible. First of all, central banks tend to accommodate productivity shocks and keep inflation stable. Therefore productivity shocks can lead to higher real wage growth via nominal wage growth. Notice also, we are looking at wages per employee and changes in hours are consequently translated directly into changes in wages. Also to the extent that workers receive piece rate wages, the translation of productivity to changes in wages is direct. Finally, to the extent that wages are negotiated at the sectoral or even the firm level, information about local productivity might be more easily available than information about aggregate inflation.

Interestingly there is a difference in the response of wages to the wage share. US wages respond more to the demand wage for labour, while European wages tend to adjust more strongly to average productivity growth. This could reflect differences in labour market institutions and points to a difference in the response of wages to cyclical versus structural shocks. The US aggregate wage response seems typical of a decentralised labour market, while the European wage response seems more typical of a centralised labour market. Suppose shocks to labour demand result from sectoral shifts, with an increase in production in a low productivity sector (e.g. services). At the aggregate level this can be represented as a decline in the demand wage for labour. However, employment can be sustained if real wages in the low productivity sector declines. If the labour market would ignore the negative demand (productivity shock) then the low productivity sector would not expand. Thus the Phillips curve estimates suggest that the EU and US labour markets respond fairly similarly to typical business cycle movements but they tend to respond differently to structural shocks. There is other micro and macro evidence from the empirical literature which suggests that the response of wages and prices to the business cycle is similar. In particular some recent micro studies suggest that the degree of nominal rigidity (e.g. measured by the duration of price changes by firms as well as the duration of wage contracts) is similar across the two regions.

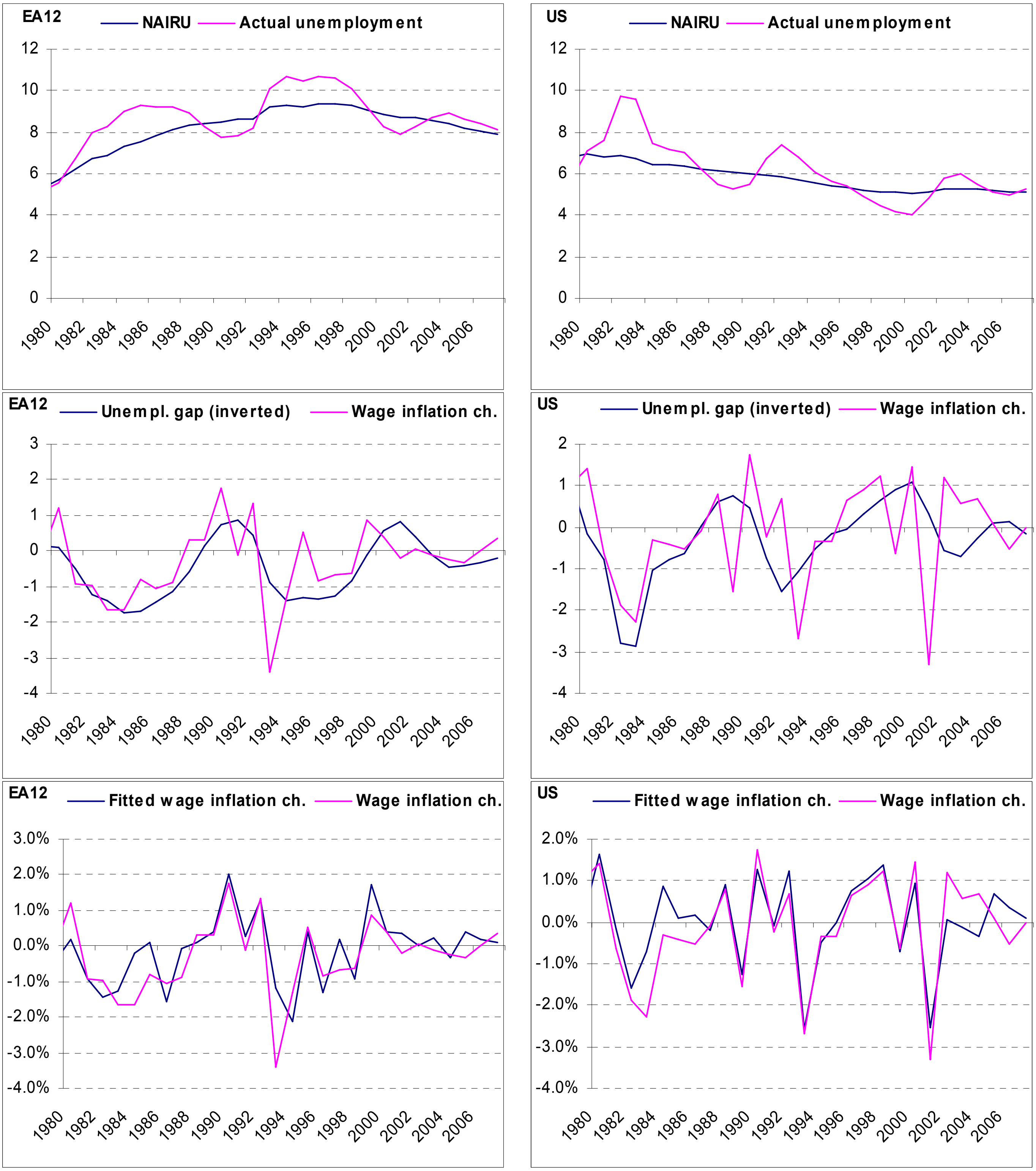
In terms of statistical criteria, the unemployment gap together with the observed shock variables, as suggested by the theoretical model, explain about 50% of the observed fluctuations in the first difference of wage inflation in the case of the EU and about 70% in the case of the US. A more intuitive way to look at the empirical fit is to compare fluctuations in the (inverse of the) unemployment gap with fluctuations in wage indicators. The Phillips curve predicts that episodes in which the NAIRU is above the actual unemployment rate should be associated with an acceleration in wage inflation (see graph 1). The following table provides correlations between the unemployment gap as identified by our methodology and three alternative wage concepts, firstly nominal wages, secondly unit labour costs and thirdly unit labour costs adjusted for changes in the wage share. All three concepts of wage inflation show correlations with the (inverse) of the unemployment gap of a similar magnitude for the two regions.

Table 1 : Correlation between unemployment gap and wage indicators

	Euro Area	**US**
Δ^2 (Wage)	0.54	0.42
Δ^2 (ULC)	0.50	0.58
Δ^2 (ULC-Wage Share)	0.65	0.67

The following graph provides information about the evolution of the NAIRU in the euro area and the US as well as the fit of the Phillips curve. The two graphs on the top show the NAIRU for the Euro Area and the US as estimated with our model. Euro Area structural unemployment has peaked in the mid 1990s in the EU and is slightly declining since. In contrast, the US NAIRU has been on a steady decline since the early 1980s and is stabilising at a level of about 5 ½% since 2000. The two graphs in the middle show how the (inverse) of the unemployment gap is correlated with the change in wage inflation. While there is a relationship, the Phillips curve specification suggests that there are other factors influencing the change in wage inflation. This is shown by the two graphs at the bottom which indicate the fit of the Phillips curve.

Graph 1 : Euro Area (EA12) and US NAWRU estimations



ANNEX 2 : DESCRIPTION OF THE NAIRU ESTIMATION METHOD USED FOR THE NEW MEMBER STATES

For calculating the NAIRU for the new Member States, a methodology proposed by the OECD is used (i.e. the "Elmeskov" method[12]). A simple model of the labour market predicts that expected real wages will rise whenever the unemployment rate is below the NAIRU and vice versa.

$$\Delta w_t - \pi_t^e = -\beta(u_t - nairu) + u_t^w \tag{1a}$$

Assuming static inflation expectations

$$\pi_t^e = \pi_{t-1} = \Delta w_{t-1} \tag{2}$$

gives the following Phillips curve relationship

$$\Delta^2 w_t = -\beta(u_t - nairu) + u_t^w \tag{1b}$$

This is the most simple formulation of the Phillips curve which ignores all other possible influences on wage setting such as productivity, for example. Allowing for productivity shocks may be important for at least two reasons. Firstly, the new Member States show relatively high growth rates of productivity, thus productivity growth may be an important factor for wage growth. Secondly, for the EU15 member states we control for productivity shocks as well. The following paragraphs therefore present a simple extension of the framework presented above.

The wage rule (following the specification that we use for the EU15 member states) is given by

$$w_t - p_t^e = (y_t - l_t) - \beta(u_t - nairu) + u_t^w \tag{3a}$$

This can be rewritten as

$$\Delta w_t - \pi_t^e = (y_t - l_t) - (w_{t-1} - p_{t-1}) - \beta(u_t - nairu) + u_t^w \tag{3b}$$

Labour demand can be formulated as follows

$$w_t - p_t = (y_t - l_t) + u_t^l \tag{4}$$

With static inflation expectations we obtain

$$\pi_t^e = \pi_{t-1} = \Delta w_{t-1} - (\Delta y_{t-1} - \Delta l_{t-1}).$$

Using this expectation rule together with the labour demand schedule one can reformulate the wage equation as follows

[12] J. Elmeskov (1993)

$$\Delta^2 w_t = (\Delta^2 y_t - \Delta^2 l_t) - \beta(u_t - nairu) + u_t^w - u_{t-1}^l \qquad (3c)$$

or

$$\Delta^2 ulc = \Delta^2 w_t - (\Delta^2 y_t - \Delta^2 l_t) = -\beta(u_t - nairu) + u_t^w - u_{t-1}^l \qquad (3d)$$

This formulation indicates that unemployment is below the NAIRU whenever the growth rate of unit labour costs increases.

Given these alternative expressions (1b) and (3d), the calculation of the NAIRU proceeds in the following steps.

STEP 1 : Assuming the NAIRU to be constant and further assuming that the shocks have a mean of zero one can calculate β by taking a first derivative (in discrete time) of eq. (1b) and (3d) with respect to the unemployment rate

$$\beta_{ULC} = -\frac{\Delta^3 ulc}{\Delta lur} \quad \text{and} \quad \beta_W = -\frac{\Delta^3 w}{\Delta lur} \qquad (4)$$

STEP 2 : With these estimates we can solve eq. (1b) and (3d) for the NAIRU (plus shock)

$$nairu_t - u_t = lur_t + \frac{\Delta^2 w_t}{\beta_w} \quad \text{or} \quad nairu_t - u_t = lur_t + \frac{\Delta^2 ulc_t}{\beta_{ULC}} \qquad (5)$$

STEP 3 : Now one can use the right hand sides of eq. (5) to calculate the NAIRU by noticing that the right hand side is equal to the NAIRU and the shocks to the wage setting and labour demand equations. These shocks are eliminated by applying a filter to the right hand side. Notice, this procedure becomes arbitrarily close to applying a filter to the unemployment rate directly for large enough β .

ANNEX 3 : REASSESSING THE END POINT BIAS PROBLEM FOR OUTPUT GAP CALCULATIONS (USE OF THE HP FILTER TO CALCULATE TFP)

Since trend total factor productivity (TFP) is still calculated with the HP filter, there remains an end point bias problem with the production function (PF) method. This was pointed out by a number of representatives of the EPC's output gaps working group, with a suggestion being made to look more closely at an alternative approach which is used by the CPB in the Netherlands for their assessment of potential growth[13]. This annex takes up the end point bias issue as related to the calculation of the TFP trend and compares the "ECFIN" version of the method with the approach followed by the CPB. We proceed in two steps. Firstly, we analyse the bias problem by looking at the sensitivity of the TFP trend estimates with respect to different data projection periods. Secondly, we present the method used by the CPB and apply it to the EU15 Member States and compare the results to our baseline projections.

1. SENSITIVITY OF HP-TREND TO FORECAST HORIZONS

The HP Filter is symmetric. This poses a problem at the end points of the sample since the filter must be constructed in such a way that the filter weights become asymmetric at the end points. Baxter and King (1995) show that, close to the end points - especially the last 3 to 4 observations -, the Hodrick-Prescott filter not only eliminates the low frequency cycles it is supposed to eliminate, i.e. cycles with a length of more than 16 years in the case of a smoothing parameter equal to 100, but also has a tendency to dampen the influence of cycles with higher frequencies. This will affect cyclical components with a period larger than 4 years. Only cycles with shorter periods will be fully passed. This implies that the Hodrick-Prescott filter produces a series for the output gap which underestimates the length of the cycle close to the end point, if no corrective measures are taken.

Since this phenomenon especially occurs for the last 3 or 4 observations, one possibility to correct for this bias is to extend the data set by adding GDP forecasts over a range of 3 to 5 years. Of course extending the sample does not come without cost. Inaccurate projections can themselves inflict a bias. Since the HP filter is applied to calculate a trend for a medium term projection which is already 5 years beyond the last observation, adding another 4 to 5 years requires a projection for a whole decade. In order to find a compromise between the end point bias problem and a trend projection error, the "ECFIN" method projected the relevant variables for an additional 3 years beyond the medium term. This means that in order to calculate medium term projections, for example until 2007, TFP is projected until 2010. In a first exercise we therefore look how the trend estimates are affected if we extend the forecast horizon to 2013 in order to comply fully with the recommendations provided by the theoretical literature.

As shown in the Table *(comparison between "ECFIN" and "ECFIN ext."),* the sensitivity is moderate, three among the 15 countries show a difference in potential growth above 0.2% points in 2007. These countries are Greece, Italy and Luxembourg. One country, namely Spain shows a difference of greater than 0.1% point in 2007. There is practically no difference for the remaining 10 countries. Following the theoretical suggestion and extending the projection by another 3 years seems plausible. However, as will be shown in the next section other approaches can give different medium term growth paths for TFP. With very long run projection horizons, the medium term forecast may be biased more strongly if indeed the

[13] CPB Memorandum 51.

alternative method is correct. We will return to this point after presenting the CPB method and results.

2. THE CPB METHOD

The CPB uses an alternative approach for avoiding the end point bias problem. The CPB method exploits a property of moving average processes, namely that the trend becomes constant at a finite time. The CPB assumes that the growth rate of TFP follows a stochastic trend and that the second difference of TFP can be approximated by an MA process i.e. the following model is estimated

$$(1) \qquad \Delta tfp_t = \Delta tfp_{t-1} + \varepsilon_t + a_1\varepsilon_{t-1} + a_2\varepsilon_{t-2}$$

Now notice that the projection for period t+j, conditional on information in period t ($P_t(\Delta tfp_{t+j})$) is equal to

$$(2) \qquad P_t(\Delta tfp_{t+j}) = \Delta tfp_t + (a_1 + a_2)\varepsilon_t + a_2\varepsilon_{t-1} \qquad \text{for } j \geq 2 .$$

The MA process implies that the projection of TFP growth becomes constant after two periods. The constant defined by the right hand side of equation (2) constitutes the end point for trend TFP. This end point is connected to the HP trend which is calculated for the historical TFP series only. The historic trend is obtained by calculating an HP trend over the historic sample and discarding the last two years. The gap is filled by interpolating between the HP trend and the MA endpoint.

In this case the growth differences to the "ECFIN vintage" of the method are substantially larger *(comparison between "ECFIN" and CPB in Table)*. Ordering countries according to the growth differential obtained by the two alternative methods yields the following result. With the CPB method Greek growth in 2007 is estimated to be 1 % higher while Portuguese growth is estimated to be 0.6% points lower than growth projected by the "ECFIN" version. In the case of Spain the difference is 0.6% points. Germany, Luxembourg and Finland show differences of 0.3% points, Italy, Netherlands and the UK 0.2% and for Austria, France, Belgium, Denmark and Sweden a growth differential of 0.1% point is projected. The only country for which both methods do not give a different result is Ireland.

In interpreting these differences one has to keep in mind that the two approaches differ in two dimensions. Apart from a different treatment of the end point problem, the underlying time series representations of TFP differ. The "ECFIN" version uses a deterministic trend model, while the CPB uses a stochastic trend specification.

With the "ECFIN" method, the medium term projection reverts to the (average) trend estimated over the period 1975 to 2004, while the CPB trend is more heavily influenced by recent growth rates.

These features generate different trend forecasts, depending on the historic evolution of TFP growth. The following pattern can be observed. Those countries which had a relatively weak TFP growth in the 1990s, the "ECFIN" method projects a recovery over the medium term

(Germany, France, Italy, the Netherlands, Portugal, UK), i.e. a return of growth to the deterministic trend and therefore predicts a higher trend growth than the CPB method, while for countries which showed a rising trend for the 1990s (Belgium, Denmark, Greece, Austria, Finland, Sweden), the "ECFIN" trend reverts back to the historic average. For these countries, the CPB trend which gives more weight to the more recent evolution tends to lie above the "ECFIN" trend. Spain, which showed a declining trend in the 1980s and 1990s is a special case. Here a negative deterministic trend is estimated over the sample and is projected forward. The MA method extrapolates forward the recovery of TFP which is projected in the forecast.

This observation suggests that there is both an 'end point problem' and a 'choice of methods problem'. The method chosen (deterministic vs. stochastic trend) for representing the TFP series may actually be more important as an explanation of the difference in growth rates at the end of the projection than the treatment of the end point problem itself. In order to shed some light on this issue we have also applied the HP filter trend extraction method to the stochastic trend model. If the choice of model is important for the results then we would expect a far smaller difference when comparing two different treatments of the end point problem. We find *(comparison between CPB and CPB HP in the Table)* that in general the differences are in fact much smaller. For 7 countries (Belgium, Denmark, France, Austria, Finland, Sweden, UK) there is no difference. 2 countries (DE, NL) show a difference of 0.1% point. In 4 countries (Greece, Spain, Ireland, Portugal) the deviation is 0.2% points and for Italy the deviation is 0.3% points[14].

After having established that differences in medium term growth rates are partly model related, one can ask the question whether the adoption of a longer projection period would actually accentuate differences between various alternatives. It is in fact interesting to observe that the differences between the "ECFIN" method and the CPB approach increases with the longer projection period (*comparison between "ECFIN ext." and CPB*). Differences are larger for 5 countries (Germany, Greece, Spain, Italy, Luxembourg). This could be explained by the fact that a longer extension pulls the HP trend even more strongly to the long term trend (and away from the actual realisation of the data). This reveals a dilemma pointed out above : if the deterministic trend model is correct then a longer extrapolation period seems to be preferred. If, however, the deterministic trend model is not correct, then the error inflicted by a longer extrapolation could become even stronger.

3. TENTATIVE CONCLUSIONS

This annex has analysed the sensitivity of the trend growth rate with respect to the choice of the end point. It has also looked at an alternative method which is based on a stochastic trend and which avoids the end point bias problem. The alternative method is, however, likely to be more sensitive to erratic movements at the end of the sample. This comparison shows that the model choice (stochastic versus deterministic trend) is important for the medium term trend. This result also draws attention to the fact that extrapolations are model dependent. A trade-off may therefore exist between lowering the endpoint bias on the one hand and accentuating the trend forecast error.

[14] There is one exception, namely Luxembourg, where the deviation is 1.5% points. We largely attribute this to a data problem.

Table: Potential Growth, according to the method used for TFP projection

Country	TFP method	2000	2001	2002	2003	2004	2005	2006	2007
Belgium	ECFIN	2.49	1.93	1.77	1.75	1.83	1.81	1.95	1.88
	ECFIN ext.	2.49	1.93	1.77	1.75	1.83	1.81	1.94	1.88
	CPB ori.	2.51	1.96	1.81	1.80	1.89	1.87	2.01	1.94
	CPB HP	2.51	1.95	1.80	1.77	1.87	1.85	1.99	1.92
Denmark	ECFIN	2.38	2.20	2.05	1.95	2.04	2.01	1.94	1.85
	ECFIN ext.	2.38	2.20	2.05	1.95	2.03	2.00	1.93	1.84
	CPB	2.43	2.27	2.15	2.05	2.13	2.09	2.00	1.92
	CPB HP	2.39	2.21	2.07	1.97	2.06	2.04	1.98	1.89
Germany	ECFIN	1.47	1.33	1.44	1.41	1.59	1.43	1.54	1.83
	ECFIN ext.	1.47	1.34	1.44	1.42	1.60	1.45	1.56	1.87
	CPB	1.35	1.15	1.18	1.15	1.32	1.15	1.27	1.51
	CPB HP	1.40	1.22	1.29	1.21	1.33	1.12	1.18	1.44
Greece	ECFIN	3.53	3.16	3.37	3.33	3.25	2.99	3.00	3.00
	ECFIN ext.	3.54	3.15	3.34	3.25	3.12	2.79	2.71	2.61
	CPB	3.68	3.40	3.72	3.78	3.85	3.75	3.92	4.04
	CPB HP	3.73	3.47	3.82	3.93	4.02	3.93	4.09	4.22
Spain	ECFIN	3.19	3.11	2.76	2.68	2.65	2.12	1.93	1.79
	ECFIN ext.	3.20	3.11	2.75	2.65	2.61	2.05	1.83	1.65
	CPB	3.21	3.14	2.81	2.84	2.93	2.53	2.47	2.36
	CPB HP	3.26	3.22	2.91	2.88	2.91	2.44	2.32	2.22
France	ECFIN	2.59	2.50	2.31	2.14	2.29	2.33	2.35	2.26
	ECFIN ext.	2.59	2.50	2.31	2.15	2.31	2.35	2.38	2.30
	CPB	2.54	2.42	2.20	2.04	2.19	2.22	2.24	2.12
	CPB HP	2.56	2.44	2.23	2.04	2.17	2.18	2.17	2.06
Ireland	ECFIN	8.30	7.96	7.55	6.89	6.63	5.98	5.68	5.47
	ECFIN ext.	8.30	7.96	7.55	6.90	6.65	6.00	5.71	5.51
	CPB	8.42	8.13	7.77	7.09	6.79	6.06	5.67	5.47
	CPB HP	8.28	7.93	7.50	6.83	6.55	5.88	5.57	5.34
Italy	ECFIN	2.06	2.13	1.87	1.64	1.83	1.63	1.69	1.71
	ECFIN ext.	2.06	2.14	1.88	1.67	1.89	1.72	1.81	1.87
	CPB	2.02	2.06	1.76	1.56	1.76	1.53	1.57	1.54
	CPB HP	1.98	2.01	1.68	1.40	1.53	1.27	1.27	1.24
Luxembourg	ECFIN	4.98	4.94	4.20	4.14	4.47	5.32	5.91	6.42
	ECFIN ext.	4.97	4.95	4.25	4.23	4.62	5.57	6.28	6.92
	CPB	4.69	4.47	3.52	3.73	4.22	5.15	5.86	6.12
	CPB HP	4.72	4.54	3.64	3.39	3.51	4.05	4.37	4.64
Netherlands	ECFIN	2.89	2.70	2.34	2.01	1.98	2.18	2.34	2.38
	ECFIN ext.	2.89	2.70	2.34	2.02	1.98	2.19	2.35	2.39
	CPB	2.84	2.64	2.25	1.92	1.87	2.04	2.18	2.19
	CPB HP	2.83	2.62	2.23	1.87	1.80	1.96	2.09	2.10
Austria	ECFIN	2.28	2.08	1.59	1.60	1.60	1.18	1.28	1.47
	ECFIN ext.	2.28	2.08	1.59	1.60	1.60	1.18	1.29	1.48
	CPB	2.33	2.15	1.68	1.70	1.71	1.31	1.41	1.61
	CPB HP	2.31	2.12	1.64	1.66	1.68	1.28	1.40	1.60
Portugal	ECFIN	2.98	2.80	2.55	2.40	2.53	2.32	2.68	2.75
	ECFIN ext.	2.98	2.80	2.56	2.42	2.56	2.36	2.73	2.83
	CPB	2.85	2.60	2.27	2.09	2.15	1.85	2.12	2.12
	CPB HP	2.83	2.57	2.24	1.99	2.02	1.69	1.94	1.94
Finland	ECFIN	3.52	3.54	3.14	2.75	2.76	2.71	2.40	2.27
	ECFIN ext.	3.52	3.54	3.14	2.75	2.76	2.72	2.42	2.29
	CPB	3.61	3.66	3.29	2.95	2.98	2.95	2.64	2.54
	CPB HP	3.56	3.59	3.21	2.85	2.88	2.86	2.58	2.46
Sweden	ECFIN	2.86	2.83	2.59	2.50	2.60	2.58	2.48	2.32
	ECFIN ext.	2.86	2.83	2.59	2.50	2.61	2.59	2.50	2.35
	CPB	2.88	2.86	2.62	2.52	2.60	2.54	2.40	2.24
	CPB HP	2.85	2.81	2.56	2.45	2.55	2.51	2.40	2.22
United Kingdom	ECFIN	2.80	2.77	2.53	2.56	2.60	2.66	2.70	2.62
	ECFIN ext.	2.80	2.77	2.53	2.56	2.60	2.66	2.70	2.62
	CPB	2.75	2.69	2.43	2.45	2.48	2.52	2.54	2.44
	CPB HP	2.75	2.70	2.44	2.44	2.45	2.48	2.49	2.39

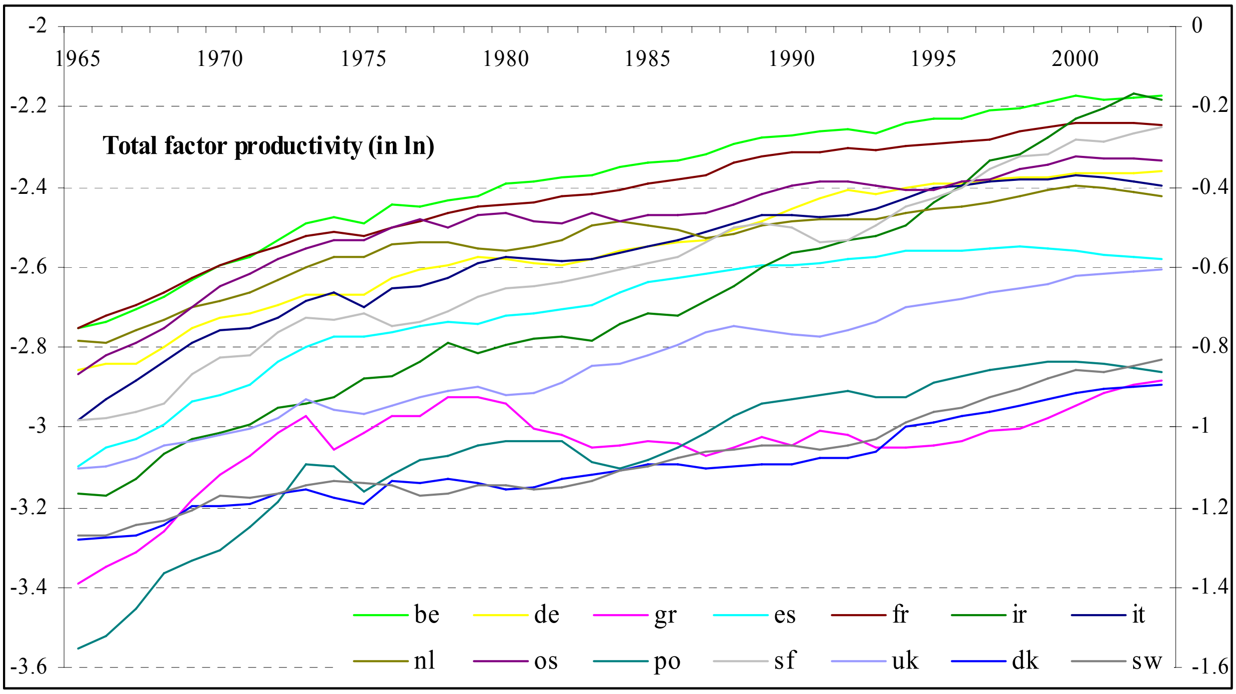
ANNEX 4 : TOTAL FACTOR PRODUCTIVITY - DETERMINISTIC VS STOCHASTIC MODELS

For the empirical discrimination between the stochastic and the deterministic trend specification we follow a traditional time series approach : in a first step, the series are checked for stationarity with panel unit root tests as well as standard augmented-Dickey-Fuller (ADF) tests on individual series. In the second step, the Box-Jenkins methodology is applied to determine parsimonious ARIMA models for the stationary series. Finally, the out-of-sample forecasting performance of the stochastic models is compared to those of the deterministic trend model.

1 : DO EU15 TFP SERIES HAVE A UNIT ROOT ?

The specification of a stochastic model for the TFP series requires that the series are stationary or suitably differenced in order to become stationary. We examine here whether TFP can be transformed in order to become stationary.

1.1 : TFP in levels : A preliminary visual inspection shows that the series (in log) display a marked positive trend until the mid-1990s. The growth trend seems to somewhat decline afterwards for most series (see graph). It is thus possible that series are integrated processes of order 1.



Standard unit root tests provide in principle an answer to such an issue. But they have a low power, *i.e.* they tend to accept (not to reject) the null hypothesis of a unit root more frequently than is warranted. This is one of the reasons mentioned by Maddala and Im (1998) to discard traditional unit root tests.

A more powerful test of the unit root hypothesis where data is available in the form of a panel is, however, provided by the more recent literature on panel unit root tests. The simple reasoning behind panel unit roots is the following : n separate ADF unit root tests are performed for n time series in a panel.

$$\Delta y_{i,t} = a_{i0} + \gamma_i y_{i,t-1} + a_{i2}t + \sum_{j=1}^{p_i} \beta_i y_{i,t-j} + \varepsilon_{it} \text{ (for i = 1 to n).}$$

Provided that the relevant coefficients obtained are corrected for mean and standard deviation biases (based on Monte Carlo simulations), the sample mean of the n independent estimates obtained should have asymptotically a standardised normal distribution according to the central limit theorem. Thus, Im, Pesaran and Shin (IPS) (1997) construct a panel unit root test according to which the null of a unit root is rejected if the sample average of the t-statistics is significantly different from zero. Such a case will occur if at least one of the coefficients is significantly different from zero.

In short, the test formulation is:

H0: all time series in the panel display a unit root

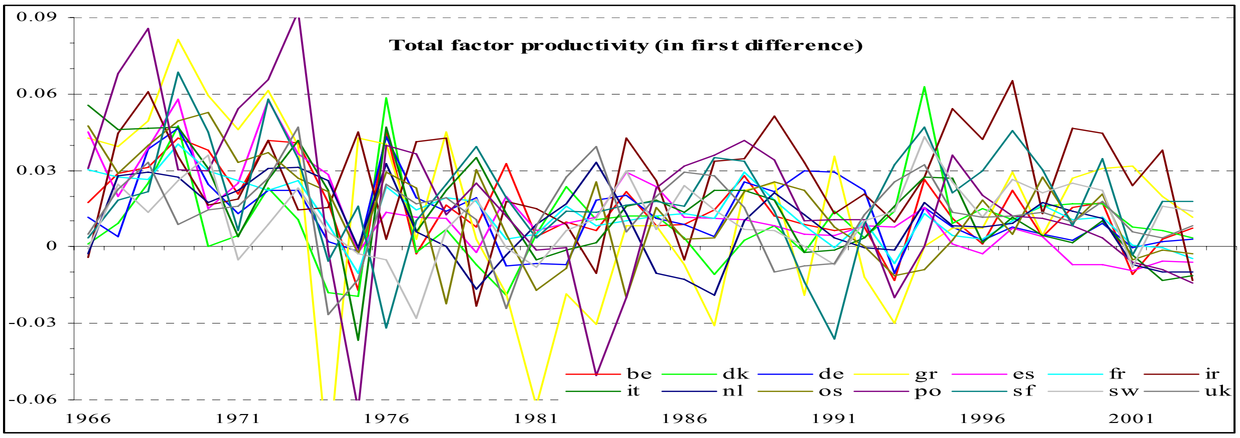
vs H1: at least one of the time series is an integrated process (of order 0 for series in levels).

The IPS test was performed on the panel of 14 TFP series (EU15 excluding Luxembourg). The de-biased t-stat is 0.95 to be compared to an exact sample critical value of -2.04 at the 99% confidence level. The null of unit roots in each series cannot be rejected : none of the series are integrated processes of order 0.

The test results are robust to :

- the exclusion of specific countries from the panel,
- the removal of some of the contemporaneous correlation across equations in the residuals (substracting a common time effect from time observations per country),
- the specification of heterogeneous time trends in the TFP series (-0.79 to be compared to an exact sample critical value of -2.67). Thus, the results are irrespective of specific time trends in the series,
- the use of TFP based on hours worked.

1.2 : TFP in first differences : The next step is to check whether the series are stationary in first differences. A visual inspection of the series (see graph) supports *prima facie* this hypothesis.



The same IPS test is applied to the first difference of the TFP series. The de-biased t-stat is now -9.69 to be compared to an exact sample critical value of -2.04 at the 99% confidence level. The null of a unit root is rejected : at least one series is an integrated process of order 1.

The test results are robust to:

- the exclusion of specific countries from the panel, for instance Spain, Ireland, UK (it should be noted that the statistic is so far from the critical value that it is anyway unlikely that only a few countries are stationary),
- the removal of some of the contemporaneous correlation in the residuals across equations, substracting a common time effect from each observation (-12.40),
- the presence of heterogeneous time trends in the TFP series (-13.14 to be compared to an exact sample critical value of -2.67),
- the choice of high order (4) lags in each ADF tests (-3.41 and -2.79 with heterogeneous time trends),
- the use of TFP based on hours worked.

Separate ADF tests confirm that the null is rejected for every country. The conclusion is that all TFP series are stationary integrated processes I(1).

2 : The determination of parsimonious ARIMA models for TFP

In this section, we apply the Box and Jenkins methodology to specify parsimonious autoregressive integrated moving average models ARIMA (p,1,q) for the countries TFP series. As a slight break is visible at the beginning of the sample (1966-1975), the identification of a stochastic representation for TFP is performed on a smaller sample : 1976-2003.

2.1 : Decision rules for the choice of the ARIMA specification : This exercise is based on the examination of the autocorrelations and partial autocorrelations of the series with a view to specifying the order of AR(p) and MA(q) polynomials. Four decision rules were applied in order to decide whether to select an AR(p) or MA(q) representation potentially identified:

- the coefficients in the regression of TFP in first difference have to be stable and significant at the 90% confidence level over the full sample (1976-2003) and two sub-samples (1984-2003, 1989-2003) in order to check for robustness of the specification,

- the modulus of the unit roots associated to a given AR(p) or MA(q) have to be smaller than 0.9 (hence different from 1) in order to avoid potentially spurious results,

- models with higher values of Akaike or Schwartz information criterion are rejected,

- models with p>4 and q>4 are rejected (considering the relatively short size of the sample).

2.2 : Model specification details across countries : The optimal models for the various countries differ slightly, as can be seen in the following table[15].

Optimal parsimonious stochastic models for TFP					
AT	ARIMA (0 , 1 , 0)	DE	ARIMA (1 , 1 , 0)	EA	ARIMA (0 , 1 , 1)
BE	ARIMA (0 , 1 , 0)	ES	ARIMA (1 , 1 , 0)	IT	ARIMA (0 , 1 , 1)
DK	ARIMA (0 , 1 , 0)			NL	ARIMA (0 , 1 , 1)
EL	ARIMA (0 , 1 , 0)			PT	ARIMA (0 , 1 , 1)
FI	ARIMA (0 , 1 , 0)			UK	ARIMA (0 , 1 , 0)
FR	ARIMA (0 , 1 , 0)				
IE	ARIMA (0 , 1 , 0)				
LU	ARIMA (0 , 1 , 0)				
SE	ARIMA (0 , 1 , 0)				

For most countries of the European Union, the most robust specification is an ARIMA(0,1,0). Correlograms generally display autocorrelations and partial autocorrelations that are not significant up to the order 10 and it was checked that the ARIMA(1,1,0) or ARIMA(0,1,1) specification did not meet significance thresholds.

The only exceptions are Spain and Germany, where the AR(1) is stable and significant. UK, Italy, Portugal and the Netherlands, where an MA(1) for TFP in first differences is also stable (albeit slightly less stable for the latter country[16]). An MA(1) process also seems valid for the euro area.

3 : OUT-OF-SAMPLE FORECAST PERFORMANCE

Forecasts obtained with these models for each country of the EU15 at various horizons can be compared to current measured values of TFP up to 2003. The forecast error is compared in a second step to the forecast error of the deterministic trend model previously used for the medium-term TFP projections in order to check whether there is a gain in forecast accuracy with the new model. Even if the final impact on the HP-filtered series would be relatively minor (because of the filtering), it is safe to assume that a potential gain in forecast accuracy

[15] With TFP series based on hours worked (corrected for differences in working time per employee across countries), the model specification is different only for the UK and IT. In the latter case, the optimal model was a more parsimonious ARIMA(0,1,0) for both countries.

[16] For the Netherlands, the MA(1) term is only significant at a level of 90% over 1989-2003 but the coefficient remains relatively stable over the shorter sample.

will translate into a gain in the accuracy of the estimation of end-of-sample points with the HP filter[17].

3.1 : The out-of-sample experiment design : A major difficulty in the handling of out-of-sample tests on fitted models is to make sure that the sample used to fit the model does not overlap with the experiment out-of-sample observations. Otherwise, there is no guarantee that the out-of-sample statistics are not affected by a model selection (or fitting) bias.

The previous (deterministic) model used was specified with data from 1976 to 2001, while the stochastic models suggested in this section were specified with data from 1976 to 2003. The best reference observations for the out-of-sample experiment seem to be 2001, 2002 and 2003 : the overlap with stochastic models is not a major concern as their very parsimonious specifications are unlikely to cause a data "snooping"[18] bias. Three years (observations) are as such not sufficient to compute decent forecast accuracy statistics. However, it is possible to take advantage of the panel structure of the data and compute compared forecast accuracy statistics across countries (and not across time) for each year. These statistics are computed separately for various forecast horizons (1 to 5 years). For each sample ending in year Y, five forecasts are thus computed for Y+1 to Y+5 and for each country and the forecasts kept for the experiment only relate to 2001, 2002 and 2003.

Another methodological problem lies in the fact that the decision rule for the stochastic models specification is the same but the individual models are formally not always the same. An answer to this is to test the forecast accuracy of the deterministic trend model against those of the same stochastic ARIMA(0,1,0) model for each country.

3.2 : Statistics for compared forecast accuracy : The statistics of model comparison are squared forecast errors differences across countries for 2001, 2002 and 2003 and the Diebold-Mariano [1995] (DM) statistics of compared predictive accuracy[19]. The DM statistic is, under its most simple form :
$\sqrt{n}\cdot\frac{\bar{d}}{\hat{\sigma}_d}\xrightarrow{d}N(0,1)$, where: n is the number of observations of the experiment, $\bar{d}=\frac{1}{n}\sum_{t=1}^{n}d_t$, $d_t=e_{at}^2-e_{bt}^2$, e_{at}^2, e_{bt}^2 are the respective squared forecast errors of models a and b, and $\hat{\sigma}_d^2=\frac{1}{n}\sum_{t=1}^{n}(d_t-\bar{d})^2$.

A slightly adapted version of the Diebold-Mariano statistics (DM) can be used for an unbiased empirical variance[20] in the case of finite samples :

[17] The other option would be to compare filtered estimation to reference trend values for TFP that would be assumed to be the "true" trend value. Mid-sample values of HP-filtered series could be good candidates insofar as there is very little revision of mid-sample observations with additional observations. However, the experiment would no longer be out-of-sample but in-sample as the reference estimates correspond to the observations, which the model was fitted on.

[18] See Pesaran *et al.* (2004).

[19] This test can be used to directly compare models that are not nested. It seems reasonable to assume that this is not the case here as the deterministic trend model includes a time trend and an AR polynomial whereas the stochastic models have no time trend, I(1) and sometimes MA(1) representations, except Spain with an AR(1).

[20] The empirical variance is not based on observations across time but mainly across sections (in the panel). Therefore, it was not relevant to compute an autocorrelation-consistent estimate using a Bartlett lag window.

$\sqrt{n-1}\cdot\frac{\bar{d}}{\hat{\sigma}'_d}\to St(n-1)$ where $\hat{\sigma}'^2_d=\frac{1}{n-1}\sum_{t-1}^{n}(d_t-\bar{d})^2$. In addition, the correction for small sample size suggested by Harvey *et al.* [1997] is introduced in the Student statistics : $\sqrt{n+1-2h+\frac{h(h-1)}{n}}\cdot\frac{\bar{d}}{\hat{\sigma}'_d}\to St(n-1)$, where h is the forecast horizon. The tested null hypothesis is: models a and b do not exhibit any difference in forecast accuracy, against : model a is superior to model b (if $\bar{d}<0$) or model b is superior to model a (if $\bar{d}>0$).

3.3 : Compared results : deterministic model vs. stochastic model : For each year and each country, differences between the squared forecast errors of the deterministic trend model and those of the stochastic model were computed (see first table on next page). Shaded[21] areas correspond to observations where the errors of the stochastic model were smaller than those of the deterministic model. For Spain, the Netherlands and Portugal (at remote forecast horizons), the deterministic trend model appears superior in forecast accuracy. For Belgium, Austria and the UK, both models are roughly equivalent. And for the other countries (Denmark, Germany, Greece, France, Ireland -in 2003-, Italy, Luxembourg, Finland and Sweden), the stochastic model seems to perform better.

When all countries are stacked together, the difference in forecast accuracy is always in favour of the stochastic model. Results are almost identical where the deterministic trend model is tested against an ARIMA(0,1,0) for all countries (see second table on next page). According to the DM statistics, the stochastic model is superior to the deterministic model at a confidence level of 90% for shorter horizons (1 or 2 years). The statistics are more in favour of the stochastic model for 2002 and 2003 than for 2001, which might be explained by the fact that 2001 remains in-sample for the deterministic trend model.

If Greece and Luxembourg are removed from the panel (see table on the right side), the difference in forecast errors remains positive (stochastic model more accurate), except in three cases where the difference is negative and close to zero (2001 for 1-year forecast horizon), 2002 for 2-year forecast horizon and 2003 for 5-year forecast horizon).

According to the Diebold-Mariano test, the hypothesis of equal forecast accuracy can still be rejected at the 1 or 2 years forecast horizon for 2003. In the other cases, one should stress that it does not provide evidence that both models are equivalent, as the non rejection of the null hypothesis can be partially accounted for by an insufficient power of the test, especially in the case of remote forecast horizons[22].

Panel excluding EL and LU					
Year	h	mean	std	T-stat	P-value
2001	1	0.00%	0.02%	- 0.12	45%
	2	0.02%	0.08%	0.86	20%
	3	0.02%	0.12%	0.58	29%
	4	0.04%	0.20%	0.55	29%
	5	0.08%	0.20%	0.98	17%
2002	1	0.02%	0.04%	1.51	8%
	2	0.00%	0.06%	- 0.08	47%
	3	0.03%	0.17%	0.49	32%
	4	0.01%	0.20%	0.20	42%
	5	0.01%	0.23%	0.10	46%
2003	1	0.02%	0.04%	1.87	4%
	2	0.06%	0.11%	1.74	5%
	3	0.02%	0.16%	0.39	35%
	4	0.04%	0.23%	0.45	33%
	5	0.00%	0.21%	- 0.06	48%

[21] Shaded P-values correspond to the rejection of the null hypothesis at a confidence level of 90%.
[22] A large penalty is imposed for more remote forecast horizons with small samples in Harvey (1997).

Difference in TFP forecast errors: deterministic model vs. optimal stochastic model for each EU15 country																		DM stat.	
Year	h	BE	DK	DE	EL	ES	FR	IR	IT	LU	NL	AT	PT	FI	SE	UK	Mean	Std	T-stat	P-value
2001	1	-0.03%	0.00%	0.01%	0.13%	-0.01%	0.00%	0.02%	0.04%	0.09%	-0.03%	-0.02%	0.01%	-0.03%	0.02%	0.00%	0.01%	0.04%	1.17	13%
	2	-0.01%	0.00%	0.02%	0.79%	-0.05%	0.00%	-0.03%	0.08%	0.18%	0.00%	0.01%	-0.04%	0.28%	0.02%	0.00%	0.08%	0.21%	1.38	10%
	3	-0.01%	0.02%	0.04%	1.63%	-0.07%	0.02%	-0.11%	0.04%	0.31%	0.05%	0.02%	-0.07%	0.39%	-0.01%	-0.01%	0.15%	0.43%	1.14	14%
	4	-0.04%	0.13%	0.02%	1.93%	-0.03%	0.02%	-0.04%	-0.08%	0.41%	0.07%	0.00%	-0.16%	0.66%	-0.01%	-0.01%	0.19%	0.52%	1.11	14%
	5	0.00%	0.54%	-0.02%	1.60%	0.05%	0.04%	-0.02%	-0.06%	0.28%	0.06%	0.00%	-0.15%	0.44%	0.14%	-0.01%	0.19%	0.43%	1.25	12%
2002	1	0.04%	0.00%	0.01%	0.05%	0.00%	0.00%	-0.01%	0.12%	0.23%	-0.01%	-0.01%	0.02%	0.03%	0.01%	0.00%	0.03%	0.06%	1.88	4%
	2	-0.04%	0.00%	0.05%	0.54%	-0.05%	0.01%	0.01%	0.16%	0.33%	-0.11%	-0.05%	0.02%	-0.04%	0.04%	-0.02%	0.06%	0.17%	1.18	13%
	3	-0.02%	0.00%	0.07%	1.69%	-0.13%	0.01%	-0.10%	0.18%	0.54%	-0.08%	0.00%	-0.10%	0.51%	0.02%	0.00%	0.17%	0.47%	1.21	12%
	4	-0.02%	0.02%	0.07%	2.32%	-0.13%	0.04%	-0.20%	0.05%	0.81%	-0.06%	0.00%	-0.16%	0.61%	-0.01%	-0.03%	0.22%	0.64%	1.05	16%
	5	-0.07%	0.13%	0.03%	2.47%	-0.05%	0.05%	-0.13%	-0.16%	1.01%	0.00%	0.00%	-0.31%	0.67%	-0.01%	-0.02%	0.24%	0.70%	0.97	17%
2003	1	0.02%	0.00%	0.01%	0.02%	0.00%	0.00%	0.11%	0.12%	0.08%	-0.01%	-0.01%	0.05%	0.02%	0.00%	0.00%	0.03%	0.04%	2.38	2%
	2	0.03%	0.00%	0.04%	0.24%	-0.01%	0.01%	0.18%	0.33%	0.46%	-0.06%	-0.03%	0.12%	0.13%	0.01%	0.00%	0.10%	0.15%	2.29	2%
	3	-0.05%	0.01%	0.10%	1.20%	-0.13%	0.01%	0.40%	0.24%	0.58%	-0.25%	-0.11%	0.03%	0.01%	0.06%	-0.04%	0.14%	0.36%	1.25	12%
	4	-0.04%	0.00%	0.13%	2.44%	-0.27%	0.02%	0.28%	0.23%	0.92%	-0.22%	-0.04%	-0.19%	0.57%	0.02%	-0.01%	0.26%	0.68%	1.15	13%
	5	-0.03%	0.01%	0.10%	2.67%	-0.22%	0.06%	-0.03%	0.03%	1.28%	-0.19%	-0.03%	-0.29%	0.59%	-0.02%	-0.04%	0.26%	0.77%	0.95	18%

Difference in TFP forecast errors: deterministic model vs. ARIMA(0,1,0) model for all EU15 countries																		DM stat.	
Year	h	BE	DK	DE	EL	ES	FR	IR	IT	LU	NL	AT	PT	FI	SE	UK	Mean	Std	T-stat	P-value
2001	1	-0.03%	0.00%	0.01%	0.13%	-0.01%	0.00%	0.02%	0.04%	0.09%	-0.02%	-0.02%	-0.01%	-0.03%	0.02%	0.00%	0.01%	0.04%	1.12	14%
	2	-0.01%	0.00%	0.02%	0.79%	-0.05%	0.00%	-0.03%	0.07%	0.18%	0.01%	0.01%	-0.03%	0.28%	0.02%	0.00%	0.08%	0.21%	1.38	10%
	3	-0.01%	0.02%	0.03%	1.63%	-0.07%	0.02%	-0.11%	0.03%	0.31%	0.06%	0.02%	-0.07%	0.39%	-0.01%	-0.01%	0.15%	0.43%	1.14	14%
	4	-0.04%	0.13%	0.01%	1.93%	-0.03%	0.02%	-0.04%	-0.05%	0.41%	0.06%	0.00%	-0.10%	0.66%	-0.01%	-0.01%	0.20%	0.52%	1.15	13%
	5	0.00%	0.54%	-0.04%	1.60%	0.05%	0.04%	-0.02%	-0.08%	0.28%	0.05%	0.00%	-0.12%	0.44%	0.14%	-0.01%	0.19%	0.43%	1.24	12%
2002	1	0.04%	0.00%	0.00%	0.05%	0.00%	0.00%	-0.01%	0.11%	0.23%	-0.03%	-0.01%	-0.01%	0.03%	0.01%	-0.01%	0.03%	0.06%	1.59	7%
	2	-0.04%	0.00%	0.05%	0.54%	-0.05%	0.01%	0.01%	0.16%	0.33%	-0.09%	-0.05%	-0.02%	-0.04%	0.04%	-0.01%	0.06%	0.17%	1.18	13%
	3	-0.02%	0.00%	0.06%	1.69%	-0.13%	0.01%	-0.10%	0.17%	0.54%	-0.06%	0.00%	-0.07%	0.51%	0.02%	-0.01%	0.17%	0.47%	1.23	12%
	4	-0.02%	0.02%	0.06%	2.32%	-0.13%	0.04%	-0.20%	0.04%	0.81%	-0.02%	0.00%	-0.13%	0.61%	-0.01%	-0.02%	0.22%	0.64%	1.07	15%
	5	-0.07%	0.13%	0.02%	2.47%	-0.05%	0.05%	-0.13%	-0.11%	1.01%	0.01%	0.00%	-0.18%	0.67%	-0.01%	-0.02%	0.25%	0.69%	1.03	16%
2003	1	0.02%	0.00%	0.00%	0.02%	0.00%	0.00%	0.11%	0.09%	0.08%	-0.02%	-0.01%	0.02%	0.02%	0.00%	0.00%	0.02%	0.04%	2.09	3%
	2	0.03%	0.00%	0.03%	0.24%	-0.01%	0.01%	0.18%	0.30%	0.46%	-0.10%	-0.03%	0.05%	0.13%	0.01%	-0.01%	0.09%	0.15%	2.04	3%
	3	-0.05%	0.01%	0.10%	1.20%	-0.13%	0.01%	0.40%	0.26%	0.58%	-0.22%	-0.11%	-0.02%	0.01%	0.06%	-0.02%	0.14%	0.36%	1.27	11%
	4	-0.04%	0.00%	0.11%	2.44%	-0.27%	0.02%	0.28%	0.22%	0.92%	-0.18%	-0.04%	-0.13%	0.57%	0.02%	-0.01%	0.26%	0.67%	1.18	13%
	5	-0.03%	0.01%	0.09%	2.67%	-0.22%	0.06%	-0.03%	0.02%	1.28%	-0.12%	-0.03%	-0.22%	0.59%	-0.02%	-0.03%	0.27%	0.76%	0.99	17%

Empirical standard deviation of forecast errors (EU15 over 2001-2003)																
	BE	DK	DE	EL	ES	FR	IR	IT	LU	NL	AT	PT	FI	SE	UK	EU15
Deterministic	0.03%	0.15%	0.09%	1.45%	0.19%	0.06%	0.19%	0.24%	0.78%	0.03%	0.02%	0.17%	0.28%	0.08%	0.01%	0.66%
Stochastic	0.05%	0.01%	0.07%	0.54%	0.22%	0.05%	0.16%	0.22%	0.52%	0.09%	0.03%	0.24%	0.04%	0.05%	0.02%	0.29%

In order to correct for a potential lack of power of the test with small samples, a simple solution is to stack the observations for all countries and for the out-of-sample years. Each country for each out-of-sample year is considered as providing one realisation for both models. Results are indeed more clear-cut when all observations are stacked : the stochastic model is always superior in terms of forecast accuracy according to the DM statistics at the 95% confidence level (see table below)[23]. It is also noteworthy that the variance of the forecast errors is much lower with the stochastic model (see details per country in third table on previous page).

With the full panel, the deterministic trend model is penalised by having very large errors in the case of two countries, Greece and Luxembourg. If both countries are removed from the panel, the average difference in forecast errors is considerably reduced. As a result, the t-stat of the DM test is generally reduced and the relative superiority of the stochastic model is weakened.

All countries and out-of-sample years stacked				
Forecast horizon (years)	Mean of differences in forecast accuracy across countries	Empirical standard deviation of differences	T-statistics	P-value
1	0.024%	0.051%	3.15	0%
2	0.079%	0.176%	2.89	0%
3	0.153%	0.413%	2.35	1%
4	0.222%	0.605%	2.27	1%
5	0.230%	0.637%	2.18	2%

Empirical standard deviation	
Stochastic model	Deterministic model
0.075%	0.106%
0.089%	0.292%
0.198%	0.605%
0.220%	0.704%
0.422%	0.809%

All countries (except EL LU) and out-of-sample years stacked				
Forecast horizon (years)	Mean of differences in forecast accuracy across countries	Empirical standard deviation of differences	T-statistics	P-value
1	0.013%	0.036%	2.22	2%
2	0.026%	0.088%	1.79	4%
3	0.024%	0.149%	0.95	17%
4	0.030%	0.203%	0.85	20%
5	0.027%	0.209%	0.72	24%

[23] The null hypothesis of equal forecast accuracy is always rejected.

3.4 : What model for what country ? : The out-of-sample experiment showed that for most countries except Spain, the Netherlands and Portugal, there is a gain or at least no loss in forecast accuracy from switching to a stochastic model. However, for the latter countries, the superior out-of-sample performance of the deterministic trend model is closely linked to the performance of their economies over the latest years' sample. The choice of a deterministic trend specification implicitly relies on the strong assumption that the growth and labour trend will stay on the same path in the forthcoming years. A stochastic model does not require any such assumption. This is the reason why the latter model was for instance more accurate in the case of Ireland in 2003 than the deterministic model, as growth changed momentum.

All in all, neutrality with respect to any assumption for the future and compliance with the prescriptions of econometric theory (unit root in the series in levels, parsimony of the specification) confirmed by out-of-sample test results (pointing to the overall superiority of the stochastic model) provide sufficient reasons to opt for a stochastic model for all countries.

3.5 : Consequences of a stochastic trend specification for potential output and output gaps : Moving to a stochastic trend specification for TFP could have implications for trend growth. This sub-section explores the consequences of changing the specification for individual member states to the ARIMA model identified previously.

One of the initial arguments in favour of moving to a stochastic trend specification has been, as mentioned previously, a paper by the CPB (CPB Memorandum 51) which avoids the end point bias problem by using an MA process for the growth rate of TFP. Since a moving average process reaches a constant long term growth rate in finite time (in fact after 2 years given the MA representation), the HP trend can be anchored at this long run trend and therefore an end point bias can be avoided. However, empirically we can select MA processes only for Portugal, the Netherlands and Spain. Therefore this trick cannot be applied generally. We therefore resort to the traditional way of dealing with the end point bias problem by projecting the TFP series 3 years beyond the medium term forecast horizon.

The results suggest that the differences between the two specifications in terms of potential growth are small but not negligible, at least for some countries. For Belgium, Spain, Italy, Greece and Finland, we obtain higher potential growth rates, while for Germany, the Netherlands, Portugal, Ireland, Luxembourg and Sweden potential growth is slightly reduced. No significant changes occur for Denmark, France, Austria and the UK.

Another interesting comparison can be made concerning the HP output gap difference between the deterministic and the stochastic trend specification. Since the HP output gap is based on a stochastic trend model one would a priori expect that the output gap calculations using the stochastic trend model would become more similar. This seems to be the case in general. The only exceptions are Belgium, Denmark, Italy, Finland. For all other countries the differences between the two gaps have narrowed or stayed the same.

4 : CONCLUSIONS

The analysis of the TFP series of the EU15 countries showed that all series in levels have a unit root and are not stationary. In such a case, coefficient estimates in OLS regressions are biased and econometric theory recommends that the series should be differenced prior to any regression exercise.

As the first difference of the TFP series seemed stationary, the Box and Jenkins methodology was applied in order to fit the best ARIMA model to each series. Applying a very strict decision rule in terms of the stability and significance of the AR and MA terms, the stochastic model chosen for most countries is the most parsimonious one for I(1) series, *i.e.* ARIMA(0,1,0). Based on an out-of-sample experiment over 2001-2003, the forecast accuracy of the stochastic model seems superior to that of the deterministic trend model for a majority of countries in terms of mean squared forecast errors. However, the hypothesis of equal forecast accuracy for all countries put together cannot be formally rejected at a 90% confidence level according to the Diebold-Mariano test.

It is suggested that the stochastic model should provide better inputs to the computation of the output gap. The generally better forecast accuracy and lower variance in forecast errors is likely to enhance, albeit modestly, the calculation of the end-of-sample points with the HP filter.

Finally, it should also be noted that the specification of the stochastic model is strictly in line with the operating principles established for the production function methodology, namely simplicity, equal treatment and prudence. These principles are recalled in the conclusions of this paper.

ANNEX 5 : TABLES AND GRAPHS FOR THE 25 EU MEMBER STATES

- **Tables for the EU15 members**: pages 57-71, in the following order:
  Belgium (be), Denmark (dk), Germany (de), Greece (el), Spain (es), France (fr), Ireland (ie), Italy (it), Luxembourg (lu), Netherlands (nl), Austria (at), Portugal (pt), Finland (fi), Sweden (se), United Kingdom (uk)

- **Graphs for the EU15 members**: pages 72-79, in the same order

- **Tables for the EU10 members**: pages 80-89, in the following order:
  Czech Rep. (cz), Estonia (ee), Cyprus (cy), Latvia (lv), Lithuania (lt), Hungary (hu), Malta (mt), Poland (pl), Slovenia (si), Slovakia (sk)

- **Graphs for the EU10 members**: pages 90-94, in the same order

be	Output Gaps (% of Potential Output)		Actual Output Growth (annual % change)	Potential Growth (annual % change)		Contributions to Potential Growth*					Determinants of Labour Potential and Capital Accumulation			
	HP Filter	**PF method**		**HP Trend Growth**	**PF Potential Growth**	**Total Labour (Hours) Contribution**	***Labour (persons) Contribution***	***Changes in Hours (per Empl) Contribution***	**Capital Accumulation Contribution**	**TFP Contribution**	**Growth of Working Age Population (annual % change)**	**Trend Participation Rate (% of Working Age Population)**	**NAIRU (% of Labour Force)**	**Investment Ratio (% of Potential Output)**
1981	0,4	-1,3	-0,3	1,9	1,7	-0,8	*-0,2*	*-0,5*	0,6	1,9	0,5	62,3	7,1	17,4
1982	-0,8	-2,2	0,6	1,8	1,6	-0,7	*-0,2*	*-0,5*	0,5	1,8	0,5	62,1	7,5	16,4
1983	-2,3	-3,7	0,3	1,8	1,8	-0,2	*0,3*	*-0,4*	0,3	1,7	0,8	61,9	7,6	15,3
1984	-1,7	-2,9	2,5	1,9	1,6	-0,4	*0,0*	*-0,4*	0,3	1,7	0,6	61,7	7,9	15,4
1985	-2,0	-2,9	1,7	2,0	1,7	-0,3	*0,0*	*-0,4*	0,4	1,6	0,3	61,6	7,9	15,8
1986	-2,2	-2,6	1,8	2,1	1,5	-0,5	*-0,1*	*-0,3*	0,4	1,6	0,1	61,5	8,1	16,0
1987	-2,1	-2,0	2,3	2,2	1,7	-0,4	*-0,1*	*-0,3*	0,5	1,5	0,0	61,5	8,2	16,5
1988	0,3	0,4	4,7	2,2	2,2	-0,2	*0,2*	*-0,3*	0,8	1,5	0,2	61,5	8,2	18,8
1989	1,5	1,4	3,5	2,3	2,5	-0,1	*0,2*	*-0,3*	1,1	1,5	0,1	61,6	8,2	20,5
1990	2,4	2,0	3,1	2,3	2,5	-0,1	*0,2*	*-0,3*	1,2	1,4	0,0	61,8	8,2	21,7
1991	2,0	1,6	1,8	2,2	2,3	0,0	*0,3*	*-0,3*	1,0	1,3	0,0	62,0	8,1	20,3
1992	1,4	0,8	1,5	2,2	2,3	0,1	*0,4*	*-0,3*	0,9	1,3	0,1	62,3	8,1	20,1
1993	-1,7	-2,2	-1,0	2,1	2,1	0,1	*0,4*	*-0,3*	0,8	1,2	0,2	62,6	8,2	19,2
1994	-0,6	-1,1	3,2	2,1	2,1	0,2	*0,4*	*-0,3*	0,7	1,2	0,1	62,9	8,2	18,9
1995	-0,4	-0,9	2,4	2,1	2,1	0,3	*0,5*	*-0,2*	0,7	1,1	0,0	63,3	8,1	19,1
1996	-1,4	-1,7	1,2	2,2	2,0	0,2	*0,4*	*-0,2*	0,6	1,1	0,0	63,7	8,0	18,9
1997	-0,3	-0,5	3,3	2,2	2,1	0,3	*0,5*	*-0,2*	0,7	1,1	0,0	64,1	8,0	19,8
1998	-0,5	-0,6	1,9	2,2	2,0	0,2	*0,4*	*-0,2*	0,8	1,0	0,0	64,4	8,0	20,1
1999	0,4	0,3	3,1	2,2	2,1	0,3	*0,5*	*-0,2*	0,8	1,0	0,1	64,8	7,9	20,5
2000	2,1	1,8	3,9	2,1	2,4	0,5	*0,6*	*-0,2*	0,8	1,0	0,1	65,1	7,6	20,9
2001	1,0	0,7	1,0	2,1	2,1	0,3	*0,5*	*-0,2*	0,7	1,0	0,3	65,4	7,6	20,6
2002	0,5	0,3	1,5	2,0	2,0	0,4	*0,6*	*-0,2*	0,5	1,1	0,5	65,7	7,6	19,7
2003	-0,6	-0,7	0,9	2,0	1,9	0,3	*0,6*	*-0,2*	0,4	1,1	0,4	66,0	7,6	19,2
2004	0,0	-0,1	2,6	2,0	2,0	0,4	*0,6*	*-0,3*	0,5	1,2	0,5	66,2	7,5	19,6
2005	-0,5	-0,8	1,4	2,0	2,1	0,3	*0,6*	*-0,3*	0,6	1,2	0,5	66,4	7,4	20,2
2006	-0,5	-0,8	2,1	2,0	2,1	0,2	*0,5*	*-0,3*	0,6	1,2	0,4	66,7	7,4	20,5
2007	-0,5	-1,0	2,0	2,0	2,3	0,3	*0,6*	*-0,3*	0,6	1,3	0,5	66,9	7,3	20,5
2008				2,0	2,3	0,3	*0,6*	*-0,3*	0,7	1,3	0,5	67,2	7,3	20,6
2009				2,1	2,1	0,1	*0,4*	*-0,3*	0,7	1,4	0,3	67,4	7,2	20,5
2010				2,1	2,1	0,0	*0,3*	*-0,3*	0,7	1,4	0,1	67,7	7,2	20,5
Periods	**Period Averages**													
1981-1985	-1,3	-2,6	0,9	1,9	1,7	-0,5	*0,0*	*-0,4*	0,4	1,7	0,5	61,9	7,6	16,0
1986-1990	0,0	-0,2	3,1	2,2	2,1	-0,3	*0,1*	*-0,3*	0,8	1,5	0,1	61,6	8,1	18,7
1991-1995	0,1	-0,4	1,6	2,2	2,2	0,1	*0,4*	*-0,3*	0,8	1,2	0,1	62,6	8,1	19,5
1996-2000	0,0	-0,2	2,7	2,2	2,1	0,3	*0,5*	*-0,2*	0,7	1,1	0,1	64,4	7,9	20,0
2001-2005	0,1	-0,1	1,5	2,0	2,0	0,3	*0,6*	*-0,2*	0,5	1,1	0,4	66,0	7,5	19,8
2006-2010				2,0	2,2	0,2	*0,5*	*-0,3*	0,7	1,3	0,4	67,2	7,3	20,5

dk	Output Gaps (% of Potential Output)		Actual Output Growth (annual % change)	Potential Growth (annual % change)		Contributions to Potential Growth*					Determinants of Labour Potential and Capital Accumulation			
	HP Filter	**PF method**		**HP Trend Growth**	**PF Potential Growth**	**Total Labour (Hours) Contribution**	***Labour (persons) Contribution***	***Changes in Hours (per Empl) Contribution***	**Capital Accumulation Contribution**	**TFP Contribution**	**Growth of Working Age Population (annual % change)**	**Trend Participation Rate (% of Working Age Population)**	**NAIRU (% of Labour Force)**	**Investment Ratio (% of Potential Output)**
1981	-3,6	-4,3	-2,1	1,5	1,1	-0,4	*0,3*	*-0,7*	0,1	1,4	0,7	82,1	5,4	13,9
1982	-2,4	-3,0	2,7	1,5	1,4	-0,2	*0,4*	*-0,7*	0,2	1,4	0,6	82,2	5,5	14,7
1983	-2,3	-2,7	1,7	1,6	1,4	-0,4	*0,3*	*-0,6*	0,3	1,5	0,5	82,3	5,7	14,7
1984	-0,5	-0,7	3,5	1,7	1,5	-0,4	*0,2*	*-0,6*	0,4	1,5	0,4	82,4	5,8	16,1
1985	1,2	1,0	3,6	1,7	1,7	-0,3	*0,2*	*-0,5*	0,6	1,4	0,3	82,4	6,0	18,1
1986	3,5	3,0	4,0	1,7	2,1	-0,2	*0,2*	*-0,4*	0,8	1,4	0,4	82,4	6,0	20,6
1987	1,8	1,0	0,0	1,7	2,0	-0,1	*0,2*	*-0,3*	0,7	1,4	0,5	82,4	6,1	20,1
1988	1,3	0,5	1,2	1,7	1,8	-0,2	*0,1*	*-0,3*	0,6	1,4	0,3	82,3	6,2	19,1
1989	-0,2	-1,1	0,2	1,7	1,7	-0,2	*0,0*	*-0,2*	0,6	1,4	0,3	82,1	6,3	18,6
1990	-1,0	-1,9	1,0	1,8	1,8	-0,1	*0,1*	*-0,2*	0,5	1,5	0,4	82,0	6,4	17,9
1991	-1,6	-2,4	1,3	1,9	1,8	0,0	*0,1*	*-0,1*	0,3	1,5	0,4	81,7	6,4	17,0
1992	-1,6	-2,3	2,0	2,0	1,8	0,0	*0,0*	*-0,1*	0,2	1,6	0,3	81,5	6,4	16,7
1993	-3,7	-4,1	-0,1	2,1	1,7	0,0	*0,0*	*0,0*	0,1	1,7	0,3	81,3	6,5	15,8
1994	-0,6	-0,8	5,5	2,3	2,1	0,2	*0,2*	*0,0*	0,2	1,7	0,3	81,1	6,3	16,8
1995	0,1	-0,1	3,1	2,4	2,3	0,3	*0,2*	*0,1*	0,4	1,6	0,4	80,9	6,1	18,4
1996	0,5	0,3	2,8	2,4	2,4	0,4	*0,3*	*0,1*	0,4	1,6	0,4	80,8	6,0	19,0
1997	1,3	1,1	3,2	2,4	2,4	0,5	*0,3*	*0,2*	0,5	1,4	0,2	80,8	5,7	20,4
1998	1,1	0,9	2,2	2,3	2,4	0,4	*0,2*	*0,2*	0,6	1,3	0,1	80,8	5,5	21,6
1999	1,4	1,3	2,6	2,3	2,2	0,4	*0,2*	*0,2*	0,5	1,2	0,1	80,9	5,3	21,1
2000	2,7	2,6	3,5	2,2	2,2	0,4	*0,3*	*0,2*	0,6	1,2	0,1	80,9	5,1	22,2
2001	1,4	1,2	0,7	2,1	2,1	0,4	*0,3*	*0,1*	0,5	1,1	0,1	81,0	4,9	21,5
2002	-0,2	-0,3	0,5	2,0	1,9	0,3	*0,2*	*0,0*	0,5	1,2	0,1	81,0	4,7	21,2
2003	-1,4	-1,4	0,6	1,9	1,8	0,1	*0,2*	*0,0*	0,5	1,2	0,1	81,0	4,6	21,1
2004	-1,3	-1,3	2,1	1,9	1,9	0,1	*0,2*	*-0,1*	0,5	1,3	0,0	81,0	4,4	21,4
2005	-0,6	-0,6	2,7	1,9	2,1	0,1	*0,3*	*-0,1*	0,6	1,3	0,2	81,0	4,2	21,8
2006	-0,2	-0,4	2,3	2,0	2,1	0,1	*0,2*	*-0,2*	0,7	1,4	0,2	81,0	4,0	22,2
2007	-0,1	-0,4	2,1	2,0	2,1	0,0	*0,3*	*-0,2*	0,7	1,4	0,2	81,0	3,8	22,5
2008				2,0	2,0	-0,2	*0,1*	*-0,3*	0,7	1,5	0,1	81,0	3,7	22,4
2009				2,0	1,9	-0,3	*0,0*	*-0,3*	0,7	1,5	-0,1	81,0	3,6	22,3
2010				2,0	1,8	-0,4	*-0,1*	*-0,3*	0,7	1,5	-0,1	81,0	3,6	22,3
Periods	**Period Averages**													
1981-1985	-1,5	-1,9	1,9	1,6	1,4	-0,3	*0,3*	*-0,6*	0,3	1,4	0,5	82,3	5,7	15,5
1986-1990	1,1	0,3	1,3	1,7	1,9	-0,2	*0,1*	*-0,3*	0,6	1,4	0,4	82,2	6,2	19,3
1991-1995	-1,5	-2,0	2,4	2,1	2,0	0,1	*0,1*	*0,0*	0,2	1,6	0,4	81,3	6,3	16,9
1996-2000	1,4	1,2	2,9	2,3	2,3	0,4	*0,3*	*0,2*	0,5	1,4	0,2	80,9	5,5	20,9
2001-2005	-0,4	-0,5	1,3	2,0	2,0	0,2	*0,2*	*0,0*	0,5	1,2	0,1	81,0	4,6	21,4
2006-2010				2,0	2,0	-0,1	*0,1*	*-0,2*	0,7	1,4	0,1	81,0	3,7	22,3

de

	Output Gaps (% of Potential Output)		Actual Output Growth (annual % change)	Potential Growth (annual % change)		Contributions to Potential Growth*					Determinants of Labour Potential and Capital Accumulation			
	HP Filter	PF method		HP Trend Growth	PF Potential Growth	Total Labour (Hours) Contribution	*Labour (persons) Contribution*	*Changes in Hours (per Empl) Contribution*	Capital Accumulation Contribution	TFP Contribution	Growth of Working Age Population (annual % change)	Trend Participation Rate (% of Working Age Population)	NAIRU (% of Labour Force)	Investment Ratio (% of Potential Output)
1981	0,5	-0,2	0,1	1,9	2,3	0,1	*0,8*	*-0,6*	0,8	1,3	1,5	69,0	4,5	22,7
1982	-2,1	-3,0	-0,8	1,9	2,1	0,1	*0,7*	*-0,6*	0,7	1,3	1,3	69,2	5,0	21,1
1983	-2,5	-3,5	1,6	2,0	2,0	0,0	*0,6*	*-0,6*	0,7	1,4	1,0	69,5	5,5	21,3
1984	-1,8	-2,7	2,8	2,1	2,0	0,0	*0,6*	*-0,6*	0,6	1,4	0,6	69,9	5,7	20,8
1985	-1,9	-2,3	2,2	2,3	1,8	-0,4	*0,2*	*-0,6*	0,6	1,5	0,2	70,3	6,1	20,4
1986	-1,9	-2,0	2,4	2,4	2,1	-0,2	*0,4*	*-0,6*	0,6	1,7	0,1	70,8	6,2	20,6
1987	-3,0	-2,5	1,5	2,6	2,1	-0,3	*0,3*	*-0,6*	0,6	1,8	0,1	71,2	6,4	20,6
1988	-2,1	-1,3	3,7	2,8	2,4	-0,1	*0,4*	*-0,6*	0,6	1,9	0,3	71,7	6,7	21,0
1989	-1,0	-0,3	3,9	2,9	2,9	0,2	*0,8*	*-0,6*	0,7	1,9	0,7	72,1	6,8	21,8
1990	1,7	1,8	5,7	2,9	3,6	0,8	*1,3*	*-0,5*	0,8	2,0	1,6	72,5	6,8	22,7
1991	4,0	3,6	5,1	2,8	3,2	0,4	*0,9*	*-0,5*	0,8	1,9	0,9	72,8	6,8	23,1
1992	3,6	3,0	2,2	2,6	2,9	0,0	*0,5*	*-0,5*	1,0	1,9	0,6	73,1	7,0	23,5
1993	0,3	-0,4	-0,8	2,5	2,5	-0,1	*0,4*	*-0,5*	0,8	1,8	0,5	73,3	7,2	21,9
1994	0,6	0,0	2,7	2,3	2,3	-0,2	*0,2*	*-0,5*	0,8	1,7	0,1	73,6	7,3	22,4
1995	0,4	-0,3	1,9	2,1	2,3	-0,1	*0,4*	*-0,4*	0,8	1,6	0,2	73,8	7,2	21,8
1996	-0,6	-1,2	1,0	2,0	1,9	-0,2	*0,2*	*-0,4*	0,7	1,4	0,2	74,1	7,4	21,3
1997	-0,6	-1,1	1,8	1,8	1,7	-0,3	*0,1*	*-0,4*	0,7	1,3	0,1	74,3	7,7	21,2
1998	-0,3	-0,8	2,0	1,7	1,7	-0,2	*0,2*	*-0,4*	0,7	1,2	0,0	74,7	7,8	21,6
1999	0,1	-0,5	2,0	1,6	1,7	-0,2	*0,2*	*-0,4*	0,7	1,2	-0,1	75,0	7,9	22,3
2000	1,8	1,1	3,2	1,5	1,5	-0,3	*0,2*	*-0,4*	0,7	1,1	-0,2	75,4	7,9	22,6
2001	1,6	1,1	1,2	1,4	1,3	-0,3	*0,1*	*-0,4*	0,6	1,0	-0,1	75,8	8,1	21,5
2002	0,4	0,1	0,1	1,3	1,1	-0,2	*0,1*	*-0,4*	0,4	0,9	-0,1	76,1	8,3	20,0
2003	-1,0	-1,1	-0,2	1,2	1,0	-0,2	*0,1*	*-0,3*	0,3	0,9	-0,2	76,5	8,4	19,6
2004	-0,6	-0,6	1,6	1,2	1,1	0,0	*0,3*	*-0,3*	0,3	0,9	0,1	76,9	8,5	19,4
2005	-1,0	-0,9	0,8	1,2	1,1	-0,1	*0,2*	*-0,3*	0,3	0,9	0,0	77,2	8,6	19,1
2006	-1,0	-0,8	1,2	1,2	1,1	-0,1	*0,2*	*-0,3*	0,3	0,9	0,0	77,5	8,7	19,2
2007	-0,8	-0,4	1,6	1,3	1,2	-0,1	*0,2*	*-0,3*	0,3	0,9	0,0	77,8	8,8	19,3
2008				1,4	1,2	-0,1	*0,1*	*-0,3*	0,3	1,0	-0,1	78,2	8,8	19,5
2009				1,4	1,2	-0,2	*0,1*	*-0,3*	0,3	1,0	-0,2	78,4	8,9	19,5
2010				1,4	1,2	-0,2	*0,1*	*-0,3*	0,3	1,1	-0,2	78,7	8,9	19,5
Periods	**Period Averages**													
1981-1985	-1,5	-2,3	1,2	2,0	2,1	0,0	*0,6*	*-0,6*	0,7	1,4	0,9	69,6	5,3	21,3
1986-1990	-1,2	-0,8	3,5	2,7	2,6	0,1	*0,7*	*-0,6*	0,7	1,8	0,6	71,6	6,6	21,3
1991-1995	1,8	1,2	2,2	2,5	2,6	0,0	*0,5*	*-0,5*	0,8	1,8	0,5	73,3	7,1	22,6
1996-2000	0,1	-0,5	2,0	1,7	1,7	-0,2	*0,2*	*-0,4*	0,7	1,3	0,0	74,7	7,7	21,8
2001-2005	-0,1	-0,3	0,7	1,3	1,1	-0,2	*0,2*	*-0,3*	0,4	0,9	-0,1	76,5	8,4	19,9
2006-2010				1,3	1,2	-0,1	*0,2*	*-0,3*	0,3	1,0	-0,1	78,1	8,8	19,4

el	Output Gaps (% of Potential Output)		Actual Output Growth (annual % change)	Potential Growth (annual % change)		Contributions to Potential Growth*					Determinants of Labour Potential and Capital Accumulation			
	HP Filter	PF method		HP Trend Growth	PF Potential Growth	Total Labour (Hours) Contribution	*Labour (persons) Contribution*	*Changes in Hours (per Empl) Contribution*	Capital Accumulation Contribution	TFP Contribution	Growth of Working Age Population (annual % change)	Trend Participation Rate (% of Working Age Population)	NAIRU (% of Labour Force)	Investment Ratio (% of Potential Output)
1981	0,7	0,0	-1,6	1,4	1,7	0,7	*1,2*	*-0,5*	1,3	-0,3	1,5	57,3	4,2	22,5
1982	-1,5	-2,2	-1,1	1,1	1,1	0,3	*0,8*	*-0,5*	1,2	-0,5	1,1	57,6	4,5	21,4
1983	-3,4	-4,2	-1,1	0,9	1,0	0,4	*0,8*	*-0,5*	1,1	-0,5	1,1	57,8	4,8	20,5
1984	-2,2	-3,1	2,0	0,8	0,8	0,4	*0,9*	*-0,5*	0,9	-0,5	1,0	58,0	4,8	18,8
1985	-0,5	-1,2	2,5	0,8	0,6	0,0	*0,4*	*-0,4*	1,0	-0,4	0,5	58,2	5,0	20,4
1986	-0,8	-1,3	0,5	0,8	0,7	0,0	*0,3*	*-0,4*	1,0	-0,3	0,5	58,3	5,1	21,2
1987	-3,8	-4,2	-2,3	0,9	0,7	0,1	*0,4*	*-0,3*	0,8	-0,2	0,8	58,3	5,4	17,7
1988	-0,7	-1,0	4,3	1,0	0,9	0,1	*0,4*	*-0,2*	0,9	-0,1	0,9	58,3	5,7	19,7
1989	1,9	1,5	3,8	1,1	1,3	0,3	*0,5*	*-0,2*	0,9	0,1	1,1	58,3	5,9	20,2
1990	0,6	-0,1	0,0	1,2	1,6	0,5	*0,6*	*-0,1*	0,9	0,2	1,1	58,2	6,0	20,2
1991	2,4	1,3	3,1	1,4	1,6	0,4	*0,5*	*-0,1*	1,0	0,3	1,2	58,2	6,5	21,3
1992	1,5	0,3	0,7	1,5	1,7	0,5	*0,5*	*-0,1*	0,8	0,4	1,3	58,2	6,8	19,7
1993	-1,8	-3,0	-1,6	1,7	1,8	0,4	*0,5*	*-0,1*	0,8	0,6	1,1	58,2	7,2	18,5
1994	-1,7	-3,0	2,0	2,0	2,0	0,5	*0,5*	*-0,1*	0,7	0,8	1,0	58,3	7,5	17,9
1995	-1,9	-3,1	2,1	2,2	2,2	0,4	*0,5*	*-0,1*	0,7	1,1	0,9	58,4	7,9	18,0
1996	-2,1	-3,2	2,4	2,6	2,5	0,4	*0,5*	*-0,1*	0,7	1,3	0,9	58,6	8,2	19,1
1997	-1,3	-2,5	3,6	2,9	2,9	0,5	*0,6*	*0,0*	0,8	1,6	0,8	58,7	8,4	19,8
1998	-1,1	-2,2	3,4	3,2	3,0	0,3	*0,3*	*0,0*	0,9	1,7	0,7	58,9	8,9	21,3
1999	-1,1	-1,9	3,4	3,4	3,2	0,2	*0,2*	*0,0*	1,0	1,9	0,6	59,1	9,4	22,9
2000	-0,3	-1,2	4,5	3,6	3,7	0,6	*0,6*	*0,1*	1,1	2,0	0,5	59,4	9,4	23,8
2001	0,5	-0,2	4,6	3,8	3,5	0,3	*0,3*	*0,1*	1,2	2,0	0,3	59,6	9,6	24,6
2002	0,4	0,1	3,8	3,9	3,5	0,3	*0,2*	*0,1*	1,2	2,0	0,2	59,8	9,8	25,1
2003	1,1	0,6	4,6	3,9	4,1	0,8	*0,7*	*0,1*	1,4	1,9	0,6	60,1	9,7	27,4
2004	1,8	2,0	4,7	3,9	3,2	0,0	*0,0*	*0,0*	1,4	1,8	0,0	60,3	10,2	28,0
2005	1,4	2,0	3,5	3,9	3,5	0,6	*0,5*	*0,0*	1,3	1,6	0,4	60,6	10,2	27,4
2006	1,0	2,0	3,4	3,8	3,4	0,6	*0,5*	*0,0*	1,3	1,5	0,4	60,9	10,2	27,6
2007	0,7	2,2	3,4	3,7	3,2	0,5	*0,5*	*0,0*	1,3	1,3	0,4	61,1	10,3	27,9
2008				3,7	3,0	0,4	*0,4*	*0,0*	1,4	1,2	0,3	61,3	10,3	28,5
2009				3,6	2,9	0,4	*0,4*	*0,0*	1,4	1,1	0,3	61,5	10,3	29,2
2010				3,5	2,7	0,2	*0,2*	*-0,1*	1,4	1,1	0,0	61,7	10,3	30,0
Periods	**Period Averages**													
1981-1985	-1,4	-2,1	0,2	1,0	1,0	0,4	*0,8*	*-0,5*	1,1	-0,4	1,0	57,8	4,7	20,7
1986-1990	-0,6	-1,0	1,3	1,0	1,0	0,2	*0,4*	*-0,2*	0,9	-0,1	0,9	58,3	5,6	19,8
1991-1995	-0,3	-1,5	1,3	1,8	1,9	0,4	*0,5*	*-0,1*	0,8	0,6	1,1	58,3	7,2	19,1
1996-2000	-1,2	-2,2	3,5	3,1	3,1	0,4	*0,4*	*0,0*	0,9	1,7	0,7	59,0	8,9	21,4
2001-2005	1,0	0,9	4,2	3,9	3,6	0,4	*0,3*	*0,1*	1,3	1,9	0,3	60,1	9,9	26,5
2006-2010				3,7	3,0	0,4	*0,4*	*0,0*	1,4	1,3	0,3	61,3	10,3	28,6

es

	Output Gaps (% of Potential Output)		Actual Output Growth (annual % change)	Potential Growth (annual % change)		Contributions to Potential Growth*					Determinants of Labour Potential and Capital Accumulation			
	HP Filter	PF method		HP Trend Growth	PF Potential Growth	Total Labour (Hours) Contribution	*Labour (persons) Contribution*	*Changes in Hours (per Empl) Contribution*	Capital Accumulation Contribution	TFP Contribution	Growth of Working Age Population (annual % change)	Trend Participation Rate (% of Working Age Population)	NAIRU (% of Labour Force)	Investment Ratio (% of Potential Output)
1981	-2,4	-3,4	-0,1	1,7	1,7	-1,3	*-0,6*	*-0,7*	1,0	2,0	1,2	57,9	9,5	18,1
1982	-2,9	-3,8	1,2	1,8	1,7	-1,2	*-0,5*	*-0,7*	0,9	2,0	1,1	57,6	10,9	18,0
1983	-3,1	-3,8	1,8	2,0	1,8	-1,0	*-0,3*	*-0,7*	0,8	2,0	1,1	57,6	12,2	17,4
1984	-3,5	-3,7	1,8	2,2	1,7	-0,9	*-0,2*	*-0,7*	0,6	1,9	1,0	57,6	13,4	16,3
1985	-3,6	-3,4	2,3	2,4	2,0	-0,5	*0,1*	*-0,6*	0,7	1,8	0,9	57,8	14,3	17,1
1986	-3,0	-2,7	3,3	2,7	2,5	-0,1	*0,4*	*-0,5*	0,9	1,7	0,8	58,1	14,9	18,4
1987	-0,5	-0,1	5,5	2,8	2,8	0,2	*0,7*	*-0,5*	1,1	1,5	0,8	58,5	15,3	20,1
1988	1,6	1,8	5,1	2,9	3,2	0,4	*0,8*	*-0,4*	1,3	1,3	0,8	59,0	15,6	22,1
1989	3,4	3,1	4,8	3,0	3,5	0,7	*1,0*	*-0,3*	1,6	1,2	0,8	59,6	15,7	23,9
1990	4,3	3,5	3,8	2,9	3,4	0,7	*1,0*	*-0,2*	1,6	1,0	0,7	60,1	15,9	24,6
1991	4,0	2,8	2,5	2,8	3,3	0,8	*1,0*	*-0,2*	1,6	0,9	0,8	60,7	16,0	24,3
1992	2,2	0,8	0,9	2,8	2,9	0,8	*1,0*	*-0,2*	1,3	0,8	0,8	61,3	16,3	22,6
1993	-1,6	-2,5	-1,0	2,7	2,4	0,7	*0,9*	*-0,1*	1,0	0,7	0,7	61,9	16,6	20,1
1994	-2,0	-2,6	2,4	2,8	2,5	0,9	*1,0*	*-0,2*	1,0	0,6	0,6	62,5	16,6	20,0
1995	-2,1	-2,5	2,8	2,9	2,7	1,0	*1,2*	*-0,2*	1,1	0,6	0,5	63,1	16,4	21,0
1996	-2,6	-2,7	2,4	3,0	2,7	1,0	*1,3*	*-0,2*	1,1	0,5	0,4	63,8	16,1	21,0
1997	-2,0	-1,8	3,8	3,2	2,8	1,2	*1,4*	*-0,2*	1,1	0,5	0,4	64,6	15,6	21,4
1998	-0,9	-0,4	4,5	3,3	3,1	1,3	*1,6*	*-0,3*	1,3	0,4	0,4	65,4	14,9	23,1
1999	0,4	0,9	4,7	3,4	3,3	1,5	*1,8*	*-0,4*	1,5	0,4	0,5	66,3	14,1	24,7
2000	1,9	2,5	5,1	3,5	3,5	1,6	*2,0*	*-0,4*	1,5	0,3	0,9	67,1	13,3	25,5
2001	1,9	2,4	3,5	3,5	3,6	1,8	*2,2*	*-0,4*	1,5	0,3	1,2	68,0	12,6	25,7
2002	1,1	1,5	2,7	3,5	3,6	1,9	*2,3*	*-0,4*	1,5	0,2	1,6	68,8	11,9	25,6
2003	0,6	0,8	3,0	3,5	3,7	2,0	*2,5*	*-0,5*	1,5	0,1	1,8	69,6	11,2	26,1
2004	0,2	0,2	3,1	3,5	3,6	2,0	*2,4*	*-0,4*	1,6	0,0	1,8	70,4	10,5	26,4
2005	0,0	0,0	3,4	3,5	3,6	1,9	*2,4*	*-0,4*	1,6	0,0	1,7	71,1	9,7	27,1
2006	-0,3	-0,2	3,2	3,6	3,4	1,7	*2,2*	*-0,4*	1,7	0,0	1,6	71,8	9,0	27,6
2007	-1,0	-0,5	3,0	3,7	3,3	1,7	*2,0*	*-0,4*	1,7	0,0	1,6	72,4	8,3	27,9
2008				3,8	2,2	0,5	*0,9*	*-0,4*	1,6	0,1	0,3	72,9	8,0	28,0
2009				3,8	1,9	0,2	*0,6*	*-0,4*	1,5	0,2	0,2	73,3	7,9	28,0
2010				3,9	1,7	0,0	*0,4*	*-0,4*	1,4	0,2	0,1	73,7	7,8	28,0
Periods	**Period Averages**													
1981-1985	-3,1	-3,6	1,4	2,0	1,8	-1,0	*-0,3*	*-0,7*	0,8	2,0	1,1	57,7	12,1	17,4
1986-1990	1,2	1,1	4,5	2,9	3,1	0,4	*0,8*	*-0,4*	1,3	1,3	0,8	59,1	15,5	21,8
1991-1995	0,1	-0,8	1,5	2,8	2,7	0,8	*1,0*	*-0,2*	1,2	0,7	0,7	61,9	16,4	21,6
1996-2000	-0,6	-0,3	4,1	3,3	3,1	1,3	*1,6*	*-0,3*	1,3	0,4	0,5	65,4	14,8	23,1
2001-2005	0,8	1,0	3,1	3,5	3,6	1,9	*2,4*	*-0,4*	1,6	0,1	1,6	69,6	11,2	26,2
2006-2010				3,8	2,5	0,8	*1,2*	*-0,4*	1,6	0,1	0,8	72,8	8,2	27,9

fr	Output Gaps (% of Potential Output)		Actual Output Growth (annual % change)	Potential Growth (annual % change)		Contributions to Potential Growth*					Determinants of Labour Potential and Capital Accumulation			
	HP Filter	PF method		HP Trend Growth	PF Potential Growth	Total Labour (Hours) Contribution	*Labour (persons) Contribution*	*Changes in Hours (per Empl) Contribution*	Capital Accumulation Contribution	TFP Contribution	Growth of Working Age Population (annual % change)	Trend Participation Rate (% of Working Age Population)	NAIRU (% of Labour Force)	Investment Ratio (% of Potential Output)
1981	-0,6	-1,1	1,6	2,4	2,8	-0,3	*0,4*	*-0,7*	0,9	2,1	1,4	67,9	6,3	18,7
1982	-0,1	-0,8	2,9	2,4	2,7	-0,2	*0,4*	*-0,6*	0,8	2,1	1,4	67,7	6,7	18,0
1983	-0,4	-1,4	2,0	2,3	2,6	-0,1	*0,5*	*-0,6*	0,7	2,0	1,3	67,5	6,9	17,2
1984	-1,0	-1,9	1,7	2,3	2,2	-0,5	*0,1*	*-0,5*	0,6	2,0	1,1	67,3	7,5	16,8
1985	-1,4	-2,2	1,9	2,3	2,2	-0,3	*0,1*	*-0,5*	0,6	1,9	0,8	67,1	7,7	16,8
1986	-1,4	-1,9	2,3	2,3	2,0	-0,5	*-0,1*	*-0,4*	0,7	1,8	0,5	66,9	8,1	17,5
1987	-1,5	-2,0	2,1	2,3	2,2	-0,3	*0,0*	*-0,4*	0,8	1,7	0,6	66,9	8,4	18,1
1988	0,4	-0,1	4,3	2,3	2,4	-0,1	*0,2*	*-0,3*	0,9	1,6	0,6	66,8	8,7	19,3
1989	2,0	1,3	3,8	2,3	2,4	-0,1	*0,2*	*-0,3*	1,0	1,5	0,5	66,8	8,9	20,2
1990	2,5	1,6	2,7	2,2	2,4	-0,1	*0,2*	*-0,3*	1,0	1,4	0,4	66,9	9,1	20,7
1991	1,6	0,9	1,2	2,1	1,9	-0,3	*0,0*	*-0,3*	0,9	1,4	0,2	67,0	9,4	20,0
1992	1,5	1,0	1,9	2,0	1,8	-0,2	*0,1*	*-0,3*	0,8	1,3	0,2	67,1	9,8	19,5
1993	-1,5	-1,7	-1,0	2,0	1,8	-0,3	*0,1*	*-0,3*	0,8	1,3	0,2	67,3	10,2	18,0
1994	-1,4	-1,5	2,1	2,0	1,8	-0,2	*0,2*	*-0,3*	0,7	1,3	0,2	67,5	10,4	17,9
1995	-1,1	-1,3	2,4	2,1	2,2	0,1	*0,5*	*-0,4*	0,8	1,3	0,2	67,8	10,3	17,9
1996	-2,1	-2,0	1,1	2,1	1,8	-0,2	*0,3*	*-0,4*	0,7	1,3	0,3	68,1	10,5	17,7
1997	-1,9	-1,7	2,4	2,2	2,0	0,1	*0,5*	*-0,5*	0,6	1,3	0,3	68,4	10,5	17,4
1998	-0,7	-0,3	3,6	2,3	2,1	0,0	*0,5*	*-0,5*	0,7	1,3	0,3	68,7	10,4	18,3
1999	0,4	0,8	3,3	2,3	2,3	0,0	*0,6*	*-0,5*	0,9	1,4	0,3	69,0	10,3	19,3
2000	2,1	2,3	4,1	2,3	2,5	0,2	*0,8*	*-0,6*	0,9	1,3	0,4	69,4	10,0	20,2
2001	2,0	1,9	2,1	2,2	2,4	0,2	*0,8*	*-0,6*	0,9	1,3	0,4	69,7	9,7	20,2
2002	1,1	1,1	1,2	2,1	2,1	0,0	*0,6*	*-0,5*	0,8	1,3	0,5	69,9	9,7	19,5
2003	-0,2	-0,2	0,8	2,1	2,1	0,1	*0,6*	*-0,5*	0,8	1,2	0,5	70,2	9,6	19,6
2004	0,1	-0,2	2,3	2,0	2,3	0,2	*0,6*	*-0,5*	0,9	1,2	0,5	70,4	9,4	19,6
2005	-0,3	-0,5	1,5	2,0	1,9	-0,2	*0,3*	*-0,4*	0,9	1,2	-0,1	70,6	9,3	19,8
2006	-0,5	-0,9	1,8	2,0	2,2	0,1	*0,5*	*-0,4*	0,9	1,2	0,3	70,7	9,1	19,9
2007	-0,2	-1,0	2,3	2,0	2,4	0,3	*0,7*	*-0,4*	0,9	1,2	0,5	70,9	8,8	20,1
2008				1,9	2,3	0,2	*0,5*	*-0,4*	0,9	1,2	0,4	71,1	8,7	20,1
2009				1,9	2,2	0,0	*0,4*	*-0,4*	0,9	1,3	0,3	71,4	8,7	19,9
2010				1,9	2,2	0,0	*0,4*	*-0,4*	0,8	1,3	0,2	71,6	8,7	19,8
Periods	**Period Averages**													
1981-1985	-0,7	-1,5	2,0	2,3	2,5	-0,3	*0,3*	*-0,6*	0,8	2,0	1,2	67,5	7,0	17,5
1986-1990	0,4	-0,2	3,1	2,3	2,3	-0,2	*0,1*	*-0,3*	0,9	1,6	0,5	66,9	8,6	19,2
1991-1995	-0,2	-0,5	1,3	2,0	1,9	-0,2	*0,2*	*-0,3*	0,8	1,3	0,2	67,4	10,0	18,7
1996-2000	-0,4	-0,2	2,9	2,2	2,2	0,0	*0,5*	*-0,5*	0,8	1,3	0,3	68,7	10,3	18,6
2001-2005	0,5	0,4	1,6	2,1	2,1	0,1	*0,6*	*-0,5*	0,8	1,2	0,4	70,1	9,5	19,7
2006-2010				1,9	2,3	0,1	*0,5*	*-0,4*	0,9	1,2	0,3	71,2	8,8	20,0

ie	Output Gaps (% of Potential Output)		Actual Output Growth (annual % change)	Potential Growth (annual % change)		Contributions to Potential Growth*					Determinants of Labour Potential and Capital Accumulation			
	HP Filter	PF method		HP Trend Growth	PF Potential Growth	Total Labour (Hours) Contribution	*Labour (persons) Contribution*	*Changes in Hours (per Empl) Contribution*	Capital Accumulation Contribution	TFP Contribution	Growth of Working Age Population (annual % change)	Trend Participation Rate (% of Working Age Population)	NAIRU (% of Labour Force)	Investment Ratio (% of Potential Output)
1981	2,8	1,0	3,3	3,3	3,6	-0,4	*0,0*	*-0,4*	1,9	2,0	1,4	64,7	10,8	27,1
1982	1,9	0,0	2,3	3,1	3,3	-0,4	*-0,1*	*-0,3*	1,7	2,0	1,2	64,4	11,7	25,4
1983	-1,3	-3,1	-0,2	3,0	2,9	-0,4	*-0,2*	*-0,2*	1,3	2,0	1,2	64,2	12,7	22,4
1984	-0,1	-1,8	4,3	3,0	3,0	-0,3	*-0,2*	*-0,1*	1,2	2,1	1,2	63,9	13,7	21,2
1985	-0,1	-1,6	3,1	3,1	2,8	-0,4	*-0,3*	*0,0*	1,0	2,2	0,9	63,7	14,5	19,0
1986	-3,0	-4,0	0,3	3,3	2,8	-0,4	*-0,4*	*0,0*	0,9	2,4	0,4	63,4	15,0	18,5
1987	-2,0	-2,3	4,7	3,6	2,8	-0,5	*-0,5*	*0,0*	0,8	2,6	0,1	63,2	15,4	17,6
1988	-1,7	-1,2	4,3	3,9	3,1	-0,4	*-0,3*	*-0,1*	0,7	2,8	0,0	63,0	15,6	16,8
1989	0,1	1,0	6,2	4,3	3,9	-0,1	*0,1*	*-0,2*	0,9	3,1	0,1	62,9	15,5	18,7
1990	2,9	3,7	7,6	4,7	4,9	0,5	*0,7*	*-0,3*	1,1	3,3	0,8	62,9	15,2	19,9
1991	-0,2	0,5	1,9	5,1	5,1	0,7	*1,1*	*-0,3*	0,8	3,5	1,4	62,9	15,0	17,7
1992	-2,3	-1,6	3,3	5,6	5,6	1,1	*1,5*	*-0,4*	0,8	3,7	1,5	63,1	14,6	16,7
1993	-5,4	-4,5	2,7	6,1	5,8	1,2	*1,7*	*-0,5*	0,6	3,9	1,4	63,4	14,0	15,0
1994	-6,1	-5,0	5,8	6,6	6,4	1,5	*2,0*	*-0,6*	0,7	4,1	1,4	63,8	13,0	15,8
1995	-3,8	-2,6	9,8	7,1	7,1	1,8	*2,4*	*-0,6*	0,9	4,2	1,6	64,3	11,8	16,9
1996	-3,1	-2,0	8,3	7,5	7,6	1,9	*2,7*	*-0,7*	1,2	4,3	1,9	64,9	10,7	18,5
1997	0,4	1,2	11,7	7,8	8,2	2,2	*3,0*	*-0,8*	1,5	4,3	2,0	65,6	9,4	20,2
1998	1,1	1,3	8,5	7,9	8,4	2,2	*3,0*	*-0,8*	1,8	4,2	1,8	66,4	8,0	21,4
1999	3,8	3,6	10,7	7,8	8,3	2,1	*2,9*	*-0,8*	2,0	4,0	1,8	67,2	6,8	22,7
2000	5,5	4,9	9,2	7,5	7,9	2,1	*2,8*	*-0,8*	1,9	3,7	2,0	68,0	5,7	22,6
2001	4,5	3,7	6,2	7,1	7,4	2,0	*2,8*	*-0,7*	1,8	3,4	2,2	68,8	4,8	21,0
2002	4,0	3,1	6,1	6,7	6,7	1,8	*2,4*	*-0,7*	1,7	3,1	2,2	69,5	4,3	20,4
2003	2,2	1,4	4,4	6,2	6,1	1,5	*2,1*	*-0,6*	1,7	2,8	1,9	70,1	4,0	20,3
2004	0,9	0,1	4,5	5,8	5,8	1,3	*1,8*	*-0,6*	1,9	2,6	1,8	70,8	3,8	20,7
2005	-0,1	-1,6	4,4	5,4	6,1	1,6	*2,2*	*-0,5*	1,9	2,4	2,4	71,4	3,7	21,1
2006	-0,4	-2,2	4,8	5,1	5,5	1,3	*1,7*	*-0,5*	1,9	2,3	1,9	71,9	3,8	20,6
2007	-0,4	-2,6	5,0	4,9	5,3	1,1	*1,6*	*-0,5*	1,8	2,3	1,8	72,5	3,9	20,2
2008				4,7	4,7	0,7	*1,1*	*-0,4*	1,7	2,3	1,0	73,1	3,9	19,6
2009				4,5	4,5	0,6	*1,0*	*-0,4*	1,5	2,3	0,8	73,7	4,0	18,8
2010				4,4	4,4	0,6	*1,0*	*-0,4*	1,4	2,4	0,8	74,2	4,0	18,1
Periods	**Period Averages**													
1981-1985	0,6	-1,1	2,6	3,1	3,1	-0,4	*-0,2*	*-0,2*	1,4	2,0	1,2	64,2	12,7	23,0
1986-1990	-0,8	-0,6	4,6	4,0	3,5	-0,2	*-0,1*	*-0,1*	0,9	2,8	0,3	63,1	15,3	18,3
1991-1995	-3,5	-2,6	4,7	6,1	6,0	1,3	*1,8*	*-0,5*	0,8	3,9	1,5	63,5	13,7	16,4
1996-2000	1,5	1,8	9,7	7,7	8,1	2,1	*2,9*	*-0,8*	1,7	4,1	1,9	66,4	8,1	21,1
2001-2005	2,3	1,3	5,1	6,3	6,4	1,6	*2,3*	*-0,6*	1,8	2,9	2,1	70,1	4,1	20,7
2006-2010				4,7	4,9	0,8	*1,3*	*-0,5*	1,7	2,3	1,2	73,1	3,9	19,5

it

	Output Gaps (% of Potential Output)		Actual Output Growth (annual % change)	Potential Growth (annual % change)		Contributions to Potential Growth*					Determinants of Labour Potential and Capital Accumulation			
	HP Filter	PF method		HP Trend Growth	PF Potential Growth	Total Labour (Hours) Contribution	*Labour (persons) Contribution*	*Changes in Hours (per Empl) Contribution*	Capital Accumulation Contribution	TFP Contribution	Growth of Working Age Population (annual % change)	Trend Participation Rate (% of Working Age Population)	NAIRU (% of Labour Force)	Investment Ratio (% of Potential Output)
1981	0,8	1,2	0,8	2,6	2,6	0,0	0,3	-0,3	1,1	1,5	1,0	62,3	8,0	21,4
1982	-1,0	-0,7	0,6	2,5	2,6	0,2	0,5	-0,3	1,0	1,4	1,1	62,3	8,3	20,1
1983	-2,2	-2,3	1,2	2,4	2,8	0,6	0,8	-0,3	0,9	1,4	1,1	62,4	8,2	19,3
1984	-1,8	-2,1	2,8	2,4	2,5	0,3	0,6	-0,2	0,9	1,3	1,0	62,4	8,4	19,5
1985	-1,3	-1,4	3,0	2,4	2,3	0,2	0,4	-0,2	0,8	1,3	0,6	62,5	8,6	19,1
1986	-1,1	-1,0	2,5	2,4	2,1	0,0	0,1	-0,2	0,8	1,3	0,3	62,7	8,8	19,2
1987	-0,4	-0,1	3,0	2,3	2,1	0,0	0,1	-0,1	0,8	1,2	0,4	62,8	9,2	19,6
1988	1,2	1,5	3,9	2,2	2,3	0,1	0,3	-0,1	0,9	1,2	0,3	62,9	9,4	20,4
1989	2,0	2,1	2,9	2,1	2,3	0,1	0,3	-0,1	0,9	1,1	0,3	63,1	9,5	20,8
1990	1,9	1,7	2,0	2,0	2,4	0,3	0,4	-0,1	1,0	1,1	0,3	63,2	9,4	21,1
1991	1,5	0,8	1,4	1,9	2,3	0,3	0,5	-0,1	0,9	1,1	0,5	63,4	9,5	20,9
1992	0,5	-0,4	0,8	1,8	2,0	0,1	0,3	-0,2	0,8	1,1	0,3	63,5	9,6	20,2
1993	-2,1	-2,3	-0,9	1,7	1,0	-0,6	-0,4	-0,2	0,5	1,0	-0,1	63,6	10,3	17,8
1994	-1,6	-1,4	2,2	1,7	1,2	-0,3	-0,1	-0,2	0,5	1,0	-0,2	63,8	10,5	17,6
1995	-0,3	0,3	2,9	1,6	1,2	-0,4	-0,2	-0,2	0,6	1,0	-0,1	64,0	11,0	18,4
1996	-0,9	0,0	1,1	1,6	1,4	-0,1	0,1	-0,2	0,6	0,9	-0,1	64,3	11,2	18,8
1997	-0,5	0,6	2,0	1,6	1,5	0,1	0,3	-0,2	0,6	0,8	-0,1	64,7	11,3	18,9
1998	-0,2	0,6	1,8	1,6	1,7	0,4	0,6	-0,2	0,6	0,7	-0,1	65,1	10,9	19,3
1999	-0,1	0,7	1,7	1,5	1,6	0,4	0,6	-0,3	0,7	0,6	-0,1	65,6	10,6	20,0
2000	1,4	1,8	3,0	1,5	1,8	0,6	0,9	-0,3	0,8	0,4	-0,1	66,1	10,1	21,0
2001	1,8	1,8	1,8	1,4	1,8	0,7	1,0	-0,3	0,8	0,3	-0,1	66,6	9,4	21,0
2002	0,9	0,6	0,4	1,3	1,6	0,6	0,9	-0,3	0,7	0,3	-0,1	67,2	8,9	20,9
2003	-0,1	-0,4	0,3	1,2	1,3	0,4	0,7	-0,3	0,6	0,2	-0,1	67,8	8,6	20,3
2004	0,0	-0,5	1,2	1,2	1,4	0,5	0,8	-0,3	0,6	0,2	-0,1	68,3	8,2	20,4
2005	-1,0	-1,5	0,2	1,1	1,2	0,3	0,6	-0,3	0,6	0,3	-0,2	68,9	7,9	20,0
2006	-0,6	-1,2	1,5	1,1	1,2	0,3	0,5	-0,3	0,6	0,3	-0,2	69,5	7,7	20,3
2007	-0,3	-1,2	1,4	1,1	1,3	0,3	0,6	-0,3	0,6	0,4	-0,1	70,0	7,5	20,5
2008				1,1	1,4	0,3	0,5	-0,3	0,6	0,5	-0,1	70,6	7,4	20,4
2009				1,1	1,4	0,2	0,4	-0,3	0,6	0,6	-0,1	71,1	7,3	20,2
2010				1,1	1,4	0,2	0,4	-0,3	0,5	0,7	-0,1	71,6	7,3	20,1
Periods	**Period Averages**													
1981-1985	-1,1	-1,0	1,7	2,5	2,6	0,3	0,5	-0,3	0,9	1,4	1,0	62,4	8,3	19,9
1986-1990	0,7	0,9	2,9	2,2	2,2	0,1	0,2	-0,1	0,9	1,2	0,3	62,9	9,3	20,2
1991-1995	-0,4	-0,6	1,3	1,7	1,6	-0,2	0,0	-0,2	0,7	1,0	0,1	63,7	10,2	19,0
1996-2000	-0,1	0,7	1,9	1,6	1,6	0,3	0,5	-0,2	0,7	0,7	-0,1	65,1	10,8	19,6
2001-2005	0,3	0,0	0,8	1,2	1,4	0,5	0,8	-0,3	0,7	0,3	-0,1	67,8	8,6	20,5
2006-2010				1,1	1,3	0,2	0,5	-0,3	0,6	0,5	-0,1	70,6	7,4	20,3

lu	Output Gaps (% of Potential Output)		Actual Output Growth (annual % change)	Potential Growth (annual % change)		Contributions to Potential Growth*					Determinants of Labour Potential and Capital Accumulation			
	HP Filter	PF method		HP Trend Growth	PF Potential Growth	Total Labour (Hours) Contribution	*Labour (persons) Contribution*	*Changes in Hours (per Empl) Contribution*	Capital Accumulation Contribution	TFP Contribution	Growth of Working Age Population (annual % change)	Trend Participation Rate (% of Working Age Population)	NAIRU (% of Labour Force)	Investment Ratio (% of Potential Output)
1981	-3,0	0,0	-0,6	2,6					0,8	2,1	0,9	65,2	#N/A	#N/A
1982	-4,8	-5,7	1,1	3,0					0,8	2,4	0,7	65,4	2,1	21,5
1983	-5,3	-5,9	3,0	3,5	3,2	0,1	0,6	-0,5	0,3	2,8	0,7	65,6	2,3	18,3
1984	-3,4	-3,7	6,2	4,1	3,8	0,5	1,0	-0,4	0,1	3,1	0,7	65,9	2,1	17,7
1985	-5,0	-4,3	2,9	4,6	3,6	0,5	0,9	-0,4	-0,2	3,3	0,5	66,5	2,1	15,5
1986	-0,6	0,3	10,0	5,1	5,0	0,8	1,1	-0,3	0,7	3,4	0,7	67,2	2,1	20,2
1987	-2,1	-1,4	4,0	5,5	5,7	1,0	1,3	-0,3	1,1	3,4	0,8	68,1	2,1	22,5
1988	0,4	0,9	8,5	5,7	6,0	1,2	1,4	-0,2	1,4	3,3	0,6	69,2	2,1	23,7
1989	4,1	4,4	9,8	5,9	6,1	1,4	1,6	-0,2	1,4	3,2	0,7	70,4	2,1	23,9
1990	3,6	3,6	5,3	5,8	6,1	1,7	1,9	-0,2	1,4	2,9	1,0	71,9	2,1	23,2
1991	6,5	5,8	8,6	5,7	6,5	1,8	2,0	-0,2	1,9	2,6	0,9	73,4	2,0	25,3
1992	2,7	2,5	1,8	5,6	5,0	1,7	2,0	-0,3	0,9	2,3	0,9	75,0	2,1	20,4
1993	1,6	1,2	4,2	5,4	5,5	1,8	2,1	-0,3	1,6	2,0	0,8	76,8	2,1	23,3
1994	0,1	0,1	3,8	5,3	5,0	1,8	2,0	-0,3	1,4	1,8	0,8	78,6	2,2	22,2
1995	-3,4	-3,2	1,4	5,2	4,8	2,0	2,3	-0,3	1,2	1,6	0,9	80,6	2,1	20,9
1996	-5,2	-4,4	3,3	5,2	4,6	1,9	2,2	-0,3	1,2	1,4	1,0	82,7	2,3	20,7
1997	-2,4	-1,5	8,3	5,2	5,1	2,0	2,3	-0,3	1,7	1,3	1,0	84,9	2,3	22,2
1998	-0,8	0,0	6,9	5,2	5,3	2,0	2,4	-0,3	2,0	1,2	1,0	87,3	2,5	23,6
1999	1,8	1,8	7,8	5,1	5,9	2,2	2,6	-0,4	2,5	1,1	1,2	89,9	2,6	25,5
2000	5,7	5,2	9,0	4,9	5,5	2,4	2,8	-0,4	2,0	1,0	1,6	92,5	2,8	23,3
2001	2,5	1,2	1,5	4,7	5,5	2,4	2,8	-0,4	2,2	0,9	1,5	95,3	3,0	24,3
2002	0,4	-1,0	2,5	4,5	4,7	1,9	2,3	-0,4	1,8	0,9	1,0	98,1	3,3	23,0
2003	-1,0	-2,2	2,9	4,4	4,2	1,7	2,2	-0,5	1,5	0,9	0,8	101,0	3,7	20,7
2004	-0,7	-1,8	4,5	4,2	4,1	1,6	2,0	-0,5	1,4	1,0	0,8	103,9	4,2	20,5
2005	-0,7	-1,6	4,2	4,1	4,0	1,6	2,0	-0,4	1,3	1,1	0,7	106,8	4,6	20,0
2006	-0,4	-1,3	4,4	4,1	4,1	1,5	1,9	-0,4	1,3	1,2	0,6	109,8	5,1	20,0
2007	0,1	-1,2	4,5	4,0	4,3	1,5	1,9	-0,4	1,5	1,3	0,6	112,9	5,5	20,6
2008				3,9	5,0	1,8	2,3	-0,4	1,6	1,4	1,0	115,9	5,7	21,3
2009				3,9	5,2	1,9	2,3	-0,4	1,7	1,5	1,0	118,9	5,8	21,6
2010				3,9	5,4	1,9	2,3	-0,4	1,8	1,6	1,1	122,0	5,8	21,8
Periods	**Period Averages**													
1981-1985	-4,3		2,5	3,6					0,4	2,7	0,7	65,7		#N/A
1986-1990	1,1	1,6	7,5	5,6	5,8	1,2	1,5	-0,3	1,2	3,2	0,7	69,3	2,1	22,7
1991-1995	1,5	1,3	4,0	5,4	5,4	1,8	2,1	-0,3	1,4	2,0	0,9	76,9	2,1	22,4
1996-2000	-0,2	0,2	7,1	5,1	5,3	2,1	2,5	-0,4	1,9	1,2	1,1	87,5	2,5	23,1
2001-2005	0,1	-1,1	3,1	4,4	4,5	1,8	2,3	-0,4	1,6	1,0	1,0	101,0	3,8	21,7
2006-2010				4,0	4,8	1,7	2,1	-0,4	1,6	1,4	0,9	115,9	5,6	21,1

The participation rate in excess of 100% for Luxembourg is explained by the fact that the method uses the national accounts definition of resident (domestic) employment which includes foreign workers.

nl	Output Gaps (% of Potential Output)		Actual Output Growth (annual % change)	Potential Growth (annual % change)		Contributions to Potential Growth*					Determinants of Labour Potential and Capital Accumulation			
	HP Filter	PF method		HP Trend Growth	PF Potential Growth	Total Labour (Hours) Contribution	*Labour (persons) Contribution*	*Changes in Hours (per Empl) Contribution*	Capital Accumulation Contribution	TFP Contribution	Growth of Working Age Population (annual % change)	Trend Participation Rate (% of Working Age Population)	NAIRU (% of Labour Force)	Investment Ratio (% of Potential Output)
1981	-0,5	-1,4	-0,5	1,6	1,4	-0,6	*0,1*	*-0,7*	0,7	1,3	1,3	64,7	6,8	19,2
1982	-3,3	-3,7	-1,3	1,6	1,1	-0,7	*0,0*	*-0,7*	0,6	1,3	1,1	64,4	7,4	18,3
1983	-3,3	-3,8	1,8	1,7	1,9	0,0	*0,7*	*-0,7*	0,6	1,2	1,1	64,2	7,2	18,5
1984	-2,2	-2,5	3,1	1,9	1,7	-0,1	*0,6*	*-0,7*	0,7	1,2	1,2	64,3	7,4	19,2
1985	-1,6	-2,1	2,7	2,1	2,2	0,3	*1,0*	*-0,7*	0,7	1,1	1,1	64,5	7,3	20,0
1986	-0,8	-1,3	3,1	2,3	2,3	0,4	*1,1*	*-0,7*	0,8	1,1	1,0	65,0	7,3	20,8
1987	-1,4	-1,8	1,9	2,5	2,4	0,5	*1,3*	*-0,7*	0,7	1,1	0,9	65,6	7,2	20,5
1988	-1,0	-1,5	3,0	2,6	2,6	0,6	*1,4*	*-0,7*	0,8	1,2	0,8	66,3	7,0	21,1
1989	1,0	0,5	4,8	2,7	2,7	0,6	*1,4*	*-0,7*	0,8	1,2	0,6	67,1	6,7	21,6
1990	2,2	1,8	4,1	2,8	2,8	0,8	*1,5*	*-0,7*	0,8	1,3	0,6	68,0	6,4	21,5
1991	1,9	1,3	2,4	2,8	2,8	0,8	*1,5*	*-0,7*	0,7	1,3	0,6	68,9	6,1	21,0
1992	0,5	0,0	1,5	2,8	2,9	0,9	*1,5*	*-0,6*	0,7	1,3	0,6	69,8	5,7	20,6
1993	-1,6	-1,9	0,7	2,8	2,6	0,8	*1,3*	*-0,5*	0,5	1,3	0,5	70,7	5,6	19,4
1994	-1,6	-1,7	2,9	2,9	2,6	0,8	*1,3*	*-0,5*	0,5	1,3	0,4	71,6	5,3	19,3
1995	-1,4	-1,4	3,0	2,9	2,7	0,9	*1,2*	*-0,4*	0,6	1,2	0,3	72,5	5,0	19,6
1996	-1,3	-1,1	3,0	2,9	2,7	0,9	*1,2*	*-0,3*	0,7	1,1	0,3	73,3	4,7	20,3
1997	-0,3	-0,1	3,8	2,8	2,9	1,0	*1,2*	*-0,2*	0,8	1,1	0,4	74,1	4,3	21,0
1998	1,3	1,3	4,3	2,7	2,8	1,0	*1,2*	*-0,2*	0,8	1,0	0,4	74,9	4,0	21,3
1999	2,7	2,5	4,0	2,6	2,8	1,0	*1,1*	*-0,1*	0,9	0,9	0,5	75,6	3,7	22,3
2000	3,8	3,3	3,5	2,4	2,6	1,0	*1,1*	*-0,1*	0,8	0,8	0,6	76,2	3,4	22,0
2001	3,1	2,2	1,4	2,2	2,6	1,0	*1,1*	*-0,1*	0,8	0,7	0,7	76,7	3,1	21,5
2002	1,1	0,2	0,1	2,0	2,0	0,7	*0,8*	*-0,1*	0,6	0,7	0,6	77,2	3,0	20,1
2003	-0,8	-1,5	-0,1	1,9	1,7	0,5	*0,6*	*-0,1*	0,5	0,7	0,4	77,6	3,1	19,1
2004	-0,9	-1,3	1,7	1,8	1,5	0,2	*0,3*	*-0,1*	0,5	0,7	0,2	78,0	3,2	19,4
2005	-2,2	-2,2	0,5	1,8	1,5	0,2	*0,4*	*-0,1*	0,5	0,7	0,2	78,4	3,4	19,4
2006	-2,1	-1,9	2,0	1,9	1,6	0,3	*0,4*	*-0,1*	0,6	0,8	0,1	78,9	3,5	19,9
2007	-1,7	-1,4	2,4	1,9	1,9	0,4	*0,5*	*-0,2*	0,7	0,8	0,1	79,4	3,5	20,8
2008				2,0	2,2	0,6	*0,8*	*-0,2*	0,7	0,9	0,4	80,1	3,5	21,1
2009				2,1	2,1	0,5	*0,8*	*-0,3*	0,7	0,9	0,3	80,8	3,5	21,0
2010				2,2	2,1	0,5	*0,8*	*-0,3*	0,7	0,9	0,2	81,6	3,5	20,6
Periods	**Period Averages**													
1981-1985	-2,2	-2,7	1,1	1,8	1,7	-0,2	*0,5*	*-0,7*	0,7	1,2	1,2	64,4	7,2	19,0
1986-1990	0,0	-0,5	3,4	2,6	2,6	0,6	*1,3*	*-0,7*	0,8	1,2	0,8	66,4	6,9	21,1
1991-1995	-0,4	-0,7	2,1	2,8	2,7	0,8	*1,4*	*-0,5*	0,6	1,3	0,5	70,7	5,5	20,0
1996-2000	1,3	1,2	3,7	2,7	2,8	1,0	*1,2*	*-0,2*	0,8	1,0	0,4	74,8	4,0	21,4
2001-2005	0,0	-0,5	0,7	1,9	1,8	0,5	*0,6*	*-0,1*	0,6	0,7	0,4	77,6	3,2	19,9
2006-2010				2,0	2,0	0,4	*0,7*	*-0,2*	0,7	0,9	0,2	80,2	3,5	20,7

at	Output Gaps (% of Potential Output)		Actual Output Growth (annual % change)	Potential Growth (annual % change)		Contributions to Potential Growth*					Determinants of Labour Potential and Capital Accumulation			
	HP Filter	PF method		HP Trend Growth	PF Potential Growth	Total Labour (Hours) Contribution	*Labour (persons) Contribution*	*Changes in Hours (per Empl) Contribution*	Capital Accumulation Contribution	TFP Contribution	Growth of Working Age Population (annual % change)	Trend Participation Rate (% of Working Age Population)	NAIRU (% of Labour Force)	Investment Ratio (% of Potential Output)
1981	-0,7	-1,4	-0,1	2,2	2,6	-0,1	*0,4*	*-0,5*	1,2	1,4	1,4	77,6	1,8	22,7
1982	-0,9	-1,6	1,9	2,1	2,2	-0,1	*0,3*	*-0,4*	0,9	1,4	1,3	77,2	2,1	20,3
1983	0,1	-0,6	3,1	2,1	2,0	-0,2	*0,2*	*-0,4*	0,9	1,3	1,1	76,8	2,3	20,0
1984	-2,0	-2,6	0,0	2,1	2,0	-0,2	*0,2*	*-0,4*	0,8	1,4	1,0	76,4	2,6	19,5
1985	-1,6	-2,0	2,6	2,2	1,9	-0,3	*0,0*	*-0,3*	0,9	1,4	0,5	76,2	2,8	20,2
1986	-1,6	-1,7	2,2	2,3	1,9	-0,4	*-0,1*	*-0,3*	0,8	1,4	0,3	76,0	2,9	20,2
1987	-2,4	-2,1	1,5	2,4	2,0	-0,4	*-0,1*	*-0,3*	0,9	1,5	0,1	76,0	3,1	20,6
1988	-1,5	-0,9	3,5	2,5	2,2	-0,3	*0,0*	*-0,3*	1,0	1,6	0,1	76,0	3,2	21,6
1989	-0,6	0,1	3,5	2,6	2,5	-0,1	*0,3*	*-0,4*	1,0	1,6	0,4	76,1	3,2	22,0
1990	1,3	1,8	4,6	2,6	2,9	0,2	*0,5*	*-0,4*	1,0	1,7	0,7	76,2	3,3	22,5
1991	2,2	2,2	3,6	2,6	3,1	0,3	*0,7*	*-0,4*	1,1	1,7	0,9	76,4	3,4	23,6
1992	2,0	1,5	2,4	2,6	3,1	0,3	*0,8*	*-0,5*	1,1	1,7	1,0	76,6	3,5	22,9
1993	-0,3	-0,8	0,3	2,6	2,7	0,0	*0,5*	*-0,5*	1,0	1,7	0,7	76,8	3,6	22,0
1994	-0,1	-0,6	2,7	2,5	2,5	-0,3	*0,3*	*-0,5*	1,1	1,7	0,2	77,0	3,6	22,6
1995	-0,7	-0,9	1,9	2,5	2,2	-0,4	*0,1*	*-0,5*	1,0	1,6	0,0	77,2	3,7	21,9
1996	-0,5	-0,5	2,6	2,5	2,2	-0,3	*0,2*	*-0,5*	1,0	1,5	0,1	77,5	3,8	22,0
1997	-1,1	-1,0	1,8	2,4	2,3	-0,1	*0,3*	*-0,4*	0,9	1,5	0,2	77,7	3,9	21,8
1998	0,0	0,3	3,6	2,4	2,3	0,0	*0,3*	*-0,4*	1,0	1,4	0,3	78,0	4,0	22,1
1999	1,0	1,2	3,3	2,3	2,4	0,1	*0,5*	*-0,3*	0,9	1,3	0,4	78,2	3,9	22,0
2000	2,2	2,1	3,4	2,2	2,4	0,2	*0,5*	*-0,3*	1,0	1,2	0,5	78,4	4,0	22,9
2001	0,9	0,7	0,8	2,1	2,2	0,2	*0,4*	*-0,2*	0,9	1,1	0,5	78,6	4,0	22,1
2002	-0,2	-0,2	1,0	2,0	1,9	0,2	*0,4*	*-0,1*	0,7	1,0	0,5	78,7	4,2	20,6
2003	-0,7	-0,8	1,4	2,0	2,0	0,2	*0,3*	*-0,1*	0,8	1,0	0,5	78,9	4,3	21,4
2004	-0,2	-0,2	2,4	1,9	1,8	0,1	*0,2*	*-0,1*	0,8	1,0	0,4	79,0	4,5	21,1
2005	-0,4	-0,7	1,7	1,9	2,2	0,5	*0,6*	*-0,1*	0,7	1,0	0,9	79,1	4,7	20,8
2006	-0,3	-1,0	1,9	1,9	2,2	0,5	*0,5*	*-0,1*	0,7	1,0	0,8	79,2	4,9	20,8
2007	0,0	-0,9	2,2	1,8	2,1	0,3	*0,4*	*-0,1*	0,7	1,0	0,5	79,4	5,0	21,0
2008				1,8	2,0	0,2	*0,3*	*-0,1*	0,8	1,1	0,3	79,6	5,1	21,1
2009				1,8	2,1	0,2	*0,3*	*-0,2*	0,8	1,1	0,3	79,8	5,1	21,2
2010				1,8	2,1	0,1	*0,3*	*-0,2*	0,8	1,2	0,2	80,1	5,2	21,3
Periods	**Period Averages**													
1981-1985	-1,0	-1,6	1,5	2,1	2,1	-0,2	*0,2*	*-0,4*	0,9	1,4	1,1	76,8	2,3	20,5
1986-1990	-1,0	-0,6	3,1	2,5	2,3	-0,2	*0,1*	*-0,3*	0,9	1,6	0,3	76,1	3,2	21,4
1991-1995	0,6	0,3	2,2	2,6	2,7	0,0	*0,5*	*-0,5*	1,0	1,7	0,6	76,8	3,6	22,6
1996-2000	0,3	0,4	2,9	2,4	2,3	0,0	*0,4*	*-0,4*	1,0	1,4	0,3	78,0	3,9	22,2
2001-2005	-0,1	-0,2	1,5	2,0	2,0	0,3	*0,4*	*-0,1*	0,8	1,0	0,6	78,8	4,3	21,2
2006-2010				1,8	2,1	0,2	*0,4*	*-0,1*	0,8	1,1	0,4	79,6	5,1	21,1

pt	**Output Gaps** (% of Potential Output)		**Actual Output Growth** (annual % change)	**Potential Growth** (annual % change)		**Contributions to Potential Growth***					**Determinants of Labour Potential and Capital Accumulation**			
	HP Filter	**PF method**		**HP Trend Growth**	**PF Potential Growth**	**Total Labour (Hours) Contribution**	***Labour (persons) Contribution***	***Changes in Hours (per Empl) Contribution***	**Capital Accumulation Contribution**	**TFP Contribution**	**Growth of Working Age Population (annual % change)**	**Trend Participation Rate (% of Working Age Population)**	**NAIRU (% of Labour Force)**	**Investment Ratio (% of Potential Output)**
1981	2,2	0,1	1,6	2,8	3,5	-0,5	*-0,1*	*-0,4*	2,1	1,8	1,4	78,6	6,5	23,4
1982	1,6	-0,9	2,1	2,7	3,2	-0,5	*-0,2*	*-0,3*	2,0	1,7	1,1	77,5	6,5	23,2
1983	-1,3	-3,7	-0,2	2,7	2,8	-0,6	*-0,3*	*-0,3*	1,6	1,7	1,0	76,5	6,6	21,0
1984	-5,8	-7,7	-1,9	2,8	2,3	-0,4	*-0,2*	*-0,2*	1,0	1,8	0,9	75,6	6,5	16,9
1985	-6,0	-7,2	2,8	3,0	2,3	-0,3	*-0,2*	*-0,2*	0,8	1,9	0,7	74,8	6,4	16,0
1986	-5,3	-5,7	4,1	3,3	2,5	-0,3	*-0,2*	*-0,1*	0,9	2,0	0,4	74,1	6,3	17,3
1987	-2,6	-2,8	6,4	3,5	3,1	-0,1	*-0,1*	*0,0*	1,2	2,0	0,3	73,5	6,1	19,8
1988	1,0	1,0	7,5	3,6	3,5	0,0	*0,0*	*0,0*	1,5	2,0	0,3	73,1	5,8	21,9
1989	3,8	3,9	6,4	3,6	3,4	0,0	*0,0*	*0,0*	1,4	1,9	0,2	72,9	5,7	22,0
1990	4,2	4,1	4,0	3,6	3,8	0,4	*0,4*	*0,0*	1,5	1,8	0,7	72,7	5,5	22,8
1991	5,1	4,7	4,4	3,4	3,8	0,5	*0,6*	*0,0*	1,4	1,7	0,8	72,5	5,3	22,7
1992	2,9	2,4	1,1	3,2	3,4	0,3	*0,3*	*-0,1*	1,4	1,6	0,5	72,5	5,1	23,0
1993	-2,2	-2,5	-2,0	3,1	2,9	0,2	*0,3*	*-0,1*	1,1	1,5	0,5	72,4	5,1	21,1
1994	-4,2	-4,2	1,0	3,0	2,8	0,2	*0,4*	*-0,2*	1,1	1,5	0,5	72,5	5,1	21,1
1995	-3,0	-2,7	4,3	3,0	2,7	0,3	*0,5*	*-0,2*	1,0	1,4	0,5	72,6	5,0	21,9
1996	-2,4	-1,8	3,6	3,0	2,6	0,2	*0,5*	*-0,2*	1,1	1,3	0,5	72,8	5,0	22,5
1997	-1,2	-0,6	4,2	2,9	2,9	0,2	*0,5*	*-0,3*	1,4	1,2	0,5	73,1	5,1	25,0
1998	0,6	1,0	4,7	2,8	3,1	0,4	*0,6*	*-0,3*	1,7	1,0	0,5	73,4	5,0	27,1
1999	1,9	1,9	3,9	2,6	2,9	0,3	*0,6*	*-0,3*	1,7	0,9	0,5	73,7	5,1	27,9
2000	3,4	3,0	3,8	2,3	2,7	0,3	*0,6*	*-0,3*	1,7	0,7	0,5	74,1	5,1	28,2
2001	3,5	2,7	2,0	2,0	2,3	0,4	*0,6*	*-0,2*	1,4	0,5	0,5	74,5	5,2	26,7
2002	2,3	1,3	0,5	1,6	1,9	0,4	*0,6*	*-0,2*	1,1	0,4	0,6	74,9	5,4	24,9
2003	-0,2	-1,2	-1,2	1,3	1,3	0,3	*0,5*	*-0,2*	0,7	0,3	0,6	75,2	5,7	22,1
2004	-0,1	-1,3	1,2	1,1	1,3	0,3	*0,5*	*-0,1*	0,6	0,3	0,5	75,5	5,9	22,1
2005	-0,6	-2,0	0,4	0,8	1,1	0,3	*0,4*	*-0,1*	0,5	0,3	0,5	75,8	6,1	21,4
2006	-0,4	-2,4	0,8	0,7	1,2	0,3	*0,4*	*-0,1*	0,5	0,4	0,6	76,0	6,3	21,2
2007	0,2	-2,6	1,2	0,5	1,4	0,3	*0,4*	*-0,1*	0,5	0,5	0,6	76,2	6,5	21,3
2008				0,4	1,3	0,1	*0,2*	*-0,1*	0,6	0,7	0,1	76,4	6,7	22,0
2009				0,4	1,5	0,0	*0,1*	*-0,1*	0,7	0,8	0,0	76,6	6,7	22,9
2010				0,3	1,6	-0,1	*0,0*	*-0,1*	0,8	0,9	-0,1	76,8	6,7	23,5
Periods	**Period Averages**													
1981-1985	-1,9	-3,9	0,9	2,8	2,8	-0,5	*-0,2*	*-0,3*	1,5	1,8	1,0	76,6	6,5	20,1
1986-1990	0,2	0,1	5,7	3,5	3,3	0,0	*0,0*	*0,0*	1,3	2,0	0,4	73,3	5,9	20,8
1991-1995	-0,2	-0,4	1,7	3,2	3,1	0,3	*0,4*	*-0,1*	1,2	1,6	0,5	72,5	5,1	21,9
1996-2000	0,5	0,7	4,0	2,7	2,8	0,3	*0,6*	*-0,3*	1,5	1,0	0,5	73,4	5,1	26,1
2001-2005	1,0	-0,1	0,6	1,4	1,6	0,3	*0,5*	*-0,2*	0,9	0,4	0,6	75,2	5,7	23,4
2006-2010				0,5	1,4	0,1	*0,2*	*-0,1*	0,6	0,7	0,2	76,4	6,6	22,2

fi

	Output Gaps (% of Potential Output)		Actual Output Growth	Potential Growth (annual % change)		Contributions to Potential Growth*					Determinants of Labour Potential and Capital Accumulation			
	HP Filter	PF method	(annual % change)	HP Trend Growth	PF Potential Growth	Total Labour (Hours) Contribution	*Labour (persons) Contribution*	*Changes in Hours (per Empl) Contribution*	Capital Accumulation Contribution	TFP Contribution	Growth of Working Age Population (annual % change)	Trend Participation Rate (% of Working Age Population)	NAIRU (% of Labour Force)	Investment Ratio (% of Potential Output)
1981	-0,6	-0,3	2,1	3,3	3,2	0,1	*0,5*	*-0,4*	1,0	2,1	0,7	76,6	4,6	24,7
1982	-0,5	-0,5	3,2	3,2	3,4	0,3	*0,6*	*-0,4*	1,1	2,1	0,8	76,8	4,6	25,1
1983	-0,7	-1,1	2,8	3,0	3,5	0,3	*0,7*	*-0,4*	1,1	2,0	0,7	76,8	4,3	25,0
1984	-0,4	-1,2	3,2	2,9	3,3	0,3	*0,7*	*-0,4*	0,9	2,0	0,6	76,8	4,0	23,7
1985	0,4	-0,8	3,4	2,7	3,0	0,0	*0,4*	*-0,3*	0,9	2,0	0,4	76,7	3,7	23,6
1986	0,2	-0,8	2,3	2,4	2,4	-0,5	*-0,2*	*-0,3*	0,9	2,0	0,1	76,5	3,8	23,3
1987	2,4	1,3	4,3	2,1	2,2	-0,7	*-0,4*	*-0,3*	0,9	1,9	0,1	76,2	4,1	23,8
1988	5,3	4,0	4,7	1,8	2,0	-1,0	*-0,7*	*-0,3*	1,1	1,9	0,0	75,9	4,7	26,1
1989	8,8	6,8	4,8	1,5	2,0	-1,1	*-0,9*	*-0,2*	1,3	1,8	0,0	75,4	5,5	28,8
1990	7,1	4,7	-0,3	1,2	1,7	-1,1	*-1,0*	*-0,2*	1,1	1,7	0,3	74,9	6,4	27,0
1991	-0,8	-2,7	-6,4	1,0	0,7	-1,4	*-1,3*	*-0,1*	0,5	1,7	0,4	74,3	8,0	21,8
1992	-5,6	-6,7	-3,8	1,1	0,3	-1,5	*-1,5*	*0,0*	0,0	1,8	0,4	73,8	9,9	18,2
1993	-7,9	-8,0	-1,2	1,3	0,2	-1,4	*-1,4*	*0,0*	-0,3	1,9	0,3	73,3	11,6	15,4
1994	-5,9	-5,4	3,9	1,7	1,1	-0,6	*-0,7*	*0,1*	-0,4	2,0	0,2	72,9	12,3	14,7
1995	-4,6	-3,8	3,4	2,1	1,7	-0,3	*-0,4*	*0,1*	-0,1	2,1	0,2	72,6	12,6	16,0
1996	-3,3	-2,2	3,8	2,4	2,1	-0,1	*-0,2*	*0,1*	0,0	2,2	0,2	72,5	12,9	16,8
1997	-0,1	0,9	6,2	2,8	3,0	0,5	*0,4*	*0,1*	0,2	2,3	0,3	72,5	12,6	18,5
1998	1,8	2,4	5,0	3,0	3,4	0,8	*0,7*	*0,0*	0,3	2,3	0,4	72,6	12,1	19,4
1999	2,0	2,1	3,4	3,1	3,7	1,0	*1,0*	*0,0*	0,4	2,3	0,4	72,8	11,3	19,2
2000	3,8	3,5	5,0	3,2	3,6	0,9	*0,9*	*-0,1*	0,4	2,2	0,3	73,1	10,6	19,3
2001	1,6	0,9	1,0	3,2	3,7	1,0	*1,1*	*-0,1*	0,5	2,2	0,2	73,4	9,6	19,4
2002	0,7	-0,2	2,2	3,1	3,3	0,8	*0,9*	*-0,1*	0,4	2,1	0,2	73,7	8,9	18,2
2003	0,1	-0,8	2,4	3,1	3,0	0,7	*0,8*	*-0,1*	0,3	2,1	0,1	74,0	8,3	17,4
2004	0,6	-0,2	3,6	3,1	3,0	0,6	*0,7*	*-0,1*	0,4	2,1	0,1	74,2	7,7	17,7
2005	-0,5	-1,2	1,9	3,0	2,9	0,5	*0,6*	*-0,1*	0,4	2,0	0,1	74,5	7,2	17,4
2006	-0,1	-0,7	3,5	3,0	2,9	0,4	*0,6*	*-0,1*	0,4	2,0	0,1	74,7	6,8	17,5
2007	0,1	-0,5	3,1	3,0	2,9	0,4	*0,5*	*-0,1*	0,5	2,0	0,1	74,9	6,4	17,5
2008				2,9	2,9	0,5	*0,6*	*-0,1*	0,4	2,0	0,5	75,1	6,2	16,9
2009				2,9	2,5	0,2	*0,3*	*-0,1*	0,3	2,0	0,1	75,2	6,1	15,8
2010				2,9	2,2	0,1	*0,2*	*-0,1*	0,2	2,0	0,1	75,4	6,0	14,7
Periods	**Period Averages**													
1981-1985	-0,4	-0,7	2,9	3,0	3,3	0,2	*0,6*	*-0,4*	1,0	2,0	0,6	76,7	4,2	24,4
1986-1990	4,8	3,2	3,2	1,8	2,0	-0,9	*-0,6*	*-0,2*	1,1	1,9	0,1	75,8	4,9	25,8
1991-1995	-4,9	-5,3	-0,8	1,4	0,8	-1,0	*-1,1*	*0,0*	-0,1	1,9	0,3	73,4	10,9	17,2
1996-2000	0,8	1,3	4,7	2,9	3,1	0,6	*0,6*	*0,0*	0,3	2,3	0,3	72,7	11,9	18,6
2001-2005	0,5	-0,3	2,2	3,1	3,2	0,7	*0,8*	*-0,1*	0,4	2,1	0,2	74,0	8,3	18,0
2006-2010				2,9	2,7	0,3	*0,4*	*-0,1*	0,3	2,0	0,2	75,1	6,3	16,5

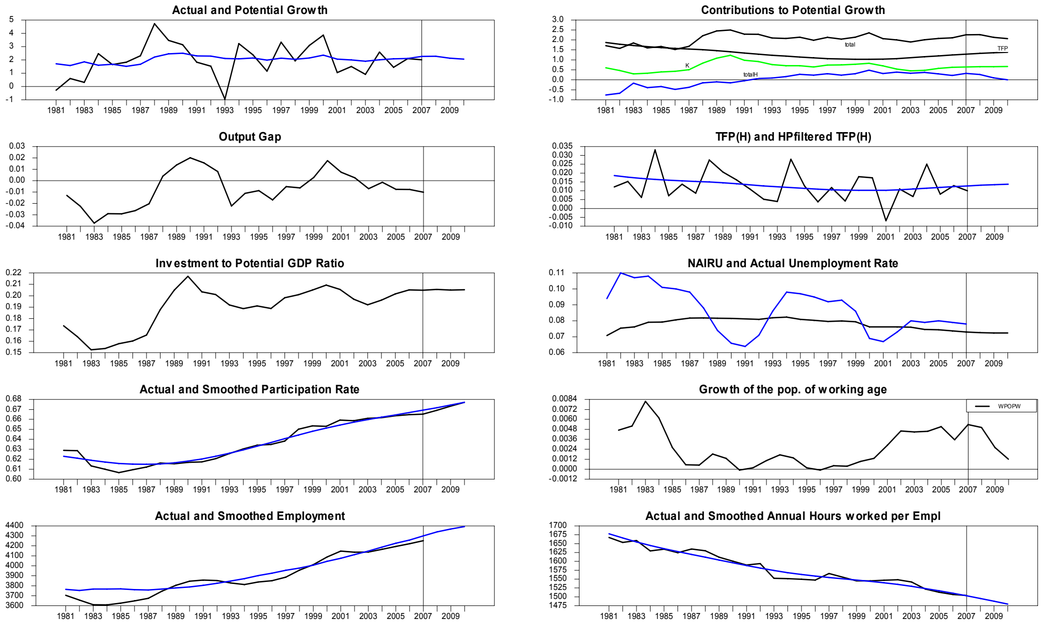
se

	Output Gaps (% of Potential Output)		Actual Output Growth (annual % change)	Potential Growth (annual % change)		Contributions to Potential Growth*					Determinants of Labour Potential and Capital Accumulation			
	HP Filter	**PF method**		**HP Trend Growth**	**PF Potential Growth**	**Total Labour (Hours) Contribution**	***Labour (persons) Contribution***	***Changes in Hours (per Empl) Contribution***	**Capital Accumulation Contribution**	**TFP Contribution**	**Growth of Working Age Population (annual % change)**	**Trend Participation Rate (% of Working Age Population)**	**NAIRU (% of Labour Force)**	**Investment Ratio (% of Potential Output)**
1981	-2,0	-2,8	-0,2	1,8	1,8	0,4	*0,6*	*-0,2*	0,7	0,7	0,4	81,8	1,0	16,0
1982	-2,5	-3,3	1,2	1,8	1,8	0,4	*0,5*	*-0,1*	0,7	0,7	0,3	82,1	1,1	15,8
1983	-2,6	-3,2	1,9	1,9	1,8	0,4	*0,3*	*0,0*	0,7	0,7	0,2	82,5	1,2	15,9
1984	-0,4	-1,0	4,3	2,0	2,0	0,5	*0,4*	*0,1*	0,7	0,7	0,2	82,8	1,2	16,8
1985	-0,1	-0,8	2,2	2,0	1,9	0,3	*0,2*	*0,2*	0,8	0,8	0,0	83,0	1,2	17,6
1986	0,6	0,2	2,8	2,0	1,8	0,2	*0,0*	*0,2*	0,8	0,7	0,0	83,1	1,4	17,5
1987	2,1	1,6	3,4	1,9	2,0	0,4	*0,1*	*0,3*	0,9	0,7	0,3	83,2	1,6	18,5
1988	2,9	2,2	2,6	1,8	2,0	0,3	*0,0*	*0,3*	0,9	0,7	0,4	83,2	1,9	19,3
1989	4,1	2,8	2,7	1,7	2,2	0,3	*0,0*	*0,3*	1,1	0,7	0,6	83,0	2,3	21,2
1990	3,5	1,7	1,0	1,5	2,1	0,3	*0,0*	*0,3*	1,0	0,8	0,7	82,8	2,8	20,8
1991	1,0	-0,9	-1,1	1,5	1,6	-0,1	*-0,5*	*0,3*	0,8	0,9	0,5	82,5	3,5	18,7
1992	-1,7	-3,2	-1,2	1,5	1,2	-0,4	*-0,8*	*0,4*	0,6	1,0	0,3	82,0	4,4	16,4
1993	-5,1	-5,9	-2,0	1,6	0,8	-0,6	*-1,0*	*0,4*	0,3	1,2	0,4	81,5	5,6	13,9
1994	-2,9	-3,7	4,2	1,8	1,8	0,0	*-0,3*	*0,3*	0,4	1,4	0,5	81,1	6,0	14,6
1995	-0,9	-2,0	4,1	2,0	2,2	0,2	*-0,1*	*0,3*	0,5	1,5	0,5	80,6	6,0	15,7
1996	-1,8	-2,6	1,3	2,2	1,9	-0,3	*-0,5*	*0,2*	0,5	1,7	0,2	80,2	6,5	16,1
1997	-1,7	-2,2	2,4	2,4	2,1	-0,2	*-0,3*	*0,1*	0,4	1,8	0,2	79,8	6,7	15,7
1998	-0,6	-1,2	3,6	2,5	2,6	0,2	*0,2*	*0,0*	0,5	1,9	0,3	79,6	6,3	16,5
1999	1,2	0,5	4,6	2,6	2,8	0,2	*0,3*	*-0,1*	0,6	1,9	0,3	79,3	6,0	17,3
2000	2,8	2,0	4,3	2,7	2,8	0,3	*0,4*	*-0,1*	0,6	2,0	0,5	79,2	5,7	17,8
2001	1,2	0,2	1,0	2,7	2,8	0,3	*0,5*	*-0,2*	0,5	2,0	0,6	79,1	5,4	17,2
2002	0,4	-0,4	2,0	2,7	2,6	0,3	*0,5*	*-0,2*	0,4	1,9	0,6	79,0	5,2	16,3
2003	-0,8	-1,4	1,5	2,7	2,5	0,2	*0,4*	*-0,2*	0,4	1,9	0,7	78,9	5,2	15,6
2004	0,1	-0,3	3,6	2,7	2,5	0,2	*0,3*	*-0,2*	0,4	1,8	0,6	78,8	5,2	16,1
2005	-0,1	-0,4	2,5	2,7	2,6	0,2	*0,3*	*-0,1*	0,6	1,7	0,6	78,7	5,1	17,0
2006	0,3	-0,1	3,0	2,6	2,8	0,5	*0,6*	*-0,1*	0,7	1,7	0,6	78,6	4,8	17,5
2007	0,5	0,0	2,8	2,6	2,7	0,4	*0,4*	*-0,1*	0,7	1,6	0,6	78,5	4,6	17,9
2008				2,6	2,4	0,2	*0,3*	*-0,1*	0,7	1,5	0,4	78,4	4,5	17,7
2009				2,5	2,1	0,0	*0,0*	*0,0*	0,6	1,4	0,2	78,3	4,4	17,1
2010				2,5	1,8	-0,1	*-0,1*	*0,0*	0,6	1,4	0,0	78,1	4,4	16,6
Periods	**Period Averages**													
1981-1985	-1,5	-2,2	1,9	1,9	1,9	0,4	*0,4*	*0,0*	0,7	0,7	0,2	82,4	1,1	16,4
1986-1990	2,7	1,7	2,5	1,8	2,0	0,3	*0,0*	*0,3*	0,9	0,7	0,4	83,1	2,0	19,5
1991-1995	-1,9	-3,2	0,8	1,6	1,5	-0,2	*-0,5*	*0,3*	0,5	1,2	0,4	81,5	5,1	15,9
1996-2000	0,0	-0,7	3,3	2,5	2,4	0,1	*0,0*	*0,0*	0,5	1,9	0,3	79,6	6,2	16,7
2001-2005	0,2	-0,4	2,1	2,7	2,6	0,2	*0,4*	*-0,2*	0,5	1,9	0,6	78,9	5,2	16,4
2006-2010				2,6	2,4	0,2	*0,2*	*-0,1*	0,6	1,5	0,4	78,4	4,5	17,4

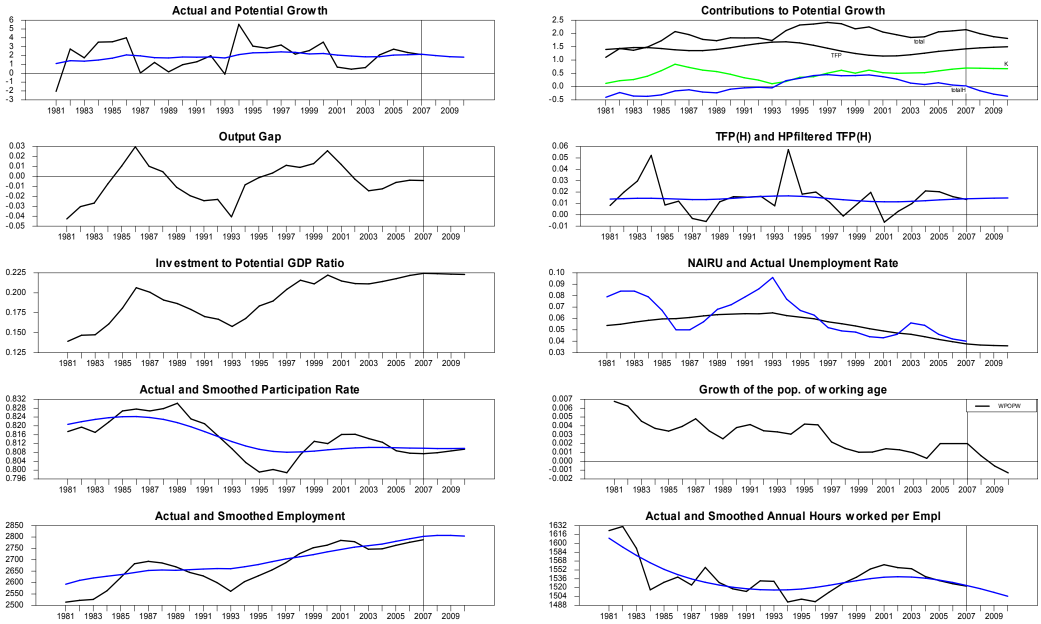
100

uk	Output Gaps (% of Potential Output)		Actual Output Growth (annual % change)	Potential Growth (annual % change)		Contributions to Potential Growth*					Determinants of Labour Potential and Capital Accumulation			
	HP Filter	PF method		HP Trend Growth	PF Potential Growth	Total Labour (Hours) Contribution	*Labour (persons) Contribution*	*Changes in Hours (per Empl) Contribution*	Capital Accumulation Contribution	TFP Contribution	Growth of Working Age Population (annual % change)	Trend Participation Rate (% of Working Age Population)	NAIRU (% of Labour Force)	Investment Ratio (% of Potential Output)
1981	-3,9	-4,1	-1,4	1,7	1,4	-0,2	-0,2	0,0	0,3	1,3	0,6	73,3	7,6	13,7
1982	-3,8	-4,1	1,9	1,9	1,9	0,2	0,2	0,0	0,3	1,3	0,5	73,4	8,0	14,2
1983	-2,5	-2,8	3,5	2,1	2,2	0,4	0,4	0,1	0,4	1,4	0,8	73,7	8,5	14,6
1984	-2,2	-2,8	2,6	2,3	2,6	0,6	0,6	0,1	0,5	1,4	0,8	74,0	8,8	15,5
1985	-1,2	-1,6	3,6	2,4	2,3	0,2	0,2	0,1	0,5	1,5	0,2	74,3	9,1	15,8
1986	0,2	-0,1	3,9	2,5	2,4	0,3	0,3	0,0	0,5	1,5	0,3	74,6	9,2	15,7
1987	2,1	1,8	4,5	2,6	2,6	0,4	0,5	-0,1	0,6	1,6	0,2	74,9	9,2	16,8
1988	4,6	4,0	5,0	2,5	2,8	0,3	0,5	-0,2	0,9	1,6	0,1	75,2	8,9	18,7
1989	4,3	3,3	2,2	2,4	2,8	0,2	0,4	-0,3	1,0	1,7	0,1	75,5	8,6	19,3
1990	2,7	1,3	0,7	2,3	2,6	0,0	0,4	-0,4	0,9	1,8	0,1	75,6	8,4	18,3
1991	-1,0	-2,0	-1,4	2,3	2,0	-0,5	0,1	-0,5	0,6	1,9	0,0	75,7	8,4	16,5
1992	-2,9	-3,6	0,3	2,3	2,0	-0,5	0,1	-0,6	0,5	2,0	-0,1	75,8	8,2	16,0
1993	-2,9	-3,1	2,4	2,4	1,9	-0,6	0,1	-0,7	0,3	2,2	0,0	75,7	8,1	15,8
1994	-1,1	-1,2	4,4	2,5	2,3	-0,3	0,4	-0,7	0,4	2,2	0,2	75,7	7,6	16,1
1995	-0,8	-0,7	2,9	2,6	2,4	-0,3	0,4	-0,6	0,5	2,2	0,3	75,7	7,4	16,2
1996	-0,8	-0,5	2,7	2,7	2,6	-0,2	0,4	-0,6	0,7	2,1	0,3	75,6	7,1	16,7
1997	-0,4	-0,1	3,2	2,8	2,7	-0,1	0,4	-0,5	0,8	2,0	0,3	75,6	6,7	17,4
1998	0,0	0,2	3,2	2,8	2,9	0,0	0,5	-0,5	1,0	1,9	0,4	75,6	6,3	19,0
1999	0,2	0,4	3,0	2,8	2,9	0,1	0,5	-0,5	0,9	1,8	0,5	75,6	6,1	18,9
2000	1,4	1,4	4,0	2,8	3,0	0,3	0,7	-0,4	0,9	1,8	0,7	75,6	5,7	19,0
2001	0,9	0,8	2,2	2,7	2,8	0,3	0,7	-0,4	0,9	1,7	0,7	75,6	5,4	18,9
2002	0,2	0,2	2,0	2,7	2,7	0,2	0,5	-0,4	0,9	1,6	0,6	75,6	5,1	19,0
2003	0,2	0,1	2,5	2,6	2,6	0,2	0,5	-0,4	0,8	1,6	0,7	75,6	5,0	18,5
2004	0,8	0,6	3,2	2,5	2,7	0,2	0,6	-0,3	0,9	1,5	0,6	75,5	4,7	18,9
2005	0,0	-0,5	1,6	2,5	2,8	0,3	0,7	-0,3	0,9	1,5	0,9	75,5	4,6	18,9
2006	-0,1	-0,9	2,3	2,4	2,7	0,3	0,6	-0,3	0,9	1,5	0,9	75,5	4,6	19,1
2007	0,3	-0,8	2,8	2,3	2,7	0,2	0,5	-0,3	1,0	1,5	0,7	75,5	4,4	19,4
2008				2,3	2,5	0,0	0,3	-0,3	1,0	1,5	0,5	75,5	4,4	19,5
2009				2,2	2,4	-0,1	0,2	-0,3	1,0	1,6	0,3	75,5	4,3	19,6
2010				2,2	2,4	-0,2	0,2	-0,3	1,0	1,6	0,3	75,4	4,3	19,6
Periods	**Period Averages**													
1981-1985	-2,7	-3,1	2,0	2,1	2,1	0,3	0,2	0,0	0,4	1,4	0,6	73,7	8,4	14,8
1986-1990	2,8	2,1	3,3	2,5	2,7	0,2	0,4	-0,2	0,8	1,6	0,1	75,2	8,9	17,8
1991-1995	-1,7	-2,1	1,7	2,4	2,1	-0,4	0,2	-0,6	0,5	2,1	0,1	75,7	7,9	16,1
1996-2000	0,1	0,3	3,2	2,8	2,8	0,0	0,5	-0,5	0,8	1,9	0,4	75,6	6,4	18,2
2001-2005	0,4	0,2	2,3	2,6	2,7	0,2	0,6	-0,4	0,9	1,6	0,7	75,5	5,0	18,8
2006-2010				2,3	2,6	0,0	0,4	-0,3	1,0	1,5	0,5	75,5	4,4	19,5

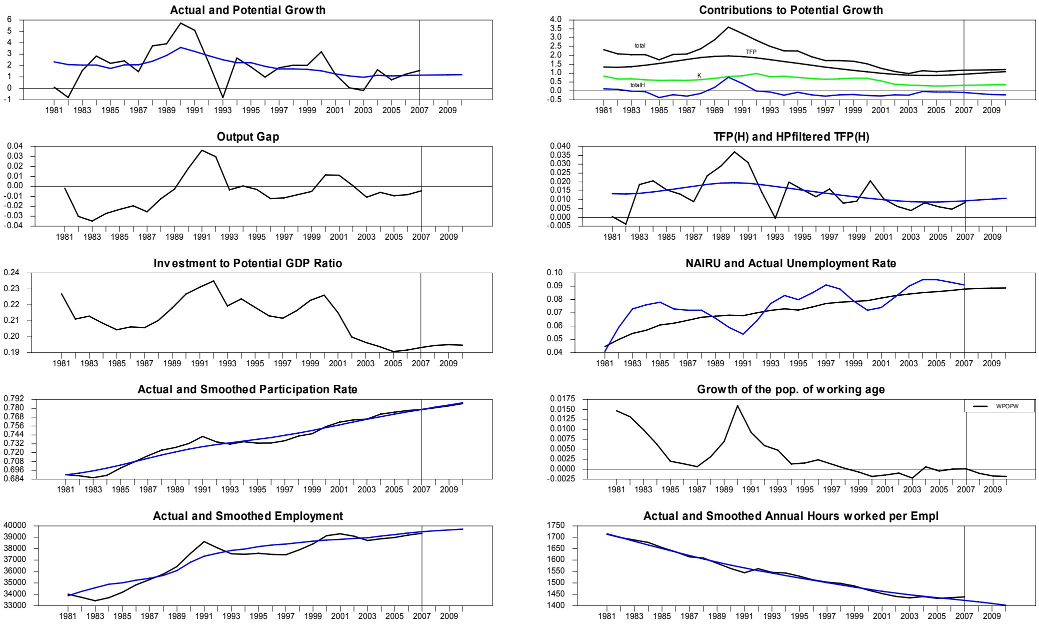
be


Actual and Potential Growth
Contributions to Potential Growth
Output Gap
TFP(H) and HPfiltered TFP(H)
Investment to Potential GDP Ratio
NAIRU and Actual Unemployment Rate
Actual and Smoothed Participation Rate
Growth of the pop. of working age
Actual and Smoothed Employment
Actual and Smoothed Annual Hours worked per Empl

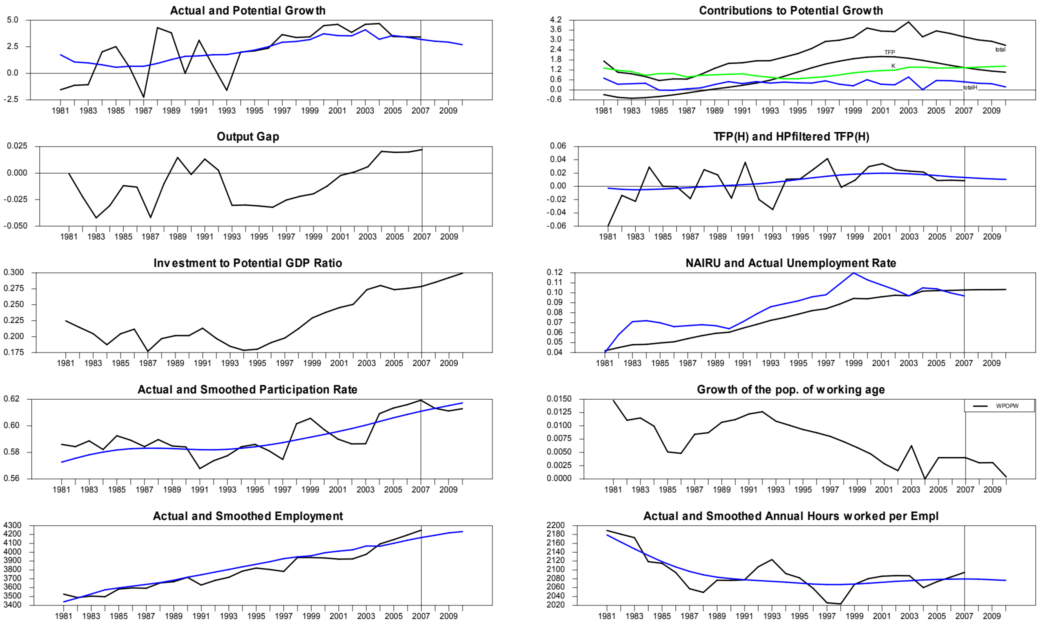
dk


Actual and Potential Growth
Contributions to Potential Growth
Output Gap
TFP(H) and HPfiltered TFP(H)
Investment to Potential GDP Ratio
NAIRU and Actual Unemployment Rate
Actual and Smoothed Participation Rate
Growth of the pop. of working age
Actual and Smoothed Employment
Actual and Smoothed Annual Hours worked per Empl

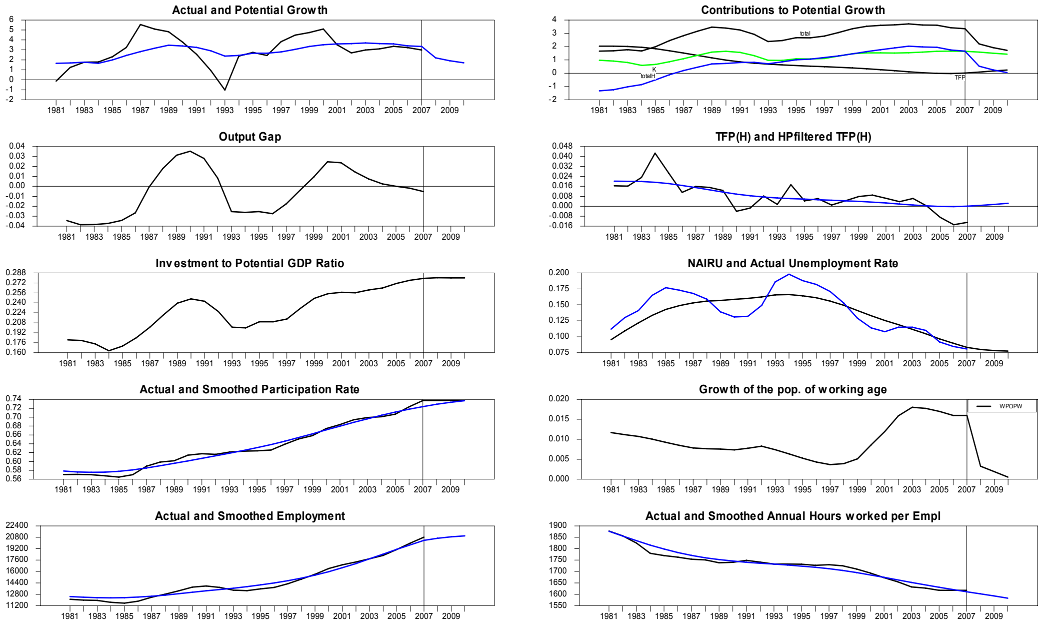
de


Actual and Potential Growth
Contributions to Potential Growth
Output Gap
TFP(H) and HPfiltered TFP(H)
Investment to Potential GDP Ratio
NAIRU and Actual Unemployment Rate
Actual and Smoothed Participation Rate
Growth of the pop. of working age
Actual and Smoothed Employment
Actual and Smoothed Annual Hours worked per Empl

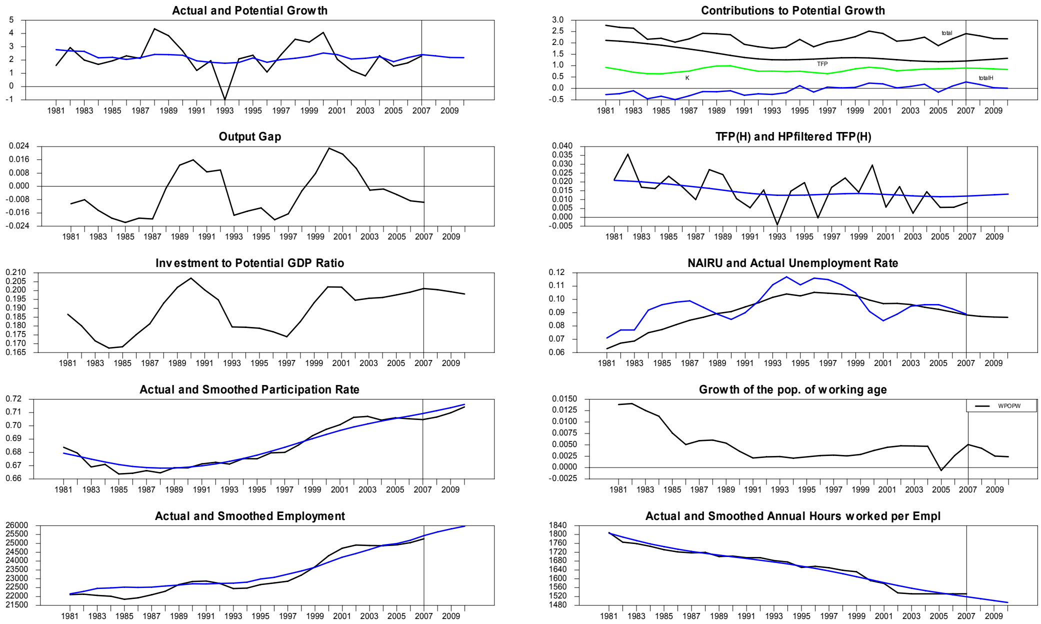
el


Actual and Potential Growth
Contributions to Potential Growth
Output Gap
TFP(H) and HPfiltered TFP(H)
Investment to Potential GDP Ratio
NAIRU and Actual Unemployment Rate
Actual and Smoothed Participation Rate
Growth of the pop. of working age
Actual and Smoothed Employment
Actual and Smoothed Annual Hours worked per Empl

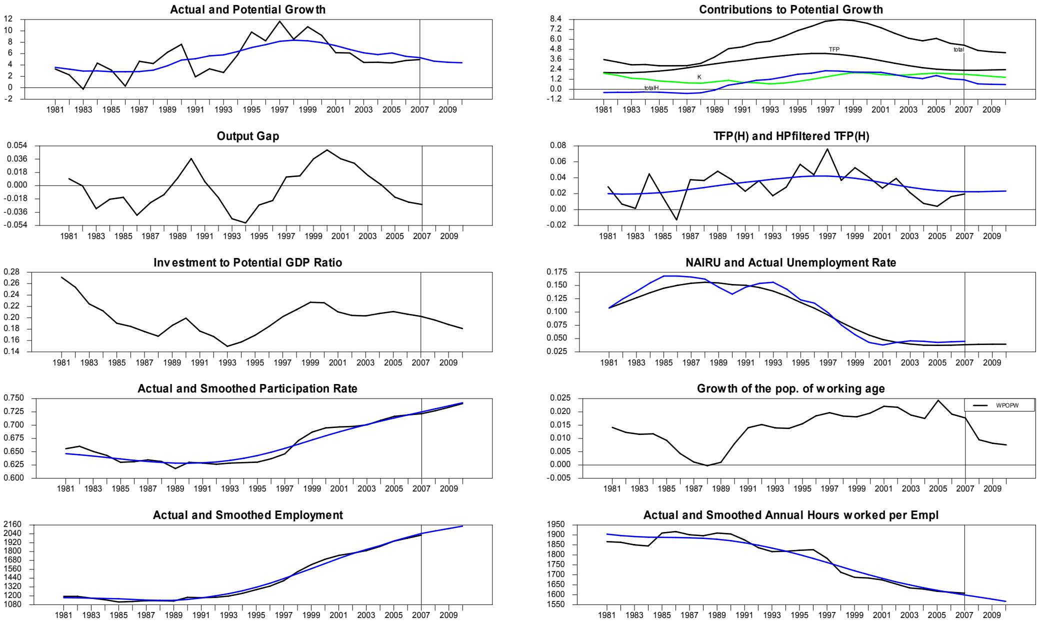
es


Actual and Potential Growth
Contributions to Potential Growth
Output Gap
TFP(H) and HPfiltered TFP(H)
Investment to Potential GDP Ratio
NAIRU and Actual Unemployment Rate
Actual and Smoothed Participation Rate
Growth of the pop. of working age
Actual and Smoothed Employment
Actual and Smoothed Annual Hours worked per Empl

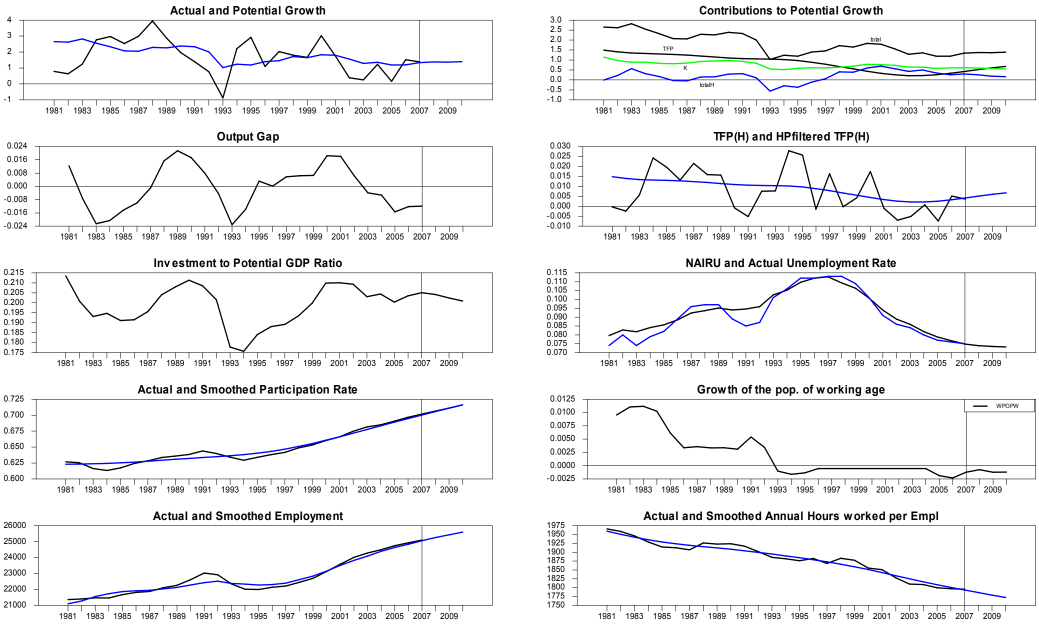
fr


Actual and Potential Growth
Contributions to Potential Growth
Output Gap
TFP(H) and HPfiltered TFP(H)
Investment to Potential GDP Ratio
NAIRU and Actual Unemployment Rate
Actual and Smoothed Participation Rate
Growth of the pop. of working age
Actual and Smoothed Employment
Actual and Smoothed Annual Hours worked per Empl

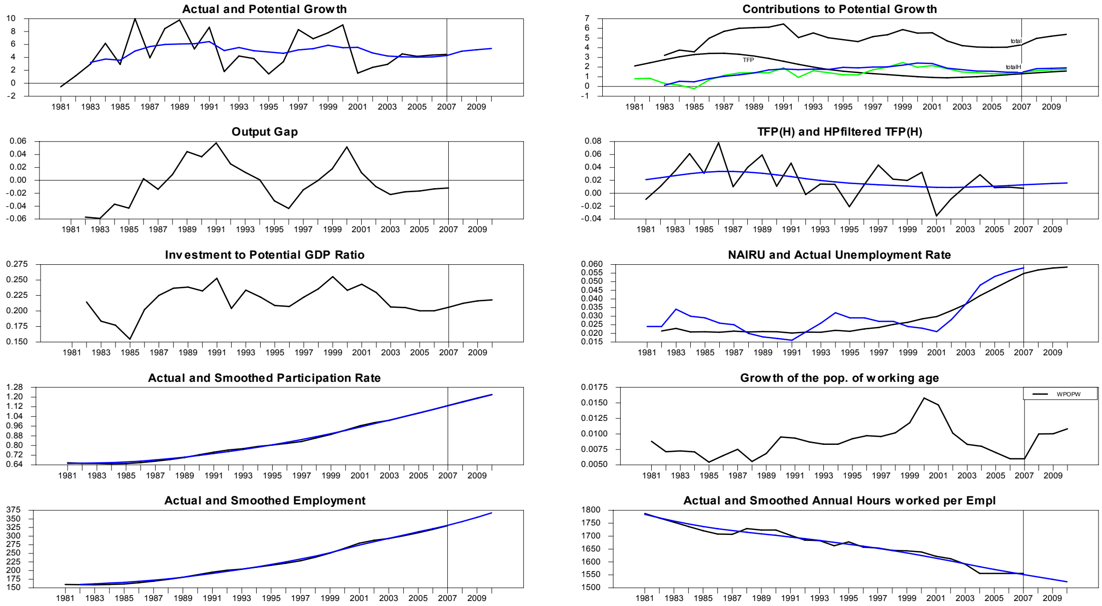
ie


Actual and Potential Growth
Contributions to Potential Growth
TFP
total
K
totalH
Output Gap
TFP(H) and HPfiltered TFP(H)
Investment to Potential GDP Ratio
NAIRU and Actual Unemployment Rate
Actual and Smoothed Participation Rate
Growth of the pop. of working age
WPOPW
Actual and Smoothed Employment
Actual and Smoothed Annual Hours worked per Empl

it

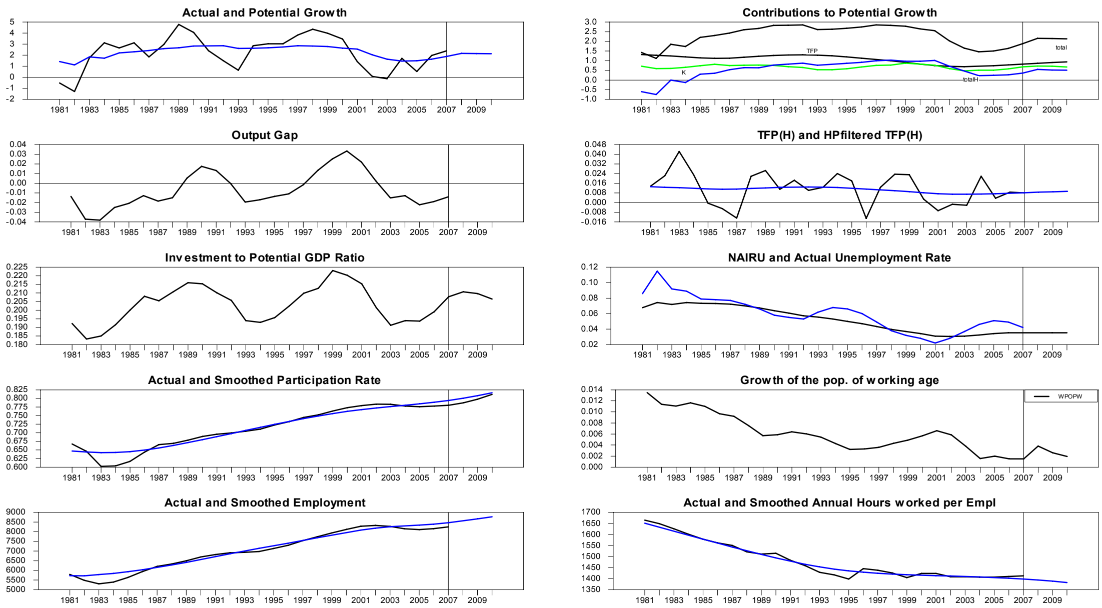

Actual and Potential Growth
Contributions to Potential Growth
TFP
total
K
totalH
Output Gap
TFP(H) and HPfiltered TFP(H)
Investment to Potential GDP Ratio
NAIRU and Actual Unemployment Rate
Actual and Smoothed Participation Rate
Growth of the pop. of working age
WPOPW
Actual and Smoothed Employment
Actual and Smoothed Annual Hours worked per Empl

lu

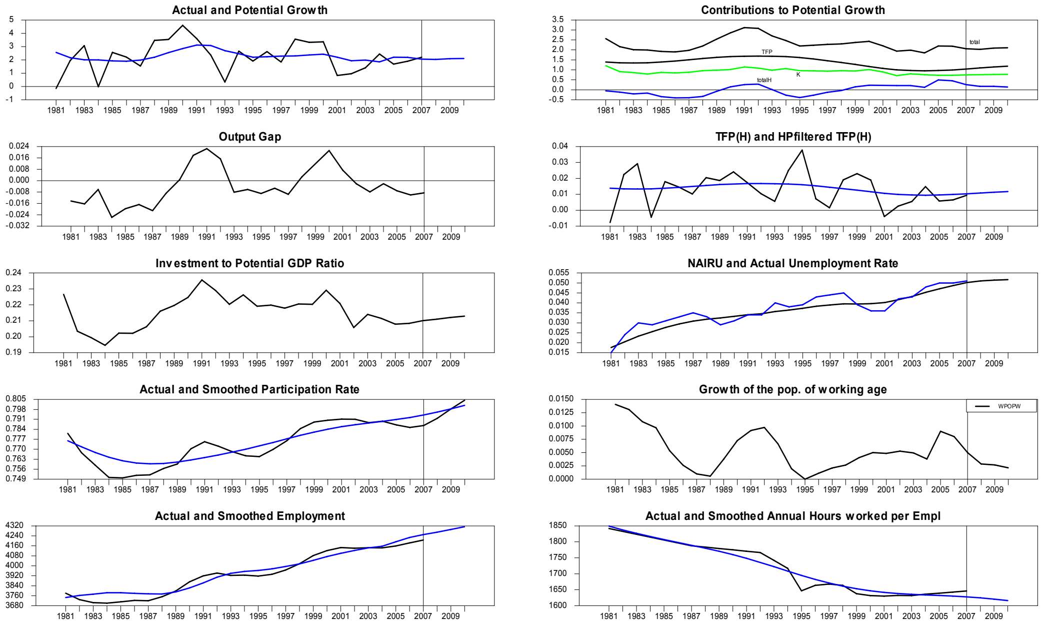


Luxembourg: The participation rate in excess of 100% is explained by the use of resident (domestic) employment which includes foreign workers.

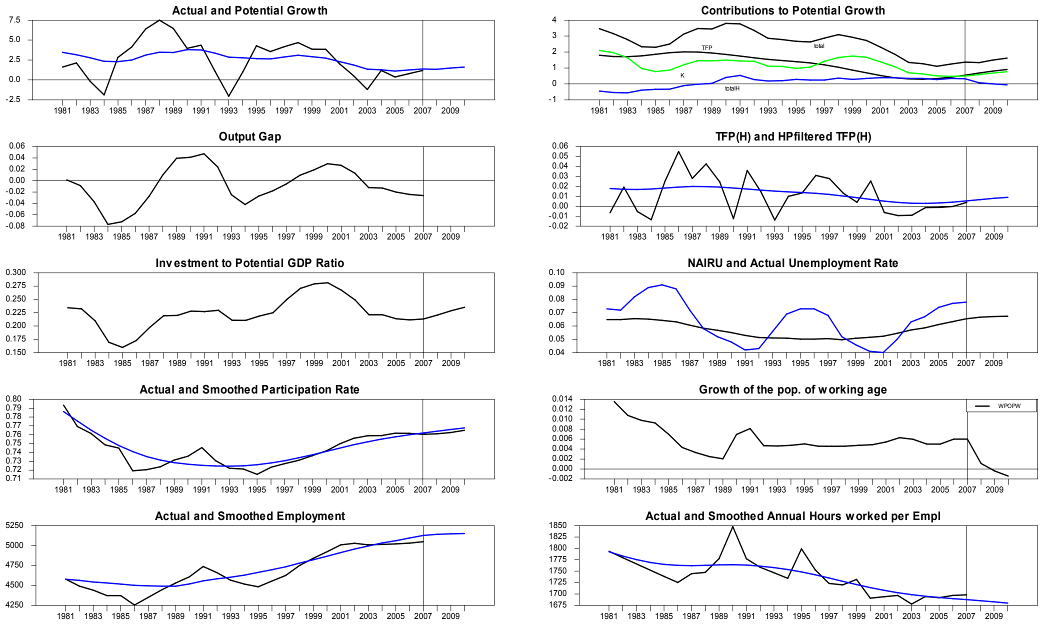
nl



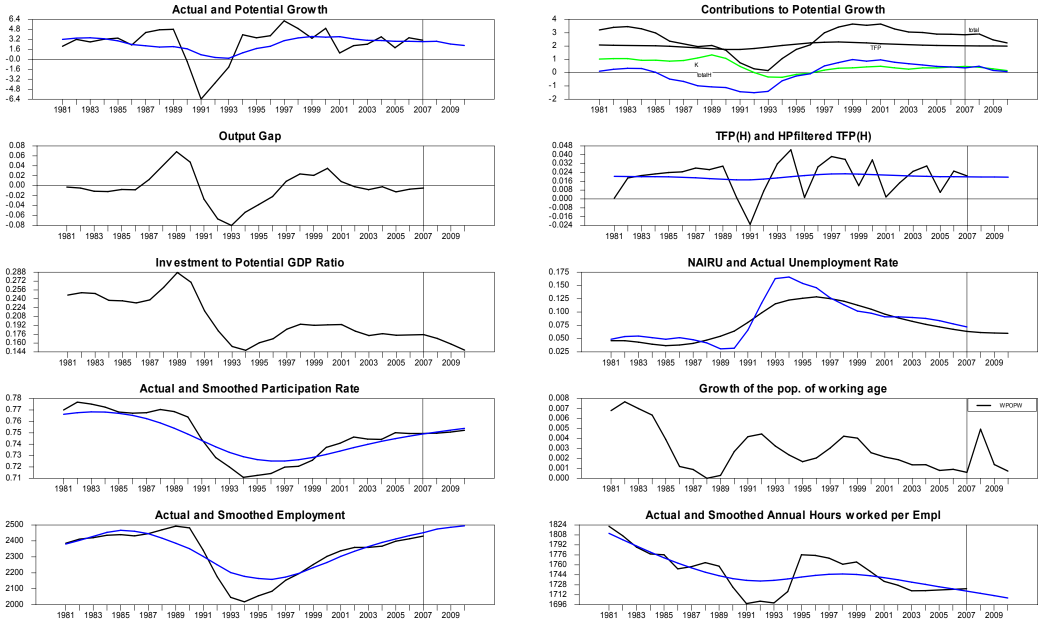
at


Actual and Potential Growth
Contributions to Potential Growth
total
TFP
K
totalH
Output Gap
TFP(H) and HPfiltered TFP(H)
Investment to Potential GDP Ratio
NAIRU and Actual Unemployment Rate
Actual and Smoothed Participation Rate
Growth of the pop. of working age
WPOPW
Actual and Smoothed Employment
Actual and Smoothed Annual Hours worked per Empl

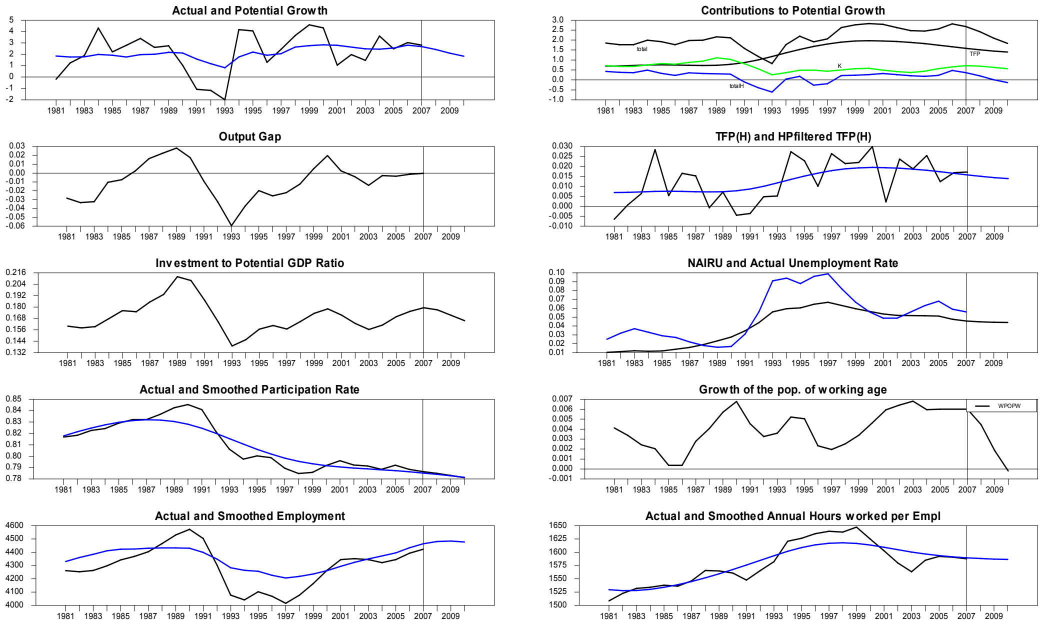
pt


Actual and Potential Growth
Contributions to Potential Growth
total
TFP
K
totalH
Output Gap
TFP(H) and HPfiltered TFP(H)
Investment to Potential GDP Ratio
NAIRU and Actual Unemployment Rate
Actual and Smoothed Participation Rate
Growth of the pop. of working age
WPOPW
Actual and Smoothed Employment
Actual and Smoothed Annual Hours worked per Empl

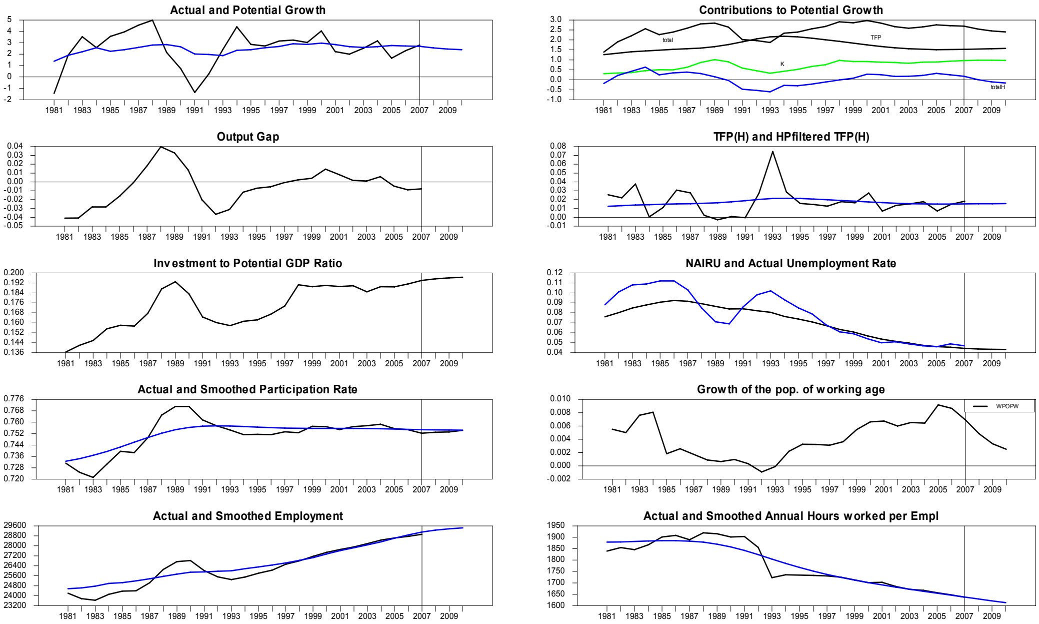
fi


Actual and Potential Growth
Contributions to Potential Growth
total
TFP
K
totalH
Output Gap
TFP(H) and HPfiltered TFP(H)
Investment to Potential GDP Ratio
NAIRU and Actual Unemployment Rate
Actual and Smoothed Participation Rate
Growth of the pop. of working age
WPOPW
Actual and Smoothed Employment
Actual and Smoothed Annual Hours worked per Empl

se


Actual and Potential Growth
Contributions to Potential Growth
total
TFP
K
totalH
Output Gap
TFP(H) and HPfiltered TFP(H)
Investment to Potential GDP Ratio
NAIRU and Actual Unemployment Rate
Actual and Smoothed Participation Rate
Growth of the pop. of working age
WPOPW
Actual and Smoothed Employment
Actual and Smoothed Annual Hours worked per Empl

uk


Actual and Potential Growth
Contributions to Potential Growth
total
TFP
K
totalH
Output Gap
TFP(H) and HPfiltered TFP(H)
Investment to Potential GDP Ratio
NAIRU and Actual Unemployment Rate
Actual and Smoothed Participation Rate
Growth of the pop. of working age
WPOPW
Actual and Smoothed Employment
Actual and Smoothed Annual Hours worked per Empl

CZ	Output Gaps (% of Potential Output)		Actual Output Growth (annual % change)	Potential Growth (annual % change)		Contributions to Potential Growth*					Determinants of Labour Potential and Capital Accumulation			
	HP Filter	PF method		HP Trend Growth	PF Potential Growth	Total Labour (Hours) Contribution	*Labour (persons) Contribution*	*Changes in Hours (per Empl) Contribution*	Capital Accumulation Contribution	TFP Contribution	Growth of Working Age Population (annual % change)	Trend Participation Rate (% of Working Age Population)	NAIRU (% of Labour Force)	Investment Ratio (% of Potential Output)
1995	1,8		5,9								0,5	76,4		
1996	4,1		4,2	1,9					2,2	1,0	0,3	76,0		
1997	1,4	-1,2	-0,7	1,9					1,8	1,0	0,3	75,5	2,3	31,4
1998	-1,7	-3,8	-1,1	2,0	1,6	-1,1	*-1,0*	*-0,1*	1,6	1,1	0,3	75,1	3,6	30,5
1999	-2,6	-4,0	1,2	2,1	1,4	-1,2	*-1,0*	*-0,1*	1,4	1,2	0,4	74,7	4,9	29,1
2000	-1,1	-1,9	3,9	2,3	1,6	-1,2	*-1,0*	*-0,2*	1,4	1,4	0,4	74,3	6,2	30,0
2001	-1,1	-1,2	2,6	2,6	1,9	-1,1	*-0,9*	*-0,2*	1,4	1,6	0,0	74,0	7,1	31,0
2002	-2,4	-2,3	1,5	2,8	2,6	-0,6	*-0,4*	*-0,2*	1,4	1,8	0,2	73,6	7,4	31,2
2003	-2,2	-2,3	3,2	3,1	3,2	-0,1	*0,0*	*-0,2*	1,4	1,9	0,4	73,3	7,4	31,7
2004	-1,2	-1,4	4,4	3,3	3,5	-0,1	*0,0*	*-0,1*	1,5	2,1	0,5	73,1	7,5	32,9
2005	0,1	-0,2	4,8	3,5	3,5	-0,3	*-0,1*	*-0,1*	1,5	2,2	0,2	72,9	7,6	33,1
2006	0,8	0,6	4,4	3,6	3,6	-0,3	*-0,2*	*-0,1*	1,5	2,3	0,2	72,7	7,7	33,3
2007	1,3	1,2	4,3	3,7	3,7	-0,2	*-0,1*	*-0,1*	1,5	2,3	0,2	72,5	7,8	33,8
2008	1,4	0,8	3,3	3,8	3,7	-0,3	*-0,3*	*-0,1*	1,6	2,4	-0,1	72,3	7,8	34,6
2009	1,2	0,4	3,2	3,8	3,6	-0,4	*-0,4*	*-0,1*	1,6	2,4	-0,3	72,1	7,8	35,2
2010	0,9	0,0	3,1	3,8	3,5	-0,6	*-0,5*	*-0,1*	1,6	2,4	-0,6	72,0	7,8	35,6
Periods	**Period Averages**													
1995-2000	0,3		2,2								0,4	75,3		30,2
2001-2005	-1,4	-1,5	3,3	3,1	2,9	-0,4	*-0,3*	*-0,2*	1,5	1,9	0,3	73,4	7,4	32,0
2005-2010	0,9	0,5	3,8	3,7	3,6	-0,4	*-0,3*	*-0,1*	1,6	2,3	-0,1	72,4	7,8	34,3

ee	Output Gaps (% of Potential Output)		Actual Output Growth (annual % change)	Potential Growth (annual % change)		Contributions to Potential Growth*					Determinants of Labour Potential and Capital Accumulation			
	HP Filter	PF method		HP Trend Growth	PF Potential Growth	Total Labour (Hours) Contribution	*Labour (persons) Contribution*	*Changes in Hours (per Empl) Contribution*	Capital Accumulation Contribution	TFP Contribution	Growth of Working Age Population (annual % change)	Trend Participation Rate (% of Working Age Population)	NAIRU (% of Labour Force)	Investment Ratio (% of Potential Output)
1995	0,9	-6,7	4,5								-1,8	74,1	0,0	24,2
1996	-0,8	-7,2	4,4	6,1	4,9	-1,5	*-1,7*	*0,1*	3,1	3,3	-1,4	73,7	0,6	25,3
1997	3,9	-0,6	11,1	6,1	3,7	-3,1	*-3,3*	*0,1*	3,6	3,3	-1,0	73,3	4,0	29,2
1998	2,2	-0,6	4,4	6,1	4,5	-2,5	*-2,7*	*0,1*	3,7	3,3	-0,6	72,8	6,9	31,9
1999	-3,4	-4,1	0,3	6,2	4,0	-1,8	*-1,9*	*0,1*	2,5	3,3	-0,2	72,4	8,9	25,9
2000	-2,0	-1,6	7,9	6,3	5,0	-1,0	*-1,2*	*0,1*	2,7	3,3	0,0	72,0	10,1	28,1
2001	-2,0	-0,8	6,5	6,4	5,7	-0,6	*-0,8*	*0,1*	2,9	3,3	0,0	71,7	10,8	30,1
2002	-1,4	-0,2	7,2	6,6	6,6	-0,1	*-0,3*	*0,2*	3,3	3,3	0,0	71,3	10,8	33,1
2003	-1,5	-0,6	6,7	6,7	7,1	0,3	*0,2*	*0,2*	3,2	3,3	0,0	71,0	10,1	33,5
2004	-0,6	-0,2	7,8	6,8	7,4	0,7	*0,6*	*0,2*	3,1	3,3	0,1	70,7	9,0	33,1
2005	0,8	0,5	8,4	6,9	7,6	1,0	*0,8*	*0,2*	3,1	3,4	0,1	70,4	7,6	33,3
2006	1,1	0,1	7,2	6,9	7,7	1,1	*0,9*	*0,2*	2,9	3,4	0,1	70,1	6,0	32,9
2007	1,6	-0,1	7,4	6,8	7,6	1,1	*0,9*	*0,2*	2,8	3,4	0,1	69,8	4,3	32,5
2008	1,6	-0,1	7,1	6,8	7,0	0,2	*0,0*	*0,2*	3,3	3,4	-0,4	69,5	3,4	36,0
2009	1,4	0,0	6,9	6,7	6,8	-0,1	*-0,3*	*0,2*	3,3	3,4	-0,4	69,1	3,0	37,3
2010	1,0	0,0	6,4	6,6	6,4	-0,3	*-0,5*	*0,2*	3,1	3,4	-0,6	68,8	2,8	37,2
Periods	**Period Averages**													
1995-2000	0,1	-3,5	5,4								-0,8	73,1	5,1	27,4
2001-2005	-0,9	-0,3	7,3	6,7	6,9	0,3	*0,1*	*0,2*	3,1	3,3	0,0	71,0	9,7	32,6
2005-2010	1,3	0,1	7,2	6,8	7,2	0,5	*0,3*	*0,2*	3,1	3,4	-0,2	69,6	4,5	34,9

cy	Output Gaps (% of Potential Output)		Actual Output Growth (annual % change)	Potential Growth (annual % change)		Contributions to Potential Growth*					Determinants of Labour Potential and Capital Accumulation			
	HP Filter	PF method		HP Trend Growth	PF Potential Growth	Total Labour (Hours) Contribution	*Labour (persons) Contribution*	*Changes in Hours (per Empl) Contribution*	Capital Accumulation Contribution	TFP Contribution	Growth of Working Age Population (annual % change)	Trend Participation Rate (% of Working Age Population)	NAIRU (% of Labour Force)	Investment Ratio (% of Potential Output)
1995	1,2	1,6	9,9								2,3	72,0	4,3	19,1
1996	-0,7	-0,6	1,8	3,7	4,0	0,8	*1,0*	*-0,2*	1,7	1,4	2,1	71,8	4,5	19,6
1997	-2,0	-1,9	2,3	3,7	3,7	0,8	*1,0*	*-0,2*	1,4	1,4	2,0	71,7	4,7	18,2
1998	-0,8	-0,9	5,0	3,7	3,8	0,8	*1,0*	*-0,2*	1,6	1,4	1,9	71,5	4,8	18,9
1999	0,2	0,2	4,8	3,7	3,7	0,8	*1,0*	*-0,2*	1,4	1,4	1,8	71,3	4,9	18,0
2000	1,5	1,5	5,0	3,7	3,7	0,8	*1,0*	*-0,2*	1,4	1,4	1,8	71,2	4,8	18,0
2001	1,9	2,0	4,1	3,7	3,6	0,8	*1,1*	*-0,2*	1,4	1,4	1,7	71,0	4,7	18,0
2002	0,5	0,3	2,1	3,6	3,9	1,0	*1,2*	*-0,2*	1,5	1,4	1,9	70,9	4,7	18,7
2003	-1,1	-0,9	1,9	3,6	3,2	0,4	*0,7*	*-0,2*	1,4	1,3	1,2	70,8	4,7	18,2
2004	-0,9	-1,1	3,8	3,5	4,0	1,0	*1,2*	*-0,2*	1,6	1,3	2,1	70,7	4,7	19,6
2005	-0,6	-0,7	3,9	3,5	3,5	0,5	*0,7*	*-0,2*	1,6	1,3	1,2	70,7	4,7	19,8
2006	0,0	-0,2	4,0	3,5	3,5	0,5	*0,7*	*-0,2*	1,6	1,3	1,2	70,6	4,8	20,0
2007	0,6	0,4	4,2	3,5	3,5	0,5	*0,7*	*-0,1*	1,6	1,3	1,2	70,5	4,7	20,3
2008	0,6	0,2	3,9	3,4	4,0	0,9	*1,1*	*-0,1*	1,7	1,4	1,8	70,4	4,7	20,9
2009	0,5	0,1	3,8	3,4	4,0	0,8	*1,0*	*-0,1*	1,7	1,4	1,6	70,3	4,7	21,2
2010	0,3	0,0	3,8	3,4	4,0	0,8	*0,9*	*-0,1*	1,8	1,4	1,5	70,3	4,7	21,7
Periods	**Period Averages**													
1995-2000	-0,1	0,0	4,8								2,0	71,6	4,7	18,6
2001-2005	0,0	-0,1	3,2	3,6	3,6	0,8	*1,0*	*-0,2*	1,5	1,3	1,6	70,8	4,7	18,9
2005-2010	0,2	0,0	3,9	3,5	3,7	0,7	*0,8*	*-0,1*	1,7	1,3	1,4	70,5	4,7	20,6

lv	Output Gaps (% of Potential Output)		Actual Output Growth (annual % change)	Potential Growth (annual % change)		Contributions to Potential Growth*					Determinants of Labour Potential and Capital Accumulation			
	HP Filter	PF method		HP Trend Growth	PF Potential Growth	Total Labour (Hours) Contribution	*Labour (persons) Contribution*	*Changes in Hours (per Empl) Contribution*	Capital Accumulation Contribution	TFP Contribution	Growth of Working Age Population (annual % change)	Trend Participation Rate (% of Working Age Population)	NAIRU (% of Labour Force)	Investment Ratio (% of Potential Output)
1995	2,4	-2,9	-0,9								-1,2	71,6	14,4	13,4
1996	0,0	-2,3	3,8	6,3	3,2	-1,1	-1,1	0,0	1,2	3,2	-0,8	71,3	14,9	15,8
1997	1,9	1,2	8,3	6,3	4,5	-0,4	-0,4	0,0	1,7	3,2	-0,5	71,0	14,7	18,3
1998	0,3	-0,6	4,7	6,4	6,7	-0,1	0,0	0,0	3,4	3,2	-0,2	70,8	14,3	27,7
1999	-2,7	-2,7	3,3	6,5	5,4	-0,5	-0,5	0,0	2,7	3,2	-1,1	70,6	13,8	24,5
2000	-2,4	-1,4	6,9	6,6	5,5	-0,6	-0,5	0,0	2,8	3,2	-1,2	70,5	13,3	25,5
2001	-1,3	0,0	8,0	6,8	6,5	0,2	0,2	0,0	2,9	3,3	-0,2	70,4	12,9	26,7
2002	-1,8	-0,5	6,4	6,9	6,9	0,4	0,4	0,0	3,1	3,3	-0,2	70,5	12,3	28,2
2003	-1,6	-0,3	7,2	7,1	7,0	0,3	0,3	0,0	3,2	3,3	-0,6	70,7	11,6	29,3
2004	-0,6	0,1	8,3	7,2	7,9	0,8	0,8	0,0	3,5	3,4	0,0	70,9	10,8	31,8
2005	1,2	0,8	9,1	7,2	8,3	0,9	0,8	0,1	3,8	3,4	-0,1	71,2	10,0	34,2
2006	1,7	0,3	7,7	7,2	8,3	0,9	0,8	0,1	3,7	3,4	-0,1	71,6	9,2	34,8
2007	1,7	-0,7	7,1	7,1	8,2	1,0	0,8	0,1	3,7	3,4	-0,1	72,0	8,4	35,2
2008	2,1	-0,5	8,2	7,0	7,9	0,5	0,4	0,1	3,8	3,4	-0,4	72,4	8,0	37,2
2009	1,7	-0,2	8,1	6,9	7,8	0,3	0,2	0,1	3,9	3,4	-0,6	72,9	7,8	38,9
2010	1,0	0,0	8,0	6,7	7,7	0,2	0,1	0,1	3,8	3,4	-0,7	73,4	7,7	40,0
Periods	**Period Averages**													
1995-2000	-0,1	-1,5	4,3								-0,8	71,0	14,3	20,9
2001-2005	-0,8	0,0	7,8	7,0	7,3	0,5	0,5	0,0	3,3	3,3	-0,2	70,7	11,5	30,1
2005-2010	1,6	0,0	8,0	7,0	8,1	0,6	0,5	0,1	3,8	3,4	-0,3	72,2	8,5	36,7

It	Output Gaps (% of Potential Output)		Actual Output Growth (annual % change)	Potential Growth (annual % change)		Contributions to Potential Growth*					Determinants of Labour Potential and Capital Accumulation			
	HP Filter	**PF method**		**HP Trend Growth**	**PF Potential Growth**	**Total Labour (Hours) Contribution**	***Labour (persons) Contribution***	***Changes in Hours (per Empl) Contribution***	**Capital Accumulation Contribution**	**TFP Contribution**	**Growth of Working Age Population (annual % change)**	**Trend Participation Rate (% of Working Age Population)**	**NAIRU (% of Labour Force)**	**Investment Ratio (% of Potential Output)**
1995	1,3		3,3								-0,8	72,7		
1996	0,6	-6,3	4,7	5,4					2,5	2,8	-0,8	72,5	3,7	22,0
1997	2,1	-3,0	7,0	5,4	3,3	-2,7	*-2,7*	*0,0*	3,2	2,9	-0,8	72,3	6,7	26,5
1998	3,9	0,0	7,3	5,5	4,1	-2,5	*-2,5*	*0,0*	3,7	2,9	-0,7	72,1	9,4	31,1
1999	-3,3	-5,2	-1,7	5,6	3,8	-2,1	*-2,1*	*0,0*	2,9	3,0	-0,5	71,8	11,5	28,1
2000	-4,9	-4,9	3,9	5,7	3,6	-1,7	*-1,7*	*0,0*	2,2	3,1	-0,4	71,5	13,0	24,7
2001	-3,8	-2,5	7,2	5,9	4,6	-1,1	*-1,1*	*0,0*	2,4	3,2	-0,1	71,2	13,9	26,8
2002	-3,2	-1,6	6,8	6,1	5,7	-0,3	*-0,2*	*0,0*	2,6	3,3	0,2	70,8	14,0	28,2
2003	0,6	2,1	10,5	6,3	6,5	0,3	*0,3*	*0,0*	2,8	3,3	0,1	70,5	13,3	30,2
2004	1,2	2,1	7,0	6,4	7,0	0,6	*0,6*	*0,0*	3,0	3,3	0,0	70,1	12,0	31,6
2005	1,8	2,2	7,0	6,4	6,9	0,5	*0,5*	*0,0*	3,0	3,2	-0,5	69,8	10,5	32,6
2006	1,7	1,4	6,2	6,3	7,0	0,7	*0,7*	*0,0*	3,0	3,1	-0,3	69,4	8,8	32,9
2007	1,3	0,2	5,8	6,2	7,0	0,8	*0,8*	*0,0*	3,0	3,1	-0,1	69,1	7,2	33,2
2008	2,1	0,1	6,3	6,1	6,4	0,2	*0,2*	*0,0*	3,0	3,0	-0,1	68,8	6,3	34,5
2009	1,5	0,1	6,0	5,9	6,0	-0,2	*-0,2*	*0,0*	3,1	3,0	-0,2	68,4	5,9	35,9
2010	0,8	0,0	5,8	5,8	5,8	-0,3	*-0,3*	*0,0*	3,1	2,9	-0,2	68,0	5,7	37,0
Periods	**Period Averages**													
1995-2000	0,0		4,1								-0,7	72,2		26,5
2001-2005	-0,7	0,5	7,7	6,2	6,1	0,0	*0,0*	*0,0*	2,8	3,2	-0,1	70,5	12,7	29,9
2005-2010	1,5	0,7	6,2	6,1	6,5	0,3	*0,3*	*0,0*	3,0	3,0	-0,2	68,9	7,4	34,4

hu	Output Gaps (% of Potential Output)		Actual Output Growth (annual % change)	Potential Growth (annual % change)		Contributions to Potential Growth*					Determinants of Labour Potential and Capital Accumulation			
	HP Filter	PF method		HP Trend Growth	PF Potential Growth	Total Labour (Hours) Contribution	*Labour (persons) Contribution*	*Changes in Hours (per Empl) Contribution*	Capital Accumulation Contribution	TFP Contribution	Growth of Working Age Population (annual % change)	Trend Participation Rate (% of Working Age Population)	NAIRU (% of Labour Force)	Investment Ratio (% of Potential Output)
1995	1,1	2,2	1,5								0,0	57,0	11,2	20,5
1996	-1,6	-0,9	1,3	4,0	4,5	1,2	*1,4*	*-0,2*	2,0	1,3	0,0	57,2	9,7	20,9
1997	-1,1	-0,9	4,6	4,1	4,6	1,1	*1,3*	*-0,2*	2,1	1,3	0,0	57,5	8,3	21,8
1998	-0,3	-0,7	4,9	4,1	4,6	0,9	*1,1*	*-0,2*	2,3	1,3	-0,1	57,8	7,1	23,7
1999	-0,2	-0,8	4,2	4,0	4,3	0,6	*0,8*	*-0,2*	2,3	1,3	-0,1	58,2	6,4	24,0
2000	0,9	0,3	5,2	4,0	4,1	0,4	*0,6*	*-0,2*	2,3	1,3	0,0	58,5	6,0	24,8
2001	0,8	0,0	3,8	4,0	4,1	0,4	*0,7*	*-0,2*	2,3	1,4	0,0	58,8	5,5	25,3
2002	0,4	-0,6	3,5	3,9	4,1	0,3	*0,5*	*-0,2*	2,4	1,4	-0,1	59,1	5,2	26,5
2003	-0,4	-1,3	2,9	3,8	3,8	0,1	*0,4*	*-0,2*	2,2	1,4	-0,1	59,5	5,1	26,2
2004	0,0	-0,9	4,2	3,8	3,7	0,0	*0,3*	*-0,2*	2,3	1,4	-0,1	59,8	5,2	27,2
2005	0,0	-0,7	3,7	3,7	3,5	-0,1	*0,1*	*-0,2*	2,3	1,3	-0,1	60,2	5,5	28,2
2006	0,3	-0,3	3,9	3,6	3,5	-0,2	*0,0*	*-0,2*	2,3	1,3	-0,1	60,5	5,9	29,1
2007	0,6	0,2	3,9	3,6	3,4	-0,2	*0,0*	*-0,2*	2,3	1,3	-0,2	60,9	6,3	29,9
2008	0,5	0,1	3,4	3,5	3,4	-0,1	*0,1*	*-0,2*	2,2	1,3	-0,3	61,2	6,5	30,3
2009	0,3	0,1	3,4	3,4	3,4	0,0	*0,1*	*-0,2*	2,2	1,3	-0,3	61,6	6,6	31,0
2010	0,1	0,0	3,3	3,3	3,3	-0,1	*0,0*	*-0,2*	2,2	1,2	-0,4	61,9	6,6	31,7
Periods	**Period Averages**													
1995-2000	-0,2	-0,1	3,6								0,0	57,7	8,1	22,6
2001-2005	0,2	-0,7	3,6	3,8	3,8	0,1	*0,4*	*-0,2*	2,3	1,4	-0,1	59,5	5,3	26,7
2005-2010	0,3	-0,1	3,6	3,5	3,4	-0,1	*0,0*	*-0,2*	2,2	1,3	-0,2	61,0	6,2	30,0

mt

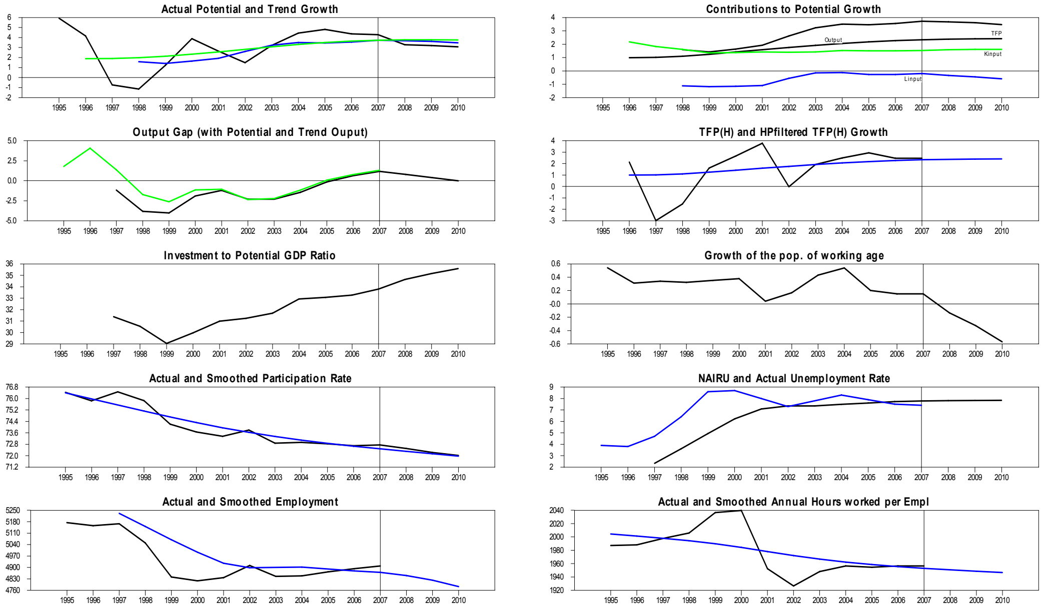
	Output Gaps (% of Potential Output)		**Actual Output Growth (annual % change)**	**Potential Growth (annual % change)**		**Contributions to Potential Growth***					**Determinants of Labour Potential and Capital Accumulation**			
	HP Filter	**PF method**		**HP Trend Growth**	**PF Potential Growth**	**Total Labour (Hours) Contribution**	***Labour (persons) Contribution***	***Changes in Hours (per Empl) Contribution***	**Capital Accumulation Contribution**	**TFP Contribution**	**Growth of Working Age Population (annual % change)**	**Trend Participation Rate (% of Working Age Population)**	**NAIRU (% of Labour Force)**	**Investment Ratio (% of Potential Output)**
1995	-3,8	-3,0	6,2									60,4	5,1	27,7
1996	-2,7	-2,3	4,0	2,8	3,3	-0,3	*-0,1*	*-0,2*	2,8	0,8	0,3	60,3	5,5	24,5
1997	-0,8	-0,7	4,9	2,8	3,1	0,1	*0,3*	*-0,2*	2,2	0,8	1,0	60,3	6,0	22,7
1998	0,0	0,0	3,4	2,7	2,7	0,1	*0,3*	*-0,2*	1,9	0,7	1,0	60,3	6,5	21,4
1999	1,5	1,5	4,1	2,5	2,5	0,1	*0,3*	*-0,2*	1,8	0,5	1,0	60,2	6,8	21,7
2000	5,6	4,3	6,4	2,2	3,6	1,0	*1,2*	*-0,2*	2,2	0,3	2,2	60,2	7,2	24,6
2001	3,9	1,8	0,2	1,9	2,7	1,1	*1,3*	*-0,2*	1,5	0,0	2,4	60,1	7,4	20,7
2002	3,0	2,1	0,8	1,6	0,4	-0,3	*-0,2*	*-0,1*	0,7	0,0	0,0	60,1	7,6	16,3
2003	-0,2	-1,1	-1,9	1,3	1,3	-0,1	*0,0*	*-0,1*	1,4	0,0	0,2	60,0	7,6	20,8
2004	-0,9	-2,0	0,4	1,1	1,3	0,0	*0,0*	*-0,1*	1,4	0,0	0,0	60,0	7,5	21,5
2005	-1,1	-3,1	0,8	0,9	2,0	0,4	*0,4*	*0,0*	1,6	0,0	0,6	59,9	7,4	23,2
2006	-1,2	-4,3	0,7	0,8	2,0	0,4	*0,4*	*0,0*	1,6	0,0	0,6	59,9	7,3	23,8
2007	-0,8	-5,1	1,1	0,7	2,0	0,4	*0,5*	*0,0*	1,5	0,0	0,6	59,8	7,1	24,0
2008	-0,7	-3,4	4,2	0,7	2,4	0,9	*1,0*	*0,0*	1,4	0,0	1,5	59,8	7,0	23,8
2009	-0,5	-1,7	3,7	0,7	1,9	0,5	*0,6*	*0,0*	1,4	0,0	0,9	59,7	7,0	23,9
2010	-0,4	0,0	3,2	0,7	1,4	0,1	*0,1*	*0,0*	1,4	0,0	0,2	59,7	7,0	24,4
Periods	**Period Averages**													
1995-2000	0,0	-0,1	4,8									60,3	6,2	23,8
2001-2005	0,9	-0,4	0,1	1,4	1,5	0,2	*0,3*	*-0,1*	1,3	0,0	0,6	60,0	7,5	20,5
2005-2010	-0,8	-3,0	2,3	0,8	1,9	0,5	*0,5*	*0,0*	1,5	0,0	0,7	59,8	7,1	23,9

pl	Output Gaps (% of Potential Output)		Actual Output Growth (annual % change)	Potential Growth (annual % change)		Contributions to Potential Growth*					Determinants of Labour Potential and Capital Accumulation			
	HP Filter	**PF method**		**HP Trend Growth**	**PF Potential Growth**	**Total Labour (Hours) Contribution**	***Labour (persons) Contribution***	***Changes in Hours (per Empl) Contribution***	**Capital Accumulation Contribution**	**TFP Contribution**	**Growth of Working Age Population (annual % change)**	**Trend Participation Rate (% of Working Age Population)**	**NAIRU (% of Labour Force)**	**Investment Ratio (% of Potential Output)**
1995	-3,1	-4,4	7,0								0,6	66,8	8,3	16,7
1996	-1,3	-2,6	6,0	4,1	4,1	-0,3	*-0,4*	*0,1*	1,9	2,4	0,6	66,4	8,8	19,2
1997	1,3	-0,5	6,8	4,1	4,5	-0,4	*-0,4*	*0,1*	2,4	2,4	0,7	66,0	9,6	22,3
1998	2,0	-0,2	4,8	4,0	4,5	-0,6	*-0,7*	*0,1*	2,7	2,4	0,9	65,6	10,8	24,4
1999	2,2	-0,2	4,1	3,9	4,1	-1,0	*-1,0*	*0,1*	2,6	2,4	0,9	65,3	12,5	25,0
2000	2,4	0,2	4,0	3,8	3,6	-1,2	*-1,3*	*0,0*	2,4	2,4	0,8	64,9	14,3	24,8
2001	-0,2	-1,8	1,0	3,7	3,0	-1,2	*-1,2*	*0,0*	1,8	2,4	0,7	64,5	15,9	22,0
2002	-2,3	-2,8	1,4	3,6	2,4	-1,4	*-1,4*	*0,0*	1,5	2,3	-0,2	64,0	17,0	20,2
2003	-2,0	-1,6	3,8	3,5	2,6	-1,1	*-1,1*	*0,0*	1,3	2,3	-0,1	63,6	17,8	19,6
2004	-0,3	0,4	5,3	3,5	3,2	-0,5	*-0,5*	*0,0*	1,4	2,3	0,4	63,1	18,2	19,9
2005	-0,4	0,2	3,4	3,5	3,6	-0,2	*-0,2*	*0,0*	1,4	2,3	0,3	62,7	18,1	20,3
2006	0,4	0,4	4,3	3,4	4,0	0,1	*0,1*	*0,0*	1,5	2,3	0,3	62,2	17,6	21,1
2007	1,6	0,6	4,5	3,3	4,3	0,3	*0,2*	*0,0*	1,7	2,3	0,3	61,7	16,9	22,4
2008	1,3	0,4	3,9	3,2	4,1	0,0	*0,0*	*0,0*	1,7	2,2	0,3	61,3	16,6	22,6
2009	0,8	0,2	3,6	3,1	3,8	-0,1	*-0,2*	*0,0*	1,7	2,2	0,3	60,8	16,4	22,4
2010	0,3	0,0	3,3	3,0	3,5	-0,3	*-0,3*	*0,0*	1,5	2,2	0,1	60,4	16,4	21,7
Periods	**Period Averages**													
1995-2000	0,6	-1,3	5,4								0,8	65,8	10,7	22,0
2001-2005	-1,1	-1,1	3,0	3,5	3,0	-0,9	*-0,9*	*0,0*	1,5	2,3	0,2	63,6	17,4	20,4
2005-2010	0,7	0,3	3,8	3,2	3,9	0,0	*-0,1*	*0,0*	1,6	2,3	0,3	61,5	17,0	21,8

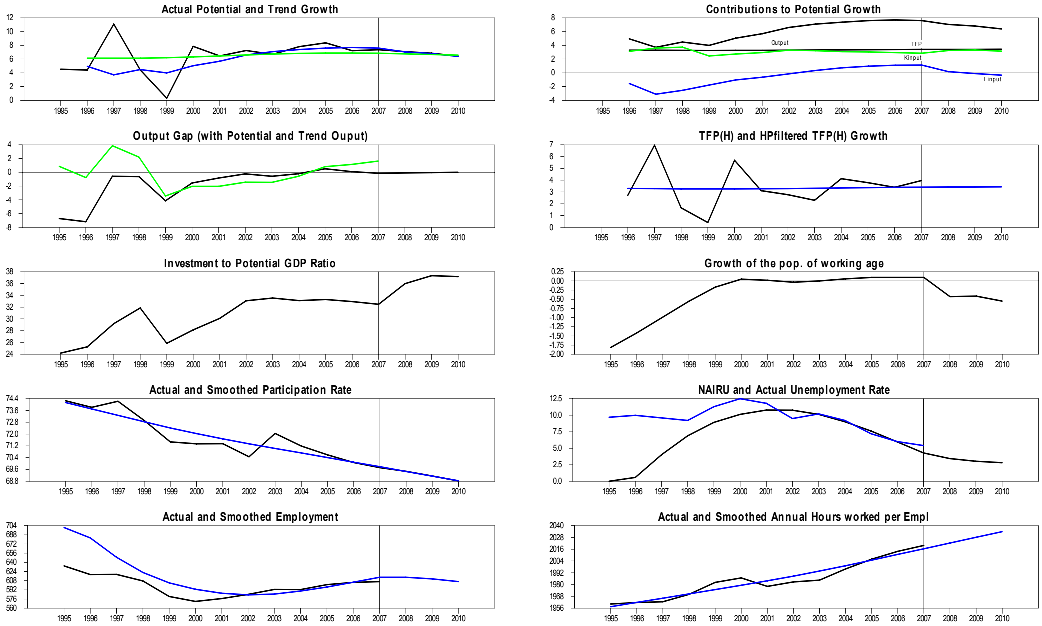
si	Output Gaps (% of Potential Output)		Actual Output Growth (annual % change)	Potential Growth (annual % change)		Contributions to Potential Growth*					Determinants of Labour Potential and Capital Accumulation			
	HP Filter	PF method		HP Trend Growth	PF Potential Growth	Total Labour (Hours) Contribution	*Labour (persons) Contribution*	*Changes in Hours (per Empl) Contribution*	Capital Accumulation Contribution	TFP Contribution	Growth of Working Age Population (annual % change)	Trend Participation Rate (% of Working Age Population)	NAIRU (% of Labour Force)	Investment Ratio (% of Potential Output)
1995	-0,6		4,1								0,2	69,5		
1996	-0,9		3,7	4,0					2,2	1,6	0,1	69,3		
1997	-0,1	0,1	4,8	4,0					2,5	1,5	0,1	69,2	6,5	24,1
1998	-0,2	0,2	3,9	4,0	3,8	-0,3	*-0,2*	*-0,2*	2,6	1,5	-0,1	69,1	6,5	25,4
1999	1,2	1,2	5,4	3,9	4,4	-0,1	*0,1*	*-0,2*	3,0	1,4	0,3	69,0	6,5	28,8
2000	1,5	1,0	4,1	3,9	4,3	0,2	*0,3*	*-0,2*	2,7	1,4	0,5	68,9	6,4	28,1
2001	0,3	-0,3	2,7	3,8	3,9	0,1	*0,3*	*-0,2*	2,4	1,4	0,2	68,9	6,2	27,1
2002	0,0	-0,5	3,5	3,8	3,7	0,1	*0,3*	*-0,2*	2,2	1,3	0,2	68,9	6,0	26,4
2003	-1,0	-1,6	2,7	3,7	3,8	0,3	*0,4*	*-0,2*	2,2	1,4	0,4	69,0	5,8	27,2
2004	-0,5	-1,2	4,2	3,7	3,7	0,1	*0,3*	*-0,1*	2,2	1,4	0,2	69,0	5,7	27,8
2005	-0,4	-0,9	3,8	3,6	3,5	0,1	*0,1*	*-0,1*	2,1	1,4	0,0	69,1	5,6	27,8
2006	0,0	-0,5	4,0	3,6	3,5	0,1	*0,1*	*-0,1*	2,0	1,4	0,1	69,1	5,5	28,1
2007	0,6	0,2	4,2	3,6	3,5	0,1	*0,1*	*0,0*	2,0	1,4	0,0	69,2	5,5	28,7
2008	0,6	0,1	3,3	3,5	3,4	0,0	*0,0*	*0,0*	1,9	1,4	-0,1	69,3	5,5	28,7
2009	0,5	0,1	3,3	3,5	3,3	0,0	*0,0*	*0,0*	1,9	1,4	-0,1	69,4	5,5	28,8
2010	0,2	0,0	3,3	3,4	3,4	0,1	*0,1*	*0,0*	1,8	1,4	0,1	69,5	5,4	29,0
Periods	**Period Averages**													
1995-2000	0,1		4,3								0,2	69,2		26,6
2001-2005	-0,3	-0,9	3,3	3,7	3,7	0,1	*0,3*	*-0,2*	2,2	1,4	0,2	69,0	5,8	27,3
2005-2010	0,3	-0,2	3,7	3,5	3,5	0,1	*0,1*	*0,0*	2,0	1,4	0,0	69,3	5,5	28,5

sk	Output Gaps (% of Potential Output)		Actual Output Growth (annual % change)	Potential Growth (annual % change)		Contributions to Potential Growth*					Determinants of Labour Potential and Capital Accumulation			
	HP Filter	PF method		HP Trend Growth	PF Potential Growth	Total Labour (Hours) Contribution	*Labour (persons) Contribution*	*Changes in Hours (per Empl) Contribution*	Capital Accumulation Contribution	TFP Contribution	Growth of Working Age Population (annual % change)	Trend Participation Rate (% of Working Age Population)	NAIRU (% of Labour Force)	Investment Ratio (% of Potential Output)
1995	-0,7		5,8								1,0	67,6		
1996	1,5	0,2	6,1	3,9					3,8	2,0	0,9	67,4	10,1	30,5
1997	2,3	0,7	4,6	3,9	4,1	-1,8	-1,3	-0,5	3,9	2,0	0,9	67,3	12,5	33,7
1998	2,6	0,7	4,2	3,9	4,2	-1,8	-1,3	-0,5	3,9	2,0	0,9	67,1	14,8	35,9
1999	0,2	-0,7	1,5	3,9	2,9	-1,6	-1,2	-0,5	2,4	2,1	0,9	67,0	16,9	28,0
2000	-1,7	-1,2	2,0	4,0	2,6	-1,5	-1,0	-0,4	1,8	2,2	0,6	66,9	18,6	25,4
2001	-2,0	-1,1	3,8	4,1	3,7	-0,8	-0,4	-0,4	2,1	2,3	0,6	66,7	19,4	27,9
2002	-1,7	-1,1	4,6	4,3	4,7	0,2	0,6	-0,4	1,9	2,5	0,8	66,6	19,1	26,5
2003	-1,8	-2,1	4,5	4,6	5,4	1,1	1,4	-0,4	1,7	2,6	0,0	66,5	17,3	24,7
2004	-1,1	-1,5	5,5	4,8	4,9	0,5	0,9	-0,3	1,6	2,7	0,2	66,4	16,2	24,2
2005	-1,0	-1,3	5,1	5,0	4,8	0,2	0,5	-0,3	1,7	2,8	0,2	66,3	15,6	25,0
2006	-0,8	-0,9	5,5	5,2	5,1	0,3	0,5	-0,2	1,8	2,9	0,3	66,3	15,1	25,8
2007	0,2	0,2	6,3	5,3	5,1	0,2	0,5	-0,2	1,8	3,0	0,3	66,2	14,6	25,8
2008	0,8	0,1	5,0	5,4	5,0	0,0	0,3	-0,2	1,9	3,0	0,3	66,1	14,4	26,2
2009	1,2	0,1	5,0	5,5	5,1	-0,1	0,2	-0,2	2,0	3,1	0,3	66,0	14,3	27,1
2010	1,2	0,0	4,9	5,5	4,9	-0,3	0,0	-0,3	2,0	3,1	0,0	65,9	14,2	27,9
Periods	**Period Averages**													
1995-2000	0,7		4,1								0,9	67,2		30,7
2001-2005	-1,5	-1,4	4,7	4,6	4,7	0,3	0,6	-0,4	1,8	2,6	0,3	66,5	17,5	25,6
2005-2010	0,3	-0,3	5,3	5,3	5,0	0,1	0,3	-0,2	1,9	3,0	0,2	66,1	14,7	26,3

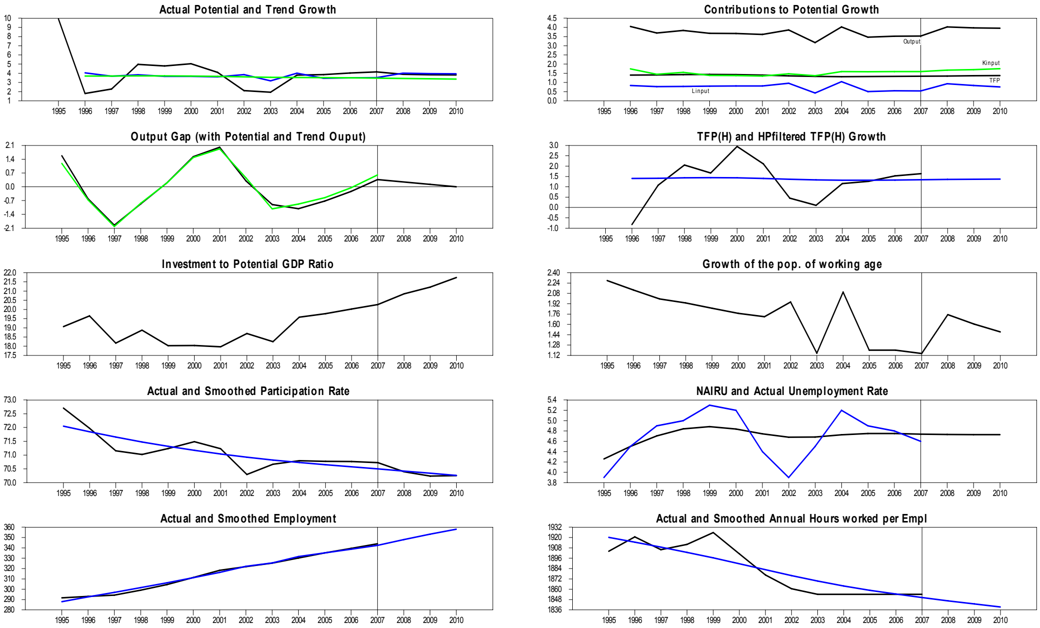
cz


Actual Potential and Trend Growth
Contributions to Potential Growth
TFP
Output
Kinput
Linput
Output Gap (with Potential and Trend Ouput)
TFP(H) and HPfiltered TFP(H) Growth
Investment to Potential GDP Ratio
Growth of the pop. of working age
Actual and Smoothed Participation Rate
NAIRU and Actual Unemployment Rate
Actual and Smoothed Employment
Actual and Smoothed Annual Hours worked per Empl

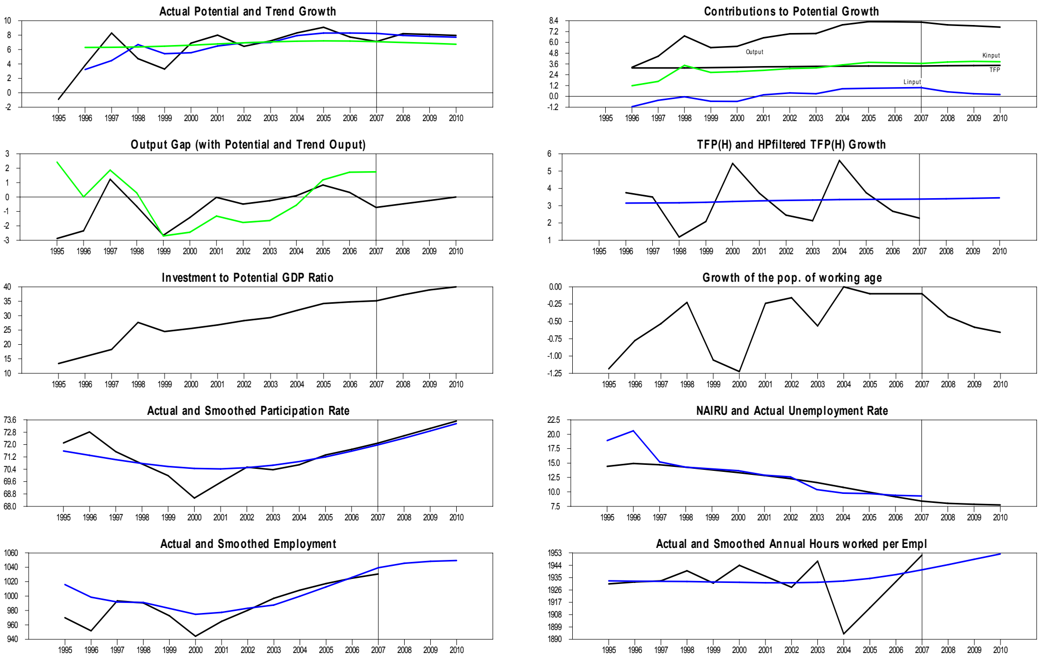
ee


Actual Potential and Trend Growth
Contributions to Potential Growth
Output
TFP
Kinput
Linput
Output Gap (with Potential and Trend Ouput)
TFP(H) and HPfiltered TFP(H) Growth
Investment to Potential GDP Ratio
Growth of the pop. of working age
Actual and Smoothed Participation Rate
NAIRU and Actual Unemployment Rate
Actual and Smoothed Employment
Actual and Smoothed Annual Hours worked per Empl

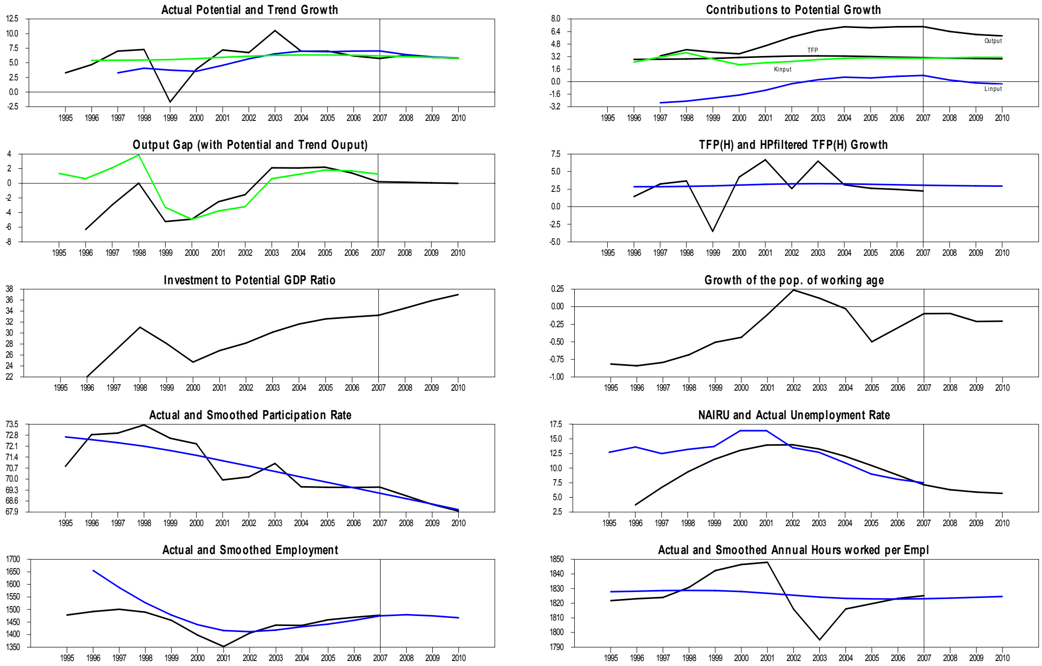
cy


Actual Potential and Trend Growth
Contributions to Potential Growth
Output
Kinput
TFP
Linput
Output Gap (with Potential and Trend Ouput)
TFP(H) and HPfiltered TFP(H) Growth
Investment to Potential GDP Ratio
Growth of the pop. of working age
Actual and Smoothed Participation Rate
NAIRU and Actual Unemployment Rate
Actual and Smoothed Employment
Actual and Smoothed Annual Hours worked per Empl

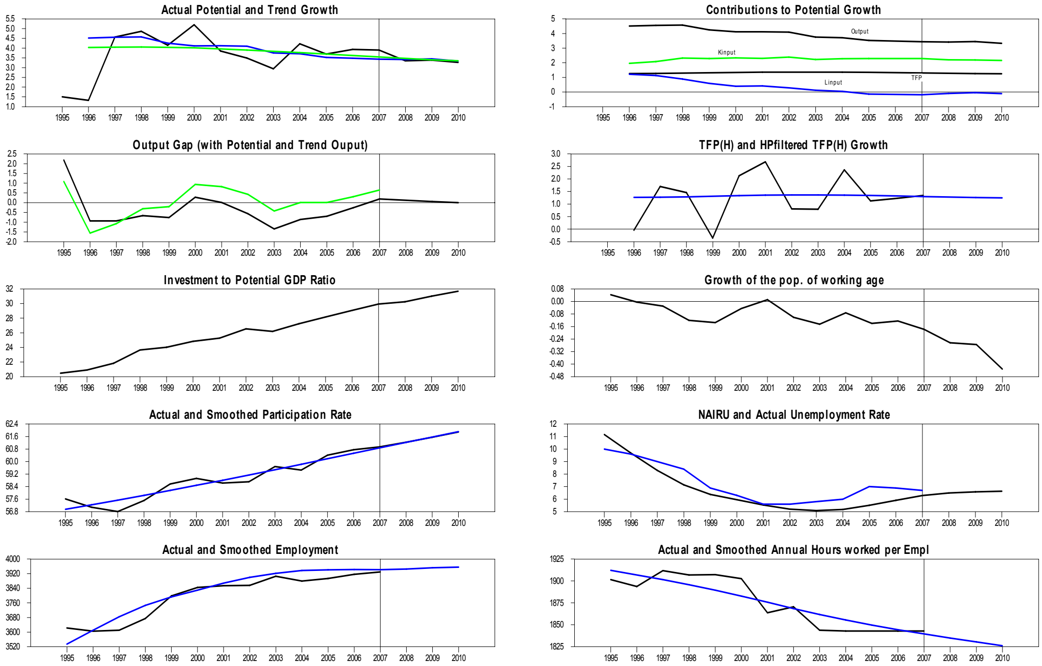
lv


Actual Potential and Trend Growth
Contributions to Potential Growth
Output
Kinput
TFP
Linput
Output Gap (with Potential and Trend Output)
TFP(H) and HPfiltered TFP(H) Growth
Investment to Potential GDP Ratio
Growth of the pop. of working age
Actual and Smoothed Participation Rate
NAIRU and Actual Unemployment Rate
Actual and Smoothed Employment
Actual and Smoothed Annual Hours worked per Empl

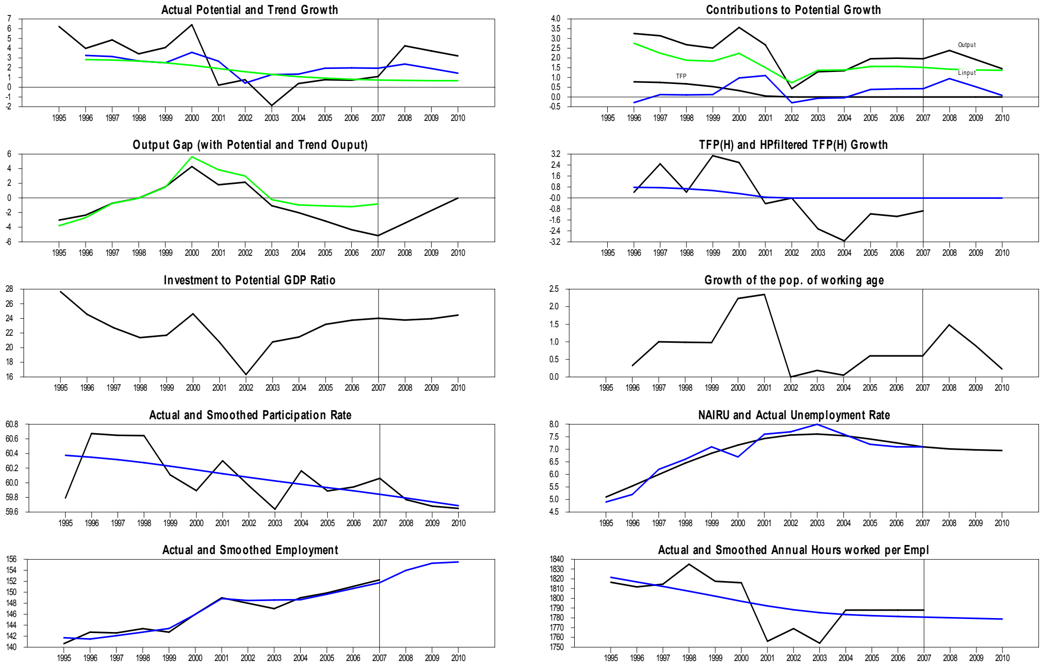
lt


Actual Potential and Trend Growth
Contributions to Potential Growth
Output
TFP
Kinput
Linput
Output Gap (with Potential and Trend Ouput)
TFP(H) and HPfiltered TFP(H) Growth
Investment to Potential GDP Ratio
Growth of the pop. of working age
Actual and Smoothed Participation Rate
NAIRU and Actual Unemployment Rate
Actual and Smoothed Employment
Actual and Smoothed Annual Hours worked per Empl

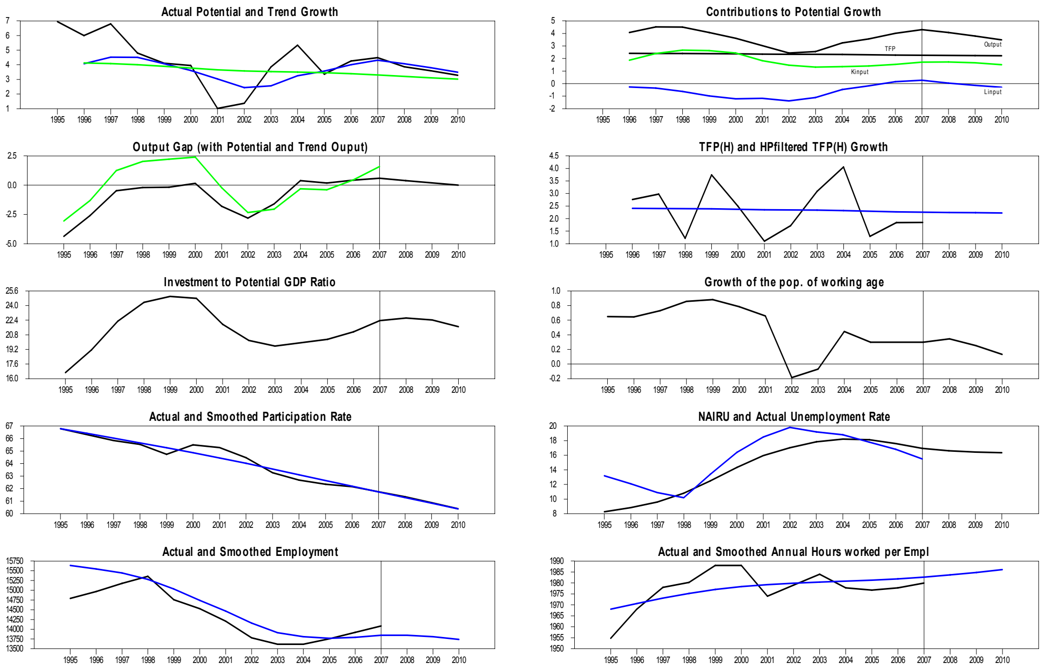
hu


Actual Potential and Trend Growth
Contributions to Potential Growth
Output
Kinput
TFP
Linput
Output Gap (with Potential and Trend Ouput)
TFP(H) and HPfiltered TFP(H) Growth
Investment to Potential GDP Ratio
Growth of the pop. of working age
Actual and Smoothed Participation Rate
NAIRU and Actual Unemployment Rate
Actual and Smoothed Employment
Actual and Smoothed Annual Hours worked per Empl

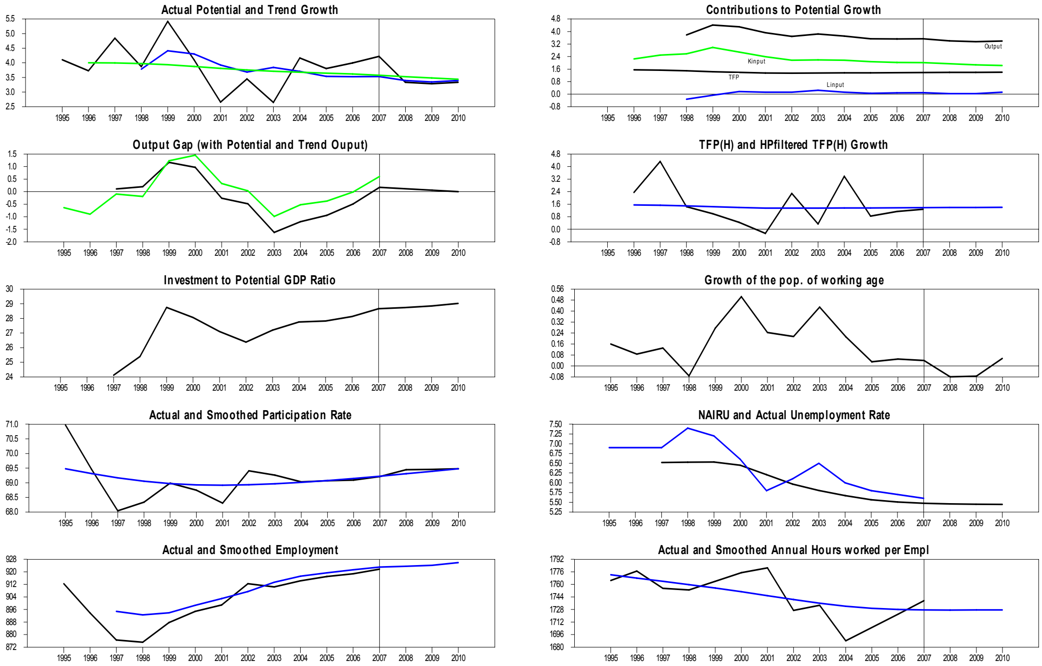
mt


Actual Potential and Trend Growth
Contributions to Potential Growth
Output
TFP
Linput
Output Gap (with Potential and Trend Ouput)
TFP(H) and HPfiltered TFP(H) Growth
Investment to Potential GDP Ratio
Growth of the pop. of working age
Actual and Smoothed Participation Rate
NAIRU and Actual Unemployment Rate
Actual and Smoothed Employment
Actual and Smoothed Annual Hours worked per Empl

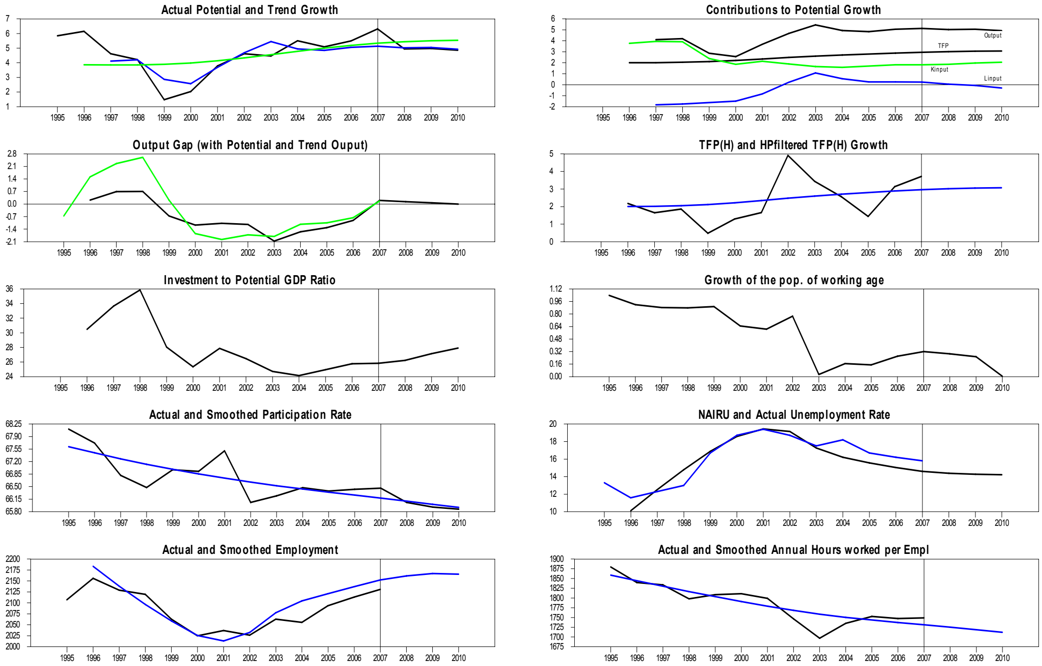
pl


Actual Potential and Trend Growth
Contributions to Potential Growth
TFP
Output
Kinput
Linput
Output Gap (with Potential and Trend Ouput)
TFP(H) and HPfiltered TFP(H) Growth
Investment to Potential GDP Ratio
Growth of the pop. of working age
Actual and Smoothed Participation Rate
NAIRU and Actual Unemployment Rate
Actual and Smoothed Employment
Actual and Smoothed Annual Hours worked per Empl

si


Actual Potential and Trend Growth
Contributions to Potential Growth
Output
Kinput
TFP
Linput
Output Gap (with Potential and Trend Ouput)
TFP(H) and HPfiltered TFP(H) Growth
Investment to Potential GDP Ratio
Growth of the pop. of working age
Actual and Smoothed Participation Rate
NAIRU and Actual Unemployment Rate
Actual and Smoothed Employment
Actual and Smoothed Annual Hours worked per Empl

sk

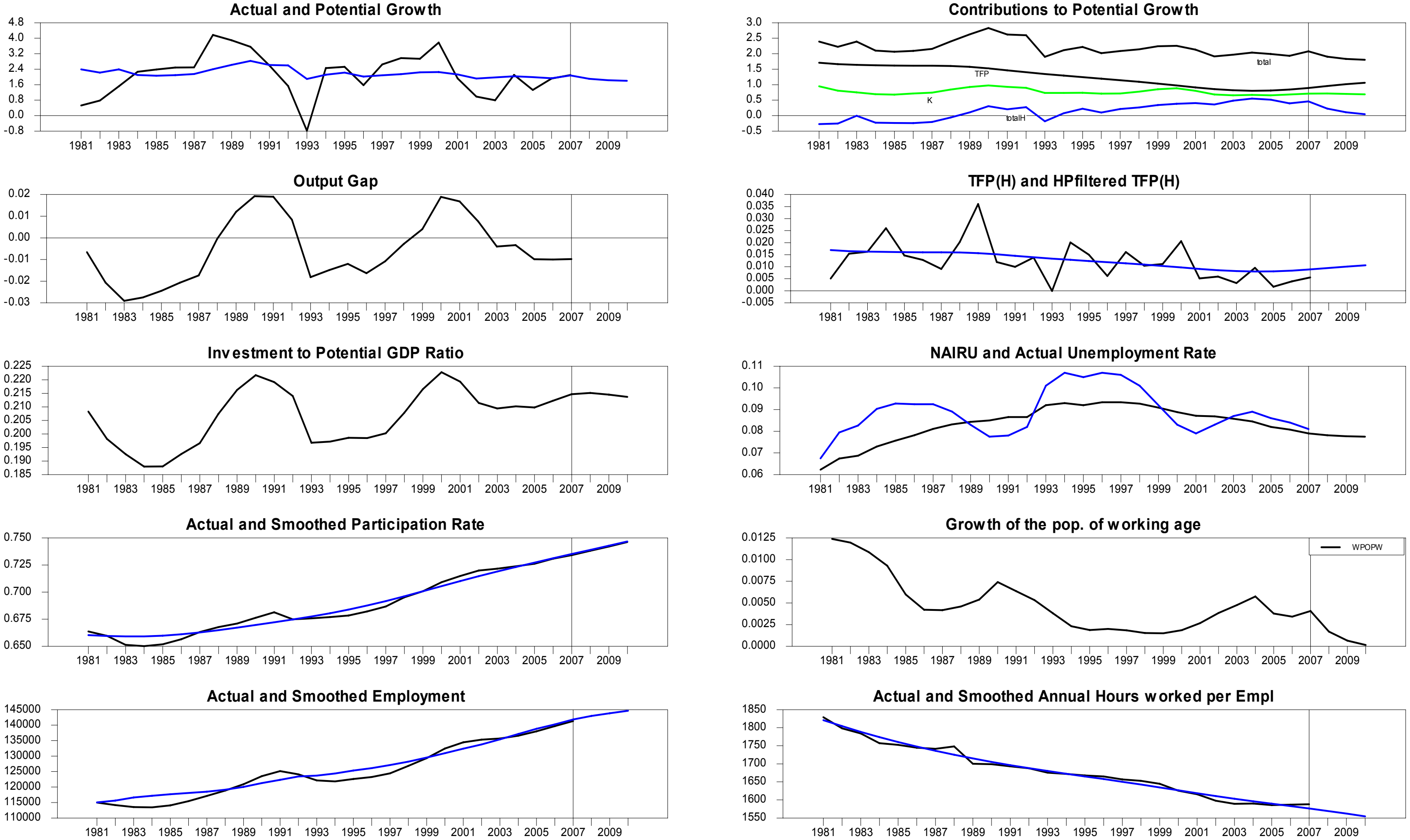

Actual Potential and Trend Growth
Contributions to Potential Growth
Output
TFP
Kinput
Linput
Output Gap (with Potential and Trend Ouput)
TFP(H) and HPfiltered TFP(H) Growth
Investment to Potential GDP Ratio
Growth of the pop. of working age
Actual and Smoothed Participation Rate
NAIRU and Actual Unemployment Rate
Actual and Smoothed Employment
Actual and Smoothed Annual Hours worked per Empl

ANNEX 6 : TABLES AND GRAPHS FOR EU AGGREGATES (EURO AREA, EU15, EU10, EU25) AND THE US

EA (AMECO aggregated values for potential)	Output Gaps (% of Potential Output)		Actual Output Growth (annual % change)	Potential Growth (annual % change)		Contributions to Potential Growth					Determinants of Labour Potential and Capital Accumulation			
	HP Filter	PF method		HP Trend Growth	PF Potential Growth	Total Labour (Hours) Contribution	*Labour (persons) Contribution (*)*	*Changes in Hours (per Empl) Contribution*	Capital Accumulation Contribution	TFP Contribution (**)	Growth of Working Age Population (annual % change)	Trend Participation Rate (% of Working Age Population)	NAIRU (% of Labour Force)	Investment Ratio (% of Potential Output)
1981			0.5								1.2	66.0		20.8
1982			0.8	2.1							1.2	66.0		19.8
1983		*-2.5*	1.5	2.1	2.3	-0.1	*0.4*	*-0.6*	0.8	1.7	1.1	65.9	*7.1*	19.3
1984		*-2.3*	2.3	2.2	2.1	-0.2	*0.3*	*-0.5*	0.7	1.6	0.9	65.9	*7.5*	18.8
1985		*-2.0*	2.4	2.3	2.0	-0.3	*0.2*	*-0.5*	0.7	1.6	0.6	66.0	*7.8*	18.8
1986		*-1.6*	2.5	2.4	2.1	-0.2	*0.3*	*-0.5*	0.7	1.6	0.4	66.1	*8.0*	19.3
1987		*-1.3*	2.5	2.5	2.2	-0.2	*0.2*	*-0.4*	0.7	1.6	0.4	66.3	*8.3*	19.7
1988		*0.4*	4.2	2.5	2.4	-0.1	*0.4*	*-0.4*	0.8	1.6	0.5	66.5	*8.5*	20.7
1989		*1.6*	3.9	2.5	2.7	0.1	*0.5*	*-0.4*	0.9	1.6	0.5	66.7	*8.6*	21.6
1990		*2.2*	3.6	2.5	2.9	0.3	*0.6*	*-0.4*	1.0	1.7	0.7	67.0	*8.7*	22.2
1991	2.7	2.1	2.6	2.4	2.7	0.2	*0.6*	*-0.3*	0.9	1.5	0.6	67.2	8.8	21.9
1992	1.9	1.2	1.5	2.4	2.5	0.1	*0.4*	*-0.3*	0.9	1.4	0.5	67.5	9.0	21.4
1993	-1.1	-1.6	-0.8	2.3	2.1	0.0	*0.3*	*-0.3*	0.7	1.4	0.4	67.7	9.3	19.7
1994	-0.9	-1.2	2.5	2.2	2.1	0.1	*0.4*	*-0.3*	0.7	1.3	0.2	68.1	9.4	19.7
1995	-0.7	-0.9	2.5	2.2	2.2	0.2	*0.4*	*-0.3*	0.7	1.3	0.2	68.4	9.4	19.9
1996	-1.4	-1.4	1.6	2.2	2.0	0.1	*0.4*	*-0.3*	0.7	1.2	0.2	68.8	9.5	19.8
1997	-1.0	-0.9	2.6	2.2	2.1	0.2	*0.5*	*-0.3*	0.7	1.1	0.2	69.2	9.5	20.0
1998	-0.3	-0.2	3.0	2.2	2.2	0.3	*0.6*	*-0.3*	0.8	1.1	0.2	69.6	9.4	20.8
1999	0.4	0.5	2.9	2.2	2.2	0.4	*0.7*	*-0.3*	0.8	1.0	0.1	70.1	9.2	21.7
2000	2.1	1.9	3.8	2.1	2.3	0.5	*0.8*	*-0.3*	0.9	0.9	0.2	70.6	8.9	22.3
2001	1.9	1.6	1.9	2.0	2.1	0.5	*0.8*	*-0.3*	0.8	0.9	0.3	71.0	8.7	21.9
2002	0.8	0.6	1.0	1.9	1.9	0.4	*0.7*	*-0.3*	0.7	0.8	0.4	71.5	8.6	21.1
2003	-0.4	-0.6	0.8	1.9	1.8	0.4	*0.7*	*-0.3*	0.7	0.7	0.5	71.9	8.5	20.9
2004	-0.2	-0.4	2.1	1.8	1.9	0.5	*0.8*	*-0.3*	0.7	0.7	0.6	72.3	8.3	21.0
2005	-0.7	-0.9	1.3	1.8	1.8	0.4	*0.6*	*-0.3*	0.7	0.8	0.4	72.7	8.2	21.0
2006	-0.7	-0.9	1.9	1.8	1.9	0.4	*0.7*	*-0.3*	0.7	0.8	0.3	73.1	8.1	21.2
2007	-0.5	-0.8	2.1	1.9	2.0	0.5	*0.8*	*-0.3*	0.7	0.8	0.4	73.5	7.9	21.5
2008					1.9	0.2	*0.5*	*-0.3*	0.7	1.0	0.2	73.9	7.8	21.5
2009					1.8	0.1	*0.4*	*-0.3*	0.7	1.0	0.1	74.3	7.7	21.5
2010					1.8	0.0	*0.4*	*-0.3*	0.7	1.1	0.0	74.7	7.7	21.4
Periods	**Period Averages**													
1981-1985		-2.3	1.5		2.1	-0.2	*0.3*	*-0.5*	0.7	1.6	1.0	66.0	7.5	19.5
1986-1990		0.3	3.3		2.5	0.0	*0.4*	*-0.4*	0.8	1.6	0.5	66.5	8.4	20.7
1991-1995		-0.1	1.7		2.3	0.1	*0.4*	*-0.3*	0.8	1.4	0.4	67.8	9.2	20.5
1996-2000		0.0	2.8		2.2	0.3	*0.6*	*-0.3*	0.8	1.1	0.2	69.6	9.3	20.9
2001-2005		0.1	1.4		1.9	0.4	*0.7*	*-0.3*	0.7	0.8	0.4	71.9	8.5	21.2
2006-2010					1.9	0.3	*0.5*	*-0.3*	0.7	0.9	0.2	73.9	7.9	21.4

(*): obtained using the aggregated NAIRU
(**): obtained by difference between aggregated potential growth and the sum of K and L contribution (as a single economy)

ea

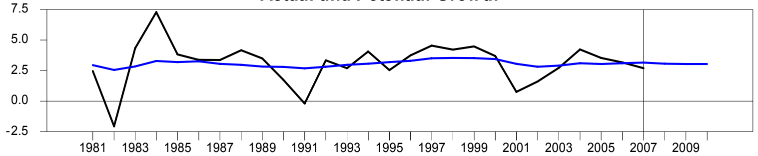


(PF method applied, as if Euro area a single economy)

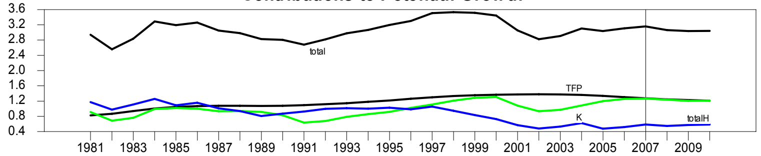
US	Output Gaps (% of Potential Output)		Actual Output Growth (annual % change)	Potential Growth (annual % change)		Contributions to Potential Growth*					Determinants of Labour Potential and Capital Accumulation			
	HP Filter	PF method		HP Trend Growth	PF Potential Growth	Total Labour (Hours) Contribution	*Labour (persons) Contribution*	*Changes in Hours (per Empl) Contribution*	Capital Accumulation Contribution	TFP Contribution	Growth of Working Age Population (annual % change)	Trend Participation Rate (% of Working Age Population)	NAIRU (% of Labour Force)	Investment Ratio (% of Potential Output)
1981		-1.2	2.5		2.9	1.2	*1.3*	*-0.1*	0.9	0.8	1.2	71.7	6.8	16.5
1982		-5.6	-2.1		2.6	1.0	*1.0*	*0.0*	0.7	0.9	1.0	72.2	6.9	14.9
1983		-4.3	4.3		2.8	1.1	*1.1*	*0.0*	0.8	0.9	0.9	72.6	6.7	15.4
1984		-0.6	7.3		3.3	1.3	*1.2*	*0.0*	1.0	1.0	1.0	73.1	6.4	17.3
1985		0.0	3.8		3.2	1.1	*1.1*	*0.0*	1.0	1.0	1.0	73.5	6.4	17.7
1986		0.2	3.4		3.3	1.2	*1.1*	*0.1*	1.0	1.1	1.0	74.0	6.3	17.4
1987		0.5	3.4		3.1	1.0	*1.0*	*0.1*	0.9	1.1	0.8	74.4	6.2	16.8
1988		1.6	4.2		3.0	0.9	*0.9*	*0.1*	0.9	1.1	0.7	74.8	6.1	16.9
1989		2.3	3.5		2.8	0.8	*0.8*	*0.0*	0.9	1.1	0.6	75.2	6.0	17.0
1990		1.2	1.7		2.8	0.9	*0.8*	*0.0*	0.8	1.1	0.8	75.5	6.0	16.4
1991		-1.6	-0.2		2.7	0.9	*0.9*	*0.0*	0.6	1.1	1.0	75.7	5.9	15.2
1992		-1.1	3.3		2.8	1.0	*1.0*	*0.0*	0.7	1.1	1.1	75.9	5.9	15.6
1993		-1.4	2.7		3.0	1.0	*1.0*	*0.0*	0.8	1.1	1.1	76.1	5.7	16.2
1994		-0.4	4.1		3.1	1.0	*1.0*	*0.0*	0.9	1.2	1.2	76.2	5.6	17.0
1995		-1.1	2.5		3.2	1.0	*1.0*	*0.0*	0.9	1.2	1.3	76.4	5.4	17.5
1996		-0.6	3.7		3.3	1.0	*1.0*	*0.0*	1.0	1.3	1.3	76.5	5.3	18.3
1997		0.3	4.5		3.5	1.1	*1.1*	*-0.1*	1.1	1.3	1.5	76.6	5.2	19.2
1998		1.0	4.2		3.5	0.9	*1.1*	*-0.1*	1.2	1.3	1.4	76.7	5.1	20.3
1999		2.0	4.5		3.5	0.8	*1.0*	*-0.2*	1.3	1.4	1.4	76.8	5.1	21.2
2000		2.2	3.7		3.4	0.7	*0.9*	*-0.2*	1.3	1.4	1.3	76.9	5.1	21.8
2001		-0.1	0.8		3.1	0.6	*0.8*	*-0.2*	1.1	1.4	1.2	76.9	5.1	20.8
2002		-1.3	1.6		2.8	0.5	*0.7*	*-0.2*	0.9	1.4	1.2	76.9	5.3	19.4
2003		-1.4	2.7		2.9	0.5	*0.8*	*-0.2*	1.0	1.4	1.2	77.0	5.3	19.4
2004		-0.4	4.2		3.1	0.6	*0.8*	*-0.2*	1.1	1.4	1.2	77.0	5.2	20.4
2005		0.1	3.5		3.0	0.5	*0.6*	*-0.2*	1.2	1.3	0.9	77.0	5.2	21.2
2006		0.2	3.2		3.1	0.5	*0.6*	*-0.1*	1.3	1.3	0.9	77.1	5.1	21.7
2007		-0.3	2.7		3.2	0.6	*0.7*	*-0.1*	1.3	1.3	1.0	77.2	5.1	21.9
2008					3.1	0.5	*0.6*	*-0.1*	1.2	1.2	0.9	77.2	5.1	21.8
2009					3.0	0.6	*0.6*	*0.0*	1.2	1.2	0.8	77.3	5.1	21.7
2010					3.0	0.6	*0.6*	*0.0*	1.2	1.2	0.8	77.4	5.1	21.8
Periods	**Period Averages**													
1981-1985		-2.3	3.2		3.0	1.1	*1.1*	*0.0*	0.9	0.9	1.0	72.6	6.7	16.3
1986-1990		1.2	3.2		3.0	1.0	*0.9*	*0.0*	0.9	1.1	0.8	74.8	6.1	16.9
1991-1995		-1.1	2.5		2.9	1.0	*1.0*	*0.0*	0.8	1.2	1.2	76.1	5.7	16.3
1996-2000		1.0	4.1		3.5	0.9	*1.0*	*-0.1*	1.2	1.3	1.4	76.7	5.2	20.2
2001-2005		-0.6	2.6		3.0	0.5	*0.7*	*-0.2*	1.1	1.4	1.1	77.0	5.2	20.2
2006-2010					3.1	0.6	*0.6*	*-0.1*	1.2	1.3	0.9	77.2	5.1	21.8

us

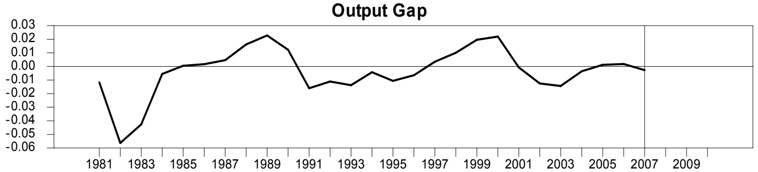
Actual and Potential Growth



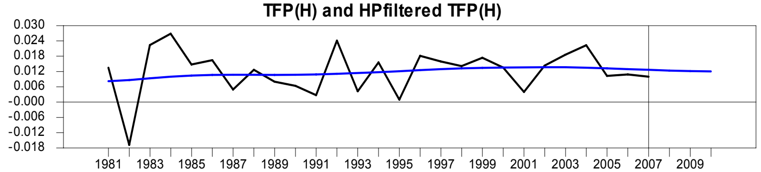
Contributions to Potential Growth



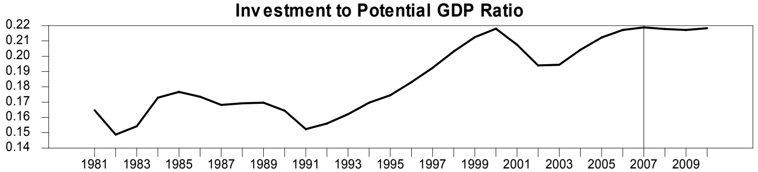
Output Gap



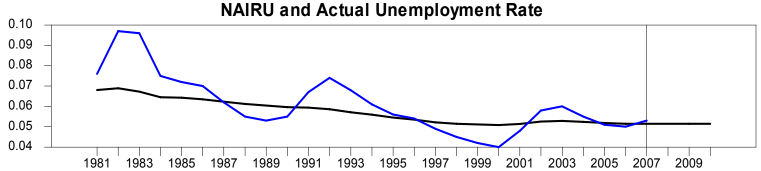
TFP(H) and HPfiltered TFP(H)



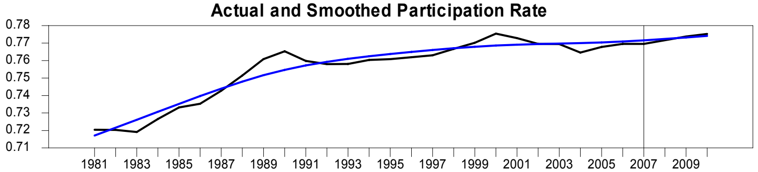
Investment to Potential GDP Ratio



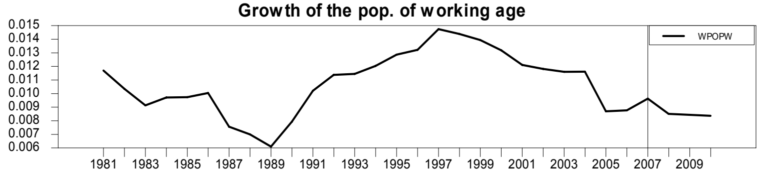
NAIRU and Actual Unemployment Rate



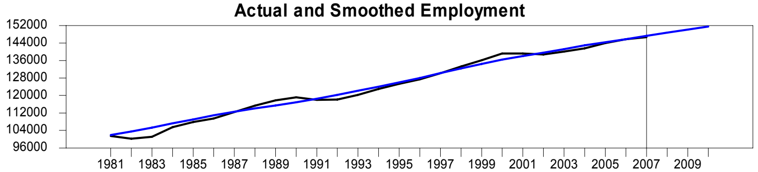
Actual and Smoothed Participation Rate



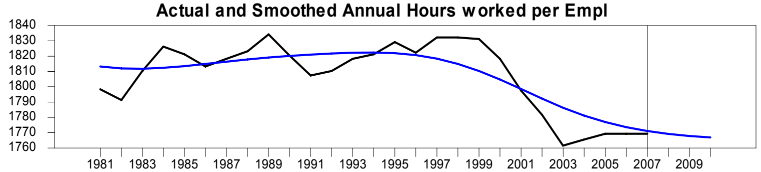
Growth of the pop. of working age



Actual and Smoothed Employment



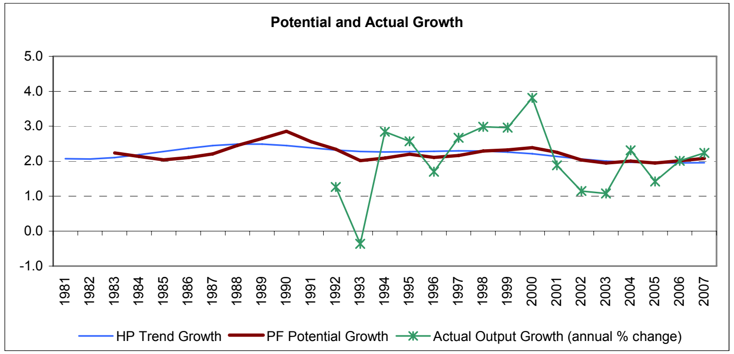
Actual and Smoothed Annual Hours worked per Empl

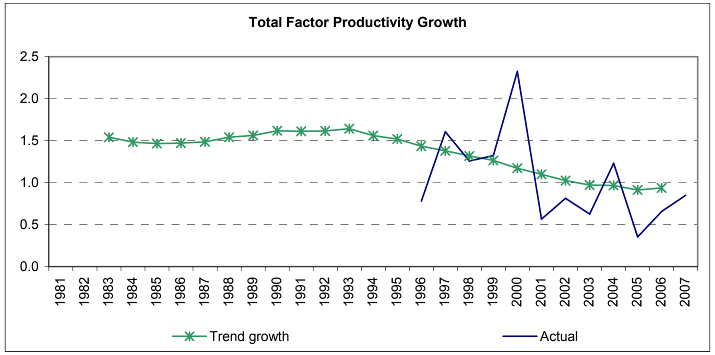


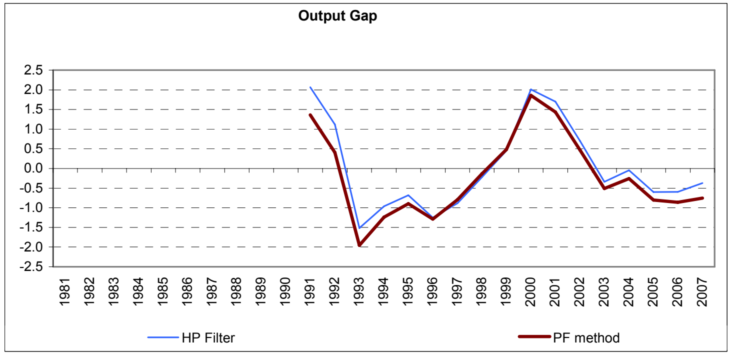
EU15 Source: AMECO and aggregation of MS values	Output Gaps (% of Potential Output)		Actual Output Growth (annual % change)	Potential Growth (annual % change)		Aggregated Contributions to Potential Growth					Related information			
	HP Filter *	PF method *	*	HP Trend Growth *	PF Potential Growth *	Total Labour (Hours) Contribution **	*Labour (persons) Contribution* **	*Changes in Hours (per Empl) Contribution* ***	Capital Accumulation Contribution **	TFP Contribution ***	Growth of Working Age Population (annual % change) **	Trend Participation Rate (% of Working Age Population) **	NAIRU (% of Labour Force) *	Investment Ratio (% of Potential Output) *
1981				2.1								67.6		
1982				2.1					0.7		1.1	67.6		
1983				2.1	2.2	0.0	0.5	-0.4	0.7	1.5	1.0	67.6		
1984				2.2	2.1	0.0	0.4	-0.4	0.7	1.5	0.9	67.7		
1985				2.3	2.0	-0.1	0.2	-0.4	0.7	1.5	0.5	67.8		
1986				2.4	2.1	-0.1	0.2	-0.3	0.7	1.5	0.4	68.0		
1987				2.4	2.2	0.0	0.3	-0.3	0.8	1.5	0.4	68.2		
1988				2.5	2.5	0.1	0.4	-0.3	0.8	1.5	0.4	68.4		
1989				2.5	2.6	0.2	0.5	-0.3	0.9	1.6	0.5	68.6		
1990				2.4	2.9	0.3	0.7	-0.3	0.9	1.6	0.7	68.8		
1991	2.1	1.4		2.4	2.6	0.1	0.5	-0.3	0.8	1.6	0.6	69.1	8.5	21.1
1992	1.1	0.4	1.3	2.3	2.3	0.0	0.4	-0.4	0.7	1.6	0.4	69.2	8.7	20.6
1993	-1.5	-2.0	-0.4	2.3	2.0	-0.2	0.2	-0.4	0.5	1.6	0.3	69.4	8.9	19.0
1994	-1.0	-1.2	2.8	2.3	2.1	0.0	0.3	-0.4	0.6	1.6	0.2	69.7	9.0	19.2
1995	-0.7	-0.9	2.6	2.3	2.2	0.1	0.4	-0.4	0.6	1.5	0.2	69.9	8.9	19.3
1996	-1.3	-1.3	1.7	2.3	2.1	0.0	0.4	-0.3	0.6	1.4	0.3	70.2	9.0	19.3
1997	-0.9	-0.8	2.7	2.3	2.2	0.1	0.5	-0.3	0.6	1.4	0.2	70.5	8.9	19.5
1998	-0.2	-0.1	3.0	2.3	2.3	0.3	0.6	-0.3	0.7	1.3	0.2	70.8	8.7	20.4
1999	0.5	0.5	3.0	2.3	2.3	0.3	0.6	-0.3	0.8	1.3	0.3	71.2	8.5	21.1
2000	2.0	1.9	3.8	2.2	2.4	0.4	0.8	-0.3	0.8	1.2	0.3	71.5	8.2	21.6
2001	1.7	1.4	1.9	2.1	2.3	0.4	0.8	-0.3	0.7	1.1	0.4	71.9	8.0	21.2
2002	0.7	0.5	1.1	2.1	2.0	0.4	0.7	-0.3	0.6	1.0	0.4	72.3	7.9	20.5
2003	-0.3	-0.5	1.1	2.0	1.9	0.4	0.7	-0.3	0.6	1.0	0.4	72.6	7.8	20.2
2004	0.0	-0.3	2.3	2.0	2.0	0.4	0.7	-0.3	0.6	1.0	0.5	73.0	7.6	20.4
2005	-0.6	-0.8	1.4	1.9	1.9	0.4	0.7	-0.3	0.7	0.9	0.4	73.3	7.5	20.4
2006	-0.6	-0.9	2.0	1.9	2.0	0.4	0.6	-0.3	0.7	0.9	0.4	73.6	7.3	20.6
2007	-0.4	-0.8	2.2	2.0	2.1	0.4	0.6	-0.3	0.7	1.0	0.5	73.9	7.2	20.9
Periods	**Period Averages**													
1981-1985					2.1	0.0	0.4	-0.4	0.7	1.5		67.7		
1986-1990					2.5	0.1	0.4	-0.3	0.8	1.5		68.4		
1991-1995	0.0	-0.5	1.6	2.3	2.2	0.0	0.4	-0.4	0.7	1.6	0.4	69.5	8.8	19.8
1996-2000	0.0	0.0	2.8	2.3	2.3	0.2	0.6	-0.3	0.7	1.3	0.3	70.8	8.7	20.4
2001-2005	0.3	0.1	1.6	2.0	2.0	0.4	0.7	-0.3	0.6	1.0	0.4	72.6	7.8	20.5
2005-2007	-0.5	-0.8	1.9	2.0	2.0	0.4	0.7	-0.3	0.7	0.9	0.4	73.6	7.3	20.6

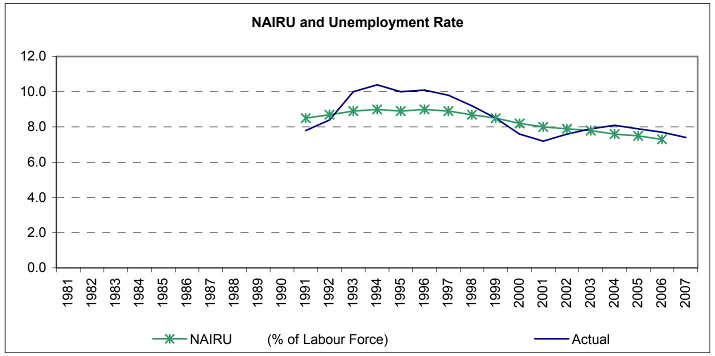
*: Source: AMECO
**: Source: aggregation of MS values
***: Source: balance

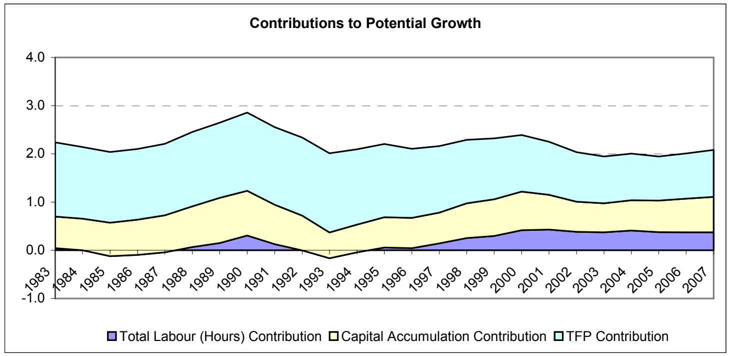
Summary Graphs EU15

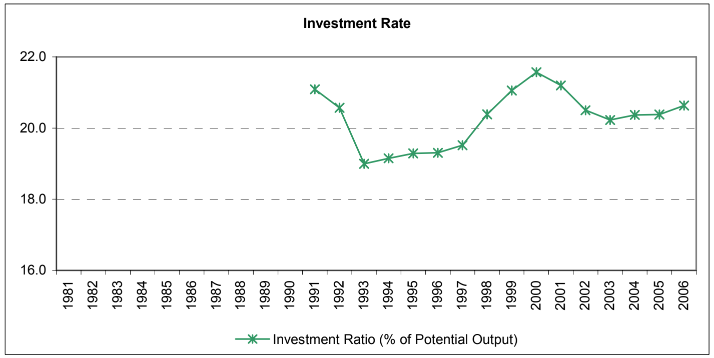








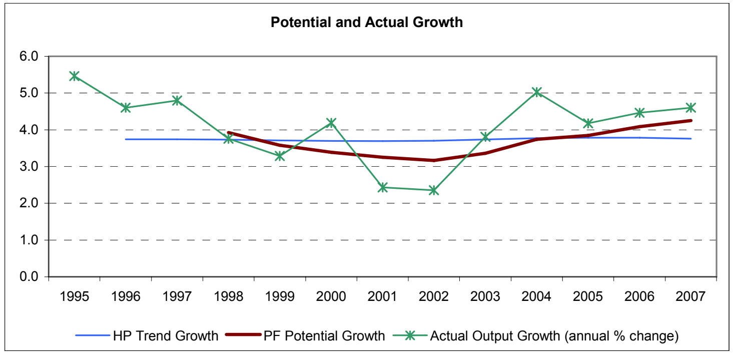


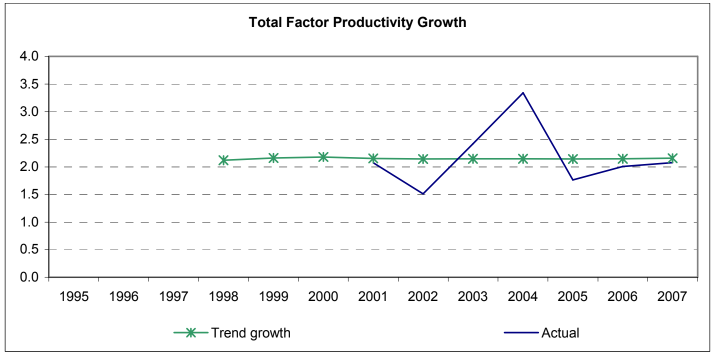


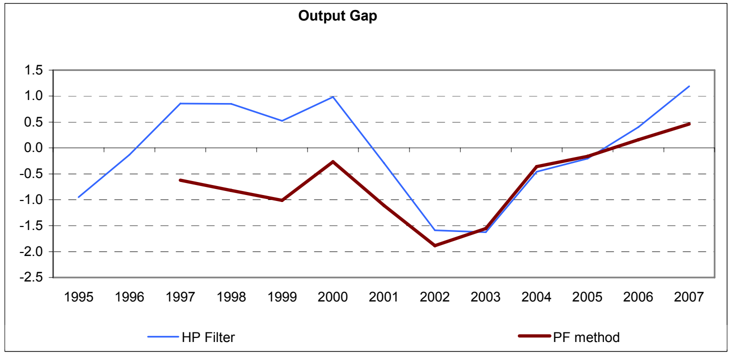
EU10 *Source: AMECO and aggregation of MS values*	Output Gaps (% of Potential Output)		Actual Output Growth (annual % change)	Potential Growth (annual % change)		Contributions to Potential Growth*					Determinants of Labour Potential and Capital Accumulation			
	HP Filter	PF method		HP Trend Growth	PF Potential Growth	Total Labour (Hours) Contribution	*Labour (persons) Contribution*	*Changes in Hours (per Empl) Contribution*	Capital Accumulation Contribution	TFP Contribution	Growth of Working Age Population (annual % change)	Trend Participation Rate (% of Working Age Population)	NAIRU (% of Labour Force)	Investment Ratio (% of Potential Output)
	*	*	*	*	*	**	**	***	**	***	**	**	*	*
1995	-0.9		5.5									67.5		22.6
1996	-0.1		4.6	3.7					2.2		0.4	67.2		24.4
1997	0.9	-0.6	4.8	3.7					2.4		0.4	67.0	8.3	26.0
1998	0.8	-0.8	3.8	3.7	3.9	-0.7	*-0.7*	*0.0*	2.5	2.1	0.5	66.7	9.3	27.5
1999	0.5	-1.0	3.3	3.7	3.6	-0.9	*-0.8*	*-0.1*	2.3	2.2	0.5	66.5	10.6	27.0
2000	1.0	-0.3	4.2	3.7	3.4	-1.0	*-0.9*	*-0.1*	2.2	2.2	0.5	66.2	11.9	27.0
2001	-0.3	-1.1	2.4	3.7	3.3	-0.8	*-0.7*	*-0.1*	1.9	2.2	0.4	66.0	12.8	25.7
2002	-1.6	-1.9	2.4	3.7	3.2	-0.7	*-0.6*	*-0.1*	1.7	2.1	0.0	65.7	13.3	25.2
2003	-1.6	-1.6	3.8	3.7	3.4	-0.4	*-0.3*	*-0.1*	1.7	2.1	0.0	65.5	13.4	25.2
2004	-0.5	-0.4	5.0	3.8	3.7	-0.1	*0.0*	*-0.1*	1.7	2.1	0.3	65.2	13.5	25.9
2005	-0.2	-0.2	4.2	3.8	3.8	-0.1	*0.0*	*-0.1*	1.8	2.1	0.2	65.0	13.3	26.2
2006	0.4	0.2	4.5	3.8	4.1	0.1	*0.2*	*0.0*	1.8	2.1	0.2	64.7	13.0	26.8
2007	1.2	0.5	4.6	3.8	4.3	0.2	*0.2*	*0.0*	1.9	2.2	0.2	64.5	12.5	27.6
Periods	**Period Averages**													
1995-2000	0.4		4.3								0.5	66.8	10.0	25.7
2001-2005	-0.8	-1.0	3.6	3.7	3.5	-0.4	*-0.3*	*-0.1*	1.8	2.1	0.2	65.5	13.3	25.6
2005-2007	0.5	0.1	4.4	3.8	4.1	0.1	*0.1*	*0.0*	1.8	2.1	0.2	64.7	12.9	26.9

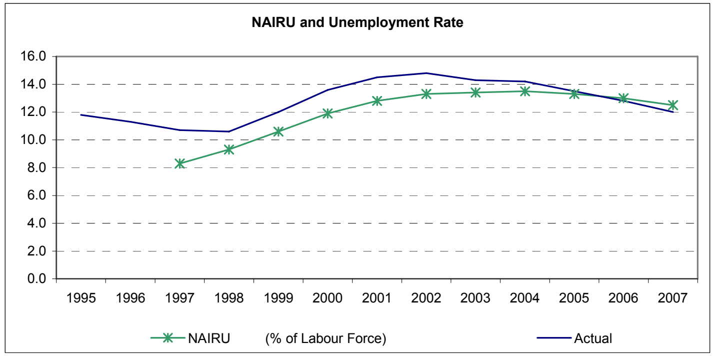
*: Source: AMECO
**: Source: aggregation of MS values
***: Source: balance

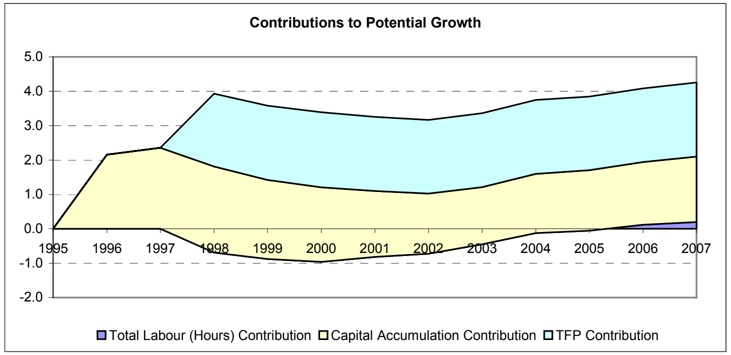
Summary Graphs EU10

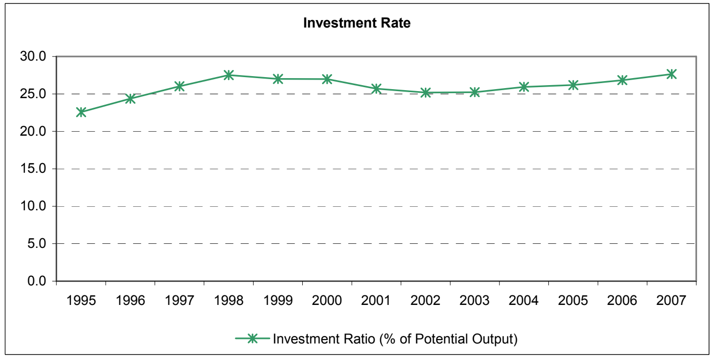












EU25 *Source: AMECO and aggregation of MS values*	Output Gaps (% of Potential Output)		Actual Output Growth (annual % change)	Potential Growth (annual % change)		Contributions to Potential Growth					Determinants of Labour Potential and Capital Accumulation			
	HP Filter	PF method		HP Trend Growth	PF Potential Growth	Total Labour (Hours) Contribution	*Labour (persons) Contribution (*)*	*Changes in Hours (per Empl) Contribution*	Capital Accumulation Contribution	TFP Contribution (**)	Growth of Working Age Population (annual % change)	Trend Participation Rate (% of Working Age Population)	NAIRU (% of Labour Force)	Investment Ratio (% of Potential Output)
	*	*	*	*	*	**	**	***	**	***	**	**	*	*
1995	-0.7		2.7									69.5		20.0
1996	-1.2		1.8	2.3					0.7		0.3	69.7		20.0
1997	-0.8	-0.8	2.7	2.3					0.7		0.3	69.9	8.8	20.4
1998	-0.2	-0.2	3.0	2.3	2.3	0.1	*0.4*	*-0.3*	0.8	1.5	0.3	70.1	8.8	21.3
1999	0.5	0.4	3.0	2.3	2.4	0.1	*0.4*	*-0.3*	0.8	1.5	0.3	70.4	8.9	21.8
2000	2.0	1.8	3.8	2.3	2.4	0.2	*0.5*	*-0.3*	0.8	1.4	0.3	70.6	8.8	22.2
2001	1.6	1.3	1.9	2.2	2.3	0.2	*0.5*	*-0.3*	0.7	1.3	0.4	70.9	8.8	21.4
2002	0.6	0.4	1.2	2.1	2.1	0.2	*0.5*	*-0.3*	0.7	1.2	0.4	71.2	8.7	20.8
2003	-0.4	-0.6	1.2	2.1	2.0	0.2	*0.5*	*-0.3*	0.6	1.1	0.4	71.4	8.7	20.7
2004	-0.1	-0.3	2.4	2.0	2.1	0.3	*0.6*	*-0.3*	0.7	1.1	0.4	71.7	8.5	21.1
2005	-0.6	-0.8	1.5	2.0	2.0	0.3	*0.6*	*-0.3*	0.7	1.0	0.4	71.9	8.4	21.0
2006	-0.6	-0.8	2.1	2.0	2.1	0.3	*0.6*	*-0.2*	0.7	1.0	0.4	72.1	8.2	21.5
2007	-0.3	-0.7	2.4	2.0	2.2	0.3	*0.6*	*-0.2*	0.8	1.1	0.4	72.3	8.0	21.8
Periods	**Period Averages**													
1995-2000	-0.1		2.8								0.3	70.0	8.8	20.9
2001-2005	0.2	0.0	1.7	2.1	2.1	0.3	*0.5*	*-0.3*	0.7	1.2	0.4	71.4	8.6	21.0
2005-2007	-0.5	-0.8	2.0	2.0	2.1	0.3	*0.6*	*-0.3*	0.7	1.0	0.4	72.1	8.2	21.4

*: Source: AMECO
**: Source: aggregation of MS values
***: Source: balance

Summary Graphs EU25