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Focus on: Output gap

January 2008
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INTRODUCTION

The output gap refers to the difference between actual real GDP and some estimate of the economy’s potential real GDP. Potential GDP is considered as a function of expected productivity and expected labor force. The wider the output gap is today, the higher will be inflation tomorrow.

Additionally the output gap is also referred to as spare capacity or excess capacity. The gap is positive when actual output exceeds the economy's potential and negative when actual output is below potential output. A positive output gap can as well be interpreted as an excessive demand and a negative output gap as an excessive supply.

Frequently the output gap is used as an indicator of slack in an economy. It provides monetary authorities with important indications about underlying inflationary pressures. However, estimation of the output gap is full with uncertainty.

Broadly speaking, economic theory gives two views of economic fluctuations, namely the “trend deviation” and the “output gap” interpretations. The first approach assumes that business cycles result from fluctuations around a long-run trend. The main purpose of trend-cycle decomposition is, in that case, to identify the cycle as the succession of some recurrent economic fluctuations. By contrast, the second approach interprets business cycles as a decline under (or a rise above) a certain level of potential output.

If, on the other hand, business cycles are interpreted as a gap to the potential output, welfare gains are possible simply because the level of production and real income might be higher after a policy measure. In the first approach, some automatic “mean reverting” forces preclude a long lasting divergence between the trend and the effective output, whereas in the second one persistent output gaps cannot be ruled out. Estimations of potential output are therefore of central interest for the evaluation of the adequacy of economic policy measures in the Euro area.
The following list is a non-exhaustive, subjective selection of publications on the output gap.

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1 FOCUS ON: OUTPUT GAP


A new approach is proposed for estimating potential output and the NAIRU. Identification is achieved using Okun’s law and a Phillips curve. The performance of the methodology is exemplified using data from Canada, the UK, and the US.

Paper available under subscription at:
http://www.sciencedirect.com/science?_ob=ArticleURL&_udi=B6V84-3X4WMV0-3&_user=10&_rdoc=1&_fmt=&_orig=search&_sort=d&view=c&_acct=C000050221&_version=1&_urlVersion=0&_userid=10&md5=14ff6107ab5e551dd4373d12daf597bf

1.2 Banque de France, Croissance potentielle, positionnement de l’économie dans le cycle et tensions inflationnistes, Bulletin de la Banque de France No. 103, juillet 2002.

Freely available at:


The OECD makes frequent use of the supply-side framework and associated measures of factor productivity, productive potential and associated output gaps in the assessment of the short-term conjunctural situation, comparative economic performance and longer-term growth determinants. This paper describes a number of recent changes and improvements in the methods used in estimating potential output for OECD countries and the systems in which they are used, notably for the
production of medium term economic scenarios. By and large, these reflect important changes and improvements in available statistical data sets, notably for measuring productive capital, as well as the development of more efficient model-based methods for making medium-term projections on a consistent international basis.

Freely available at:

http://oberon.sourceoecd.org/vl=1138574/cl=38/nw=1/rpsv/workingpapers/18151973/wp_5l9nf824rjxt.htm


The output gap (measuring the deviation of output from its potential) is a crucial concept in the monetary policy framework, indicating demand pressure that generates inflation. The output gap is also an important variable in itself, as a measure of economic fluctuations. However, its definition and estimation raise a number of theoretical and empirical questions. This paper evaluates a series of univariate and multivariate methods for extracting the output gap, and compares their value added in predicting inflation. The multivariate measures of the output gap have by far the best predictive power. This is in particular interesting, as they use information from data that are not revised in real time. We therefore compare the predictive power of alternative indicators that are less revised in real time, such as the unemployment rate and other business cycle indicators. Some of the alternative indicators do as well, or better, than the multivariate output gaps in predicting inflation. As uncertainties are particularly pronounced at the end of the calculation periods, assessment of pressures in the economy based on the uncertain output gap could benefit from being supplemented with alternative indicators that are less revised in real time.

Freely available at:

http://www.oekonomi.uio.no/memo/memopdf/memo1106.pdf

European unemployment has been steadily increasing for the last 15 years and is expected to remain very high for many years to come. In this paper, we argue that this fact implies that shocks have much more persistent effects on unemployment than standard theories can possibly explain. We develop a theory which can explain such persistence, and which is based on the distinction between insiders and outsiders in wage bargaining. We argue that if wages are largely set by bargaining between insiders and firms, shocks which affect actual unemployment tend also to affect equilibrium unemployment. We then confront the theory to both the detailed facts of the European situation as well as to earlier periods of high persistent unemployment such as the Great Depression in the US.

*Paper available under subscription at:*


We investigate the relationship between inflation and real output in a large sample of postwar economies. Our methodology is to use a structural vector autoregression to estimate the response of the level of real output to permanent inflation shocks separately for each country. We find that a permanent shock to inflation is not associated with a permanent movement in the level of real output for most countries in our sample. The main exceptions are certain low inflation countries, in which permanent inflation shocks permanently increase the level of output. We also find that permanent inflation shocks do not permanently influence real output growth rates in our sample.

*Paper available under subscription at:*

A major aim of recent empirical modelling of the business cycle is to identify the relative importance of aggregate supply and demand shocks. This paper uses the methodology of unobserved (or structural) components time series models for the identification of technology and demand shocks in a two-equation system of structural labour productivity and industrial output. It allows us to introduce the correlation between the structural and cyclical shocks such that the mutual dependency of these shocks can be estimated explicitly. The data is quarterly time series of labour productivity in industry and industrial output for Germany, the Netherlands, the United Kingdom and the United States. Our results show that the covariance of the dynamics of structural and cyclical shocks appears to be important in these countries.

*Paper available under subscription at:*

http://www.springerlink.com/content/w32938k31418506h/


In this paper, we present international comparisons of potential output growth among several economies —Canada, the euro area, France, Germany, Italy, Japan, the Netherlands, the United Kingdom, and the United States— for the period 1991-2004.

The main estimates rely on a structural approach where output of the whole economy is described by a Cobb-Douglas function. This framework enables us to take temporal considerations into account, depending on the assumed volatility of potential output.

Moreover, this study presents two original features, in other words, the construction of consistent and homogenous capital stock series, and long-run estimates including capital-deepening effects based on a stable capital/output ratio in value terms, whereas standard estimations assume a stable ratio in volume terms. Lastly, we use univariate methods as a benchmark. Even though the final estimates are obviously sensitive to
each method and the assumptions made for each of them, this paper might help to understand why some economies remained below their potential growth rate during the recent period by identifying the sources of long-run potential growth.

Freely available at:


This paper assesses the statistical reliability of different measures of the output gap for the Euro-11 area and the US using output, inflation and unemployment systems. In order to assess the reliability of an output gap estimate two criteria are adopted. Firstly, the estimate should have forecasting power over inflation. Secondly, the ex post statistical revisions of the output gap should not differ significantly from previously computed measures. As an additional check on reliability, we find out whether the estimate of the output gap is positively correlated with standard measures of capacity utilization. We find that under our multivariate specification, unobservable components (UC) type models of the output gap show temporal consistency between sequential and final estimates and are consistent with known cyclical indicators. On the other hand, our UC models for the output gap have limited forecasting power for inflation, since they underperform an arbitrary autoregressive model.

Freely available at:


No abstract available.
L’évolution économique en Europe a été marquée ces dernières années par un nouvel affaiblissement de la croissance et par une accentuation des fluctuations. La question du potentiel de croissance se pose avec d’autant plus d’acuité. L’utilisation du concept de production potentielle s’est développée dans un grand nombre de travaux macroéconomiques appliqués. Cet indicateur a la double ambition d’évaluer la position de l’économie dans le cycle et les perspectives de croissance à moyen terme. Il offre ainsi de précieux signaux pour la conduite ou l’analyse de la politique économique. En phase de ralentissement de la croissance par exemple, des politiques économiques expansionnistes, comme celles menées au Japon de 1992 à 1996, sont opportunes si le ralentissement provient d’une faiblesse de la demande relativement à la capacité de production ; néfastes s’il correspond à un ralentissement de la croissance potentielle elle-même.

Freely available at:


Freely available at:


This paper examines the notion of « equilibrium rate of unemployment » (ERU). An « asymmetric » wage-price setting based on a wage Phillips curve and on a price equation in level leads to a clear distinction between medium and long run ERU, as to a kind of reconciliation between WS/PS and Phillips models. This paper proposes medium and long run ERU estimates for six countries (France, Germany, United Kingdom, Netherlands, Spain and United States), incorporating institutional variables. The evolution of the medium run ERU explain relatively well those of the actual unemployment rate until the late eighties. In the nineties, the actual unemployment lies above its equilibrium level suggesting that a important part of the European unemployment is due to an excess supply.

Freely available at:


We explore the consequences of ageing on the French labour force. Baby-boom generations are going to leave gradually the labour market and will be partially replaced by younger ones. Differences in generations size will have an impact on the dependence ratio and therefore on the potential growth of output per head and on the balance of pension schemes. One of the remedy to labour force deficit could be an increase in participation rates, especially in the oldest and youngest. The progressive suppression of early retirement schemes could rise the participation rate of the oldest, while job-training association could increase the youngest one. According to our central projection, labour force would grow until 2016, before it will fall and reach in 2040 the level it has been in 2000.
1.15 Denis C., Grenouilleau D., MC Morrow K., Röger W., Calculating potential growth rates and output gaps - A revised production function approach, European Economy No. 247, 2006.

Freely available at:


This paper presents the current methodology used by the EU Commission to calculate potential output and output gaps. The first section of the paper provides an overview of the methodology, with special emphasis on how trends for the input components of the production function are calculated. It also discusses the medium term projections which currently extend to the year 2010.

In the following the paper discusses the NAIRU and TFP trends in the euro area which underlie the potential growth estimates and draws some conclusions concerning the medium term outlook for the euro area.

Freely available at:

This book presents a comprehensive treatment of the state space approach to time series analysis. The distinguishing feature of state space time series models is that observations are regarded as made up of distinct components such as trend, seasonal, regression elements and disturbance elements, each of which is modelled separately. The techniques that emerge from this approach are very flexible and are capable of handling a much wider range of problems than the main analytical system currently in use for time series analysis, the Box-Jenkins ARIMA system.

*Paper available under subscription at:*  
http://www.sciencedirect.com/science/article/B6V92-4BBMV40-1/2/a69e80aa07ce7847398a65ede7c2a34e


This paper addresses the issue of measuring the NAIRU for the euro area and assessing the robustness and precision of the obtained estimates. The empirical framework adopted is based on systems combining an Okun-type relationship between cyclical unemployment and the output gap with a Phillips curve and stochastic laws of motion for the NAIRU and potential output. Such systems have been estimated using Kalman-filter techniques.

The results obtained point to an estimate of the area-wide NAIRU that is robust to changes in the underlying models. This robustness is shown to hold both in terms of the mean - i.e., the shape of the resulting NAIRU - and the variance of the process. The latter is derived through bootstrap exercises using the models alone or pooled together. The evidence found suggests that the increase in the aggregate NAIRU that took place in the early part of the sample period has come to a halt and may be about to be reversed.

*Freely available at:*  

Many recent articles have identified behavioral disturbances in vector autoregressions by imposing restrictions on the long-run effects of shocks. This article demonstrates that this approach will be unreliable unless the underlying economy satisfies three types of strong restrictions. Although many aspects of these issues have been raised before, this article draws out and illustrates the implications for inferences under the long-run scheme. Furthermore, it provides strategies for dealing with the problems.

Paper available under subscription at:
http://www.jstor.org/pss/1392338


Dans l’ensemble des pays industrialisés, la vie active est aujourd’hui principalement concentrée autour des âges médians (25 à 54 ans.) Ce phénomène est plus marquée en France où le taux d’activité des jeunes de moins de 25 ans est le plus bas observé sur l’ensemble de l’OCDE et celui des hommes de plus de 54 ans l’un des bas de cet ensemble de pays. Les taux d’activité aux deux extrêmes des âges de la vie active ont baissé sensiblement au cours des trente dernières années, activité des femmes exceptée, dans la mesure où cette dernière est affectée par la généralisation de l’activité féminine. Pour illustrer les sources de ces évolutions, nous procédons à un exercice de modélisation statistique des taux d’activité des âges extrêmes par tranche quinquennale. En ce qui concerne les personnes âgées, ceci permet de mettre en évidence l’importance à long terme des effets des politiques (généralisation des systèmes de préretraite, baisse de l’âge légal de la retraite à 60 ans) mises en œuvre au cours de la période pour lutter contre la montée du chômage. Pour les personnes jeunes, les évolutions de long terme sont plus difficilement associées à des causes.
particulières. Dans les deux cas, on ne peut mettre en évidence que des effets de faible amplitude de flexion conjoncturelle des taux d’activité aux évolutions du chômage.

Freely available at:


Several considerations suggest that the ECB may respond to EMU-wide output gaps in setting policy: estimated reaction functions indicate that central banks respond to output gaps; a Taylor rule in which the central bank responds to inflation and the gap accounts for recent movements in interest rates in the EMU-area; and optimal control exercises conducted in estimated econometric models suggest that reacting to the gap may be optimal, even if the central bank cares solely about inflation. In this paper, we obtain point estimates with associated confidence bands of the EMU-wide output gap using UC models.

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http://www.sciencedirect.com/science?ob=ArticleURL&udi=B6V64-3WRBN38-9&user=10&rdcid=1&fmt=orig=search&sort=d&view=c&acct=C000050221&version=1&urlVersion=0&userid=10&md5=be84f73a8ebcb7eb698e73ef3bc4e073


This paper estimates the NAIRU (standing for the Non-Accelerating Inflation Rate of Unemployment) as a parameter that varies over time. The NAIRU is the unemployment rate that is consistent with a constant rate of inflation. Its value is determined in an econometric model in which the inflation rate depends on its own past values (‘inertia’), demand shocks proxied by the difference between the actual unemployment rate and the estimated NAIRU, and a set of supply shock variables.
The estimation in this paper applies to the US economy over the period 1955–96. The estimated NAIRU differs somewhat for alternative measures of the inflation rate. The NAIRU estimated for the GDP deflator varies over the past 40 years within the narrow range of 5.7–6.4%; its estimated value for the most recent quarter (1996:Q1) is 5.7%. In that quarter a lower NAIRU of 5.3% is obtained for the chain-weighted personal consumption expenditure (PCE) deflator. Recent research claiming that there is a three-percentage-point range of uncertainty about the NAIRU is rejected as inconsistent with the behaviour of the US economy in the late 1980s and early 1990s.

*Paper available under subscription at:*

[http://www.nber.org/papers/w5735](http://www.nber.org/papers/w5735)


This paper reviews the methods used for estimating potential output in OECD countries and the use of the resulting output gaps for the calculation of structural budget balances. The "split time trend" method for estimating trend output that was previously used for calculating structural budget balances is compared with two alternative methods, smoothing real GDP using a Hodrick Prescott filter and estimating potential output using a production function approach. It is concluded that the production function approach for estimating potential output provides the best method for estimating output gaps and for calculating structural budget balances, with the results obtained by smoothing GDP providing a cross check. New tax and expenditure elasticities, along with the potential output gaps, are used to derive structural budget balances...

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[http://caliban.sourceoecd.org/vl=349032/cl=29/nw=1/rpsv/workingpapers/18151973/wp_5lgshv86wk.htm](http://caliban.sourceoecd.org/vl=349032/cl=29/nw=1/rpsv/workingpapers/18151973/wp_5lgshv86wk.htm)

_Paper available under subscription at:_

http://www.jstor.org/pss/1391592


This paper confronts, theoretically and empirically, two estimation methods for the equilibrium rate of unemployment. The introduction of observable variables into the tv-nairu approach and unobservable variables into the structural approach improves these two methods and makes them converge even though their diagnoses differ appreciably in the French case.

_Freely available at:_


This paper confronts, theoretically and empirically, two estimation methods for the Equilibrium Rate of Unemployment (ERU), which can be derived from a WS/PS model or from a wage Phillips curve. It shows how the TV-NAIRU reduced approach can be theoretically coherent with the structural approach even though their empirical diagnoses differ appreciably in the French case. It considerably improves the econometric and explanatory properties of the French TV-NAIRU model by identifying some of its determinants (namely, inflation, labour productivity and real interest rates).
Using a standard state-space model with a reduced Phillips equation, we propose a model with better dynamics and explicit separation of NAIRU and structural unemployment. This model requires the use of a Kalman filter. Under reasonable assumptions on the innovations to the NAIRU equation, our NAIRU estimates are close to what is usual for France, while the value of the structural rate of unemployment is between 5 and 6%. This reconciles the measure of structural unemployment with the intuition of « full employment » unemployment rate. Some determinants of the structural unemployment are empirically validated. The inflation — unemployment dilemma does not stand in the long run; real interest rates and minimum wage positively influence $U^*$; productivity plays negatively; replacement rate and the fiscal-social wedge have no impact on $U^*$.

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We propose a procedure for representing a time series as the sum of a smoothly varying trend component and a cyclical component. We document the nature of the co-movements of the cyclical components of a variety of macroeconomic time series. We find that these co-movements are very different than the corresponding co-movements of the slowly varying trend components.
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We propose an unobserved components model to evaluate unemployment data for evidence on hysteresis effects. Unemployment is decomposed into a natural rate component, assumed to be non stationary, and a cyclical component, assumed to be stationary. Hysteresis effects are modelled by allowing lagged cyclical unemployment to affect the current natural rate. The model is estimated using Canadian, German, U.K., and U.S. unemployment rate series. We find substantive hysteresis effects in the Canadian, German, and U.K. unemployment series. Hysteresis effects in the U.S. unemployment series are negligible.

Paper available under subscription at:

http://www.sciencedirect.com/science/article/B6V64-45F63FK-BN/2/7f47808b2c73dee31087e736f1a90431


Econometric modeling of the relationship between inflation and unemployment has been a central topic in macroeconomics since the investigation of Phillips (1958), who documented a negative correlation between these variables in a half-century of U.K. data. Since the simultaneous occurrence of high inflation and high unemployment in the United States and other countries during the 1970s, there has been general agreement that this econometric relationship is unstable. Indeed, the instability has been so great that Lucas and Sargent characterized it as "econometric failure on a grand scale."
This article summarizes some results from our recent work that documents various dimensions of this instability.

We display econometric instability in three alternative and complementary ways. First we look at the simple correlation coefficient linking the unemployment rate and inflation, which initially attracted the attention of Phillips (1958) in U.K. data and Samuelson and Solow (1960) in U.S. data. We show that this correlation has changed in an important way since World War II, so that over the entire 1954-94 period the correlation is essentially zero. However, we also show that this largely reflects the changing trend behavior of the two series: When we eliminate trends and high-frequency components of inflation and unemployment so as to focus on the business cycle behavior of the two series, we find that there has been a remarkably stable...

Freely available at:

1.31 Irac D., Estimation of a time varying NAIRU for France, Note d'études et de recherche de la Banque de France No.75, 2000.

Among the several concepts encompassed by the idea of an equilibrium rate of unemployment (labour mismatch, unemployment trend, non inflationary unemployment, structural unemployment), the NAIRU appears as the more interesting one for a central bank since it focuses directly on inflation. Thus, the paper considers the reduced Phillips equation, assuming a stable relationship between inflation and some kind of demand disequilibrium index, as the most promising starting point to estimate an equilibrium rate of unemployment. We adopt a semi-structural method based on a combination of an economic and a statistical approach. The Phillips equation we consider is very close to the so-called "triangle model" suggested by Gordon, where inflation rate is determined by three factors (hence the "triangle"): adaptive expectations and inertia, excess demand or shortage - estimated by the gap between the actual unemployment rate and the NAIRU - and supply shock variables. We regard the NAIRU as a time-varying parameter and estimate a state
space model composed of a random walk process that describes its variations over time and of a Phillips equation. Under reasonable assumptions on the innovations to the NAIRU equation, the estimation of the state-space model (using Kalman filter techniques) yields empirical results for France that appear quite convincing: the time varying NAIRU we obtain accounts for the steady increase in the actual unemployment rate during the 1970s and the 1980s and offers the appropriate degree of smoothness. Working on the sample 1986-1999 the time varying NAIRU amounts to 10% in the second quarter of 1999 (with an interval confidence between 9% and 11%). The estimation of the model since 1970 gives information on the path followed by the NAIRU during the last decades. Whereas the NAIRU increased by 2.7 points between 1977 and 1988, its steady rise seems to slow down somewhat since the second part of the 1980s, exhibiting two main deceleration periods: first during the second part of the 1980s and second in the mid-1990s. Though this method exploits the set of information contained in the Phillips curve and provides fairly robust measures of the NAIRU, it gives little insight regarding its underlying determinants. It must therefore be completed by the analysis of the recent developments in French labour market. In the second part of this paper, we provide strong evidence that the changes in the NAIRU in France during these two episodes may be linked to significant shifts in the demographic composition of the workforce together with a break in the evolution of the fiscal-social wedge. Several other factors (such as threshold effects in unemployment benefits or individual abilities) play probably a major role in unemployment variation.

Freely available at:

http://www.banque-france.fr/gb/publications/ner/1-75.htm


In this paper we measure potential output (and consequently the output gap) using state-space models. Given that the estimated output gap is used as an indicator to measure the extent of inflationary pressures in the economy, we evaluate the use of such models for the implementation of monetary policy. Our starting point is the
Gerlach and Smets (1997) unobserved-components model, which they applied to the G7 countries. After subjecting this model to various diagnostic tests, we modify certain assumptions in it to reflect specific aspects of the Canadian economy. In particular, we focus on the specification of the permanent component of output and of inflation expectations, the issue of whether to use core or total inflation in the model, and the integration of appropriate supply shocks in the Phillips curve. In each case, the model is subjected to diagnostic tests and is examined for its out-of-sample forecasting performance. With the various modifications, we find that misspecification is somewhat alleviated and out-of-sample forecast performance is improved. Based on this performance, we feel that state-space models of the output gap can be quite useful in the formulation of monetary policy.

Freely available at:


This article proposes a new method for estimating potential output in which potential real gross domestic product (GDP) is modeled as an unobserved stochastic trend and deviations of GDP from potential affect inflation through an aggregate supply relationship. The output and inflation equations together form a bivariate unobserved-components model that is estimated via maximum likelihood through the use of the Kalman-filter algorithm. The procedure yields a measure of potential output and its standard error and an estimate of the quantitative response of inflation to real growth and the output gap.

Paper available under subscription at:
http://www.jstor.org/pss/1392092

Several specifications of state-space models are used to obtain estimates of the NAIRU for the G7 except Japan, plus Australia, over the past 28 years. A Phillips curve-type regression is shown to deliver estimates that do not mimic low-frequency movements in unemployment rates, even when a drift is included in the specification of the NAIRU. Standard errors around the estimates are extremely large. Using information about the behavior of unemployment, in addition to inflation, alleviates both these shortcomings.

Paper available under subscription at:

1.35 Le Bihan H., Sterdyniak H., Cour P., La notion de croissance potentielle a-t-elle un sens?, Economie internationale No. 69, CEPII, 1997.

Paper available at:


Basing upon OECD’s estimates of potential output growth for France (1.9%), Germany (1.5%) and Italy (1.3%), we investigate the permanent nature of such a divergence. Potential output estimates based on filtering techniques extrapolate temporary evolutions in productivity and labour force which may be irrelevant when projecting growth on a longer time horizon. We correct for this sample’s end bias by using assumptions on the long term evolution of the main demographic and economic variables, which are consistent with the medium-term equilibrium of reformed social protection systems. Potential growth is expected to slow down to 1, 7% by 2050 in France and to 1, 1% in Germany and Italy. The most recent upward revisions of population growth in France and Italy account for respectively 0, 3 and 0, 1 point of higher growth in 2050 as compared to previous projections.

Freely available at:


The aim of this special study consists in estimating the non-accelerating inflation rate of unemployment (NAIRU) for the aggregated euro area, France, Italy and Germany. An equation, estimated with the Kalman filter, relates the inflation variation with the terms of trade and the gap between the unemployment and the Nairu. The basic model, where the Nairu is specified as a random walk, shows bad forecasting properties. With this model, the forecasted unemployment rate would become lower than the Nairu before 2008. Another model relates the Nairu with the unemployment rate. This relation is significant for all countries and is interpreted as a hysteresis effect. Moreover, this model forecasts lower values of the Nairu and, for this reason, we do not expect inflation tensions.

Paper available at:

This paper analyses the Nairu and the unemployment gap in the Euro Area and the influence that monetary policy had on their development. Using the Kalman-filter technique we find that the Nairu has varied considerably since the early seventies. Although other studies have found similar results, the report differs in that the Kalman-filter technique is applied for the first time using explicit exogenous variables, in particular real interest rates. This novel approach allows us to quantify the effect of changes in real interest rates on the Nairu. An increase in real interest rates by 1 percentage point was found to raise the Nairu by 0.3 percentage points, whereas the effect of changes in productivity turned out to be negligible and the effect of the wage wedge insignificant. A quarter of the increase in the Nairu between 1980 and 1995 can be attributed to the increase in short-term real interest rates, indicating the possibility of a long-run non-superneutrality of monetary policy. This hypothesis is supported by the correlation between nominal interest rates and unemployment in the Euro Area and in the United States and bivariate VAR tests for monetary superneutrality.

Paper available at:


In 1968 Friedman put forward the notion of a natural rate of unemployment to encapsulate the idea that a normal level of unemployment, roughly equivalent to the amount of frictional and structural unemployment, persists even when the labour market is in equilibrium. Since there are no direct measures of the natural rate, as it is essentially a theoretical construct, one must be satisfied with proxy estimates derived using various methods including that which draws on Tobin's concept of the non-accelerating inflation rate of unemployment (i.e. the Nairu). The essential objective of the present paper is to produce statistically significant and economically reasonable, time-varying, Nairu estimates (TV-Nairu's) for the Community's Member States.
which also have informational content in terms of inflation. While it is clearly difficult to estimate Nairu's using variables to cover all the main contributory factors which are likely to be at play, it may nevertheless be possible to isolate the principal "sinners" by selecting a modelling strategy which is both theoretically robust and empirically respectful of a number of key pre-determined criteria, including in particular the inflation tracking performance of…

Freely available at:


1.41 Ongena H. and Roger W., Les estimations de l’écart de production de la commission Européenne, Economie internationale No.69, 1er trimestre 1997.

Paper available at:


A variety of statistical methods and econometric techniques can be used attempting to disentangle the non-cyclical trend component of a time series and its purely cyclical part. This paper serves the purpose to demonstrate the potential contribution from the use of unobserved components modelling techniques to decompose the EUR-11 unemployment series.

Paper available at:

We examine the reliability of alternative output detrending methods, with special attention to the accuracy of real-time estimates of the output gap. We show that ex post revisions of the estimated gap are of the same order of magnitude as the estimated gap itself and that these revisions are highly persistent. Although important, the revision of published data is not the primary source of revisions in measured output gaps; the bulk of the problem is due to the pervasive unreliability of end-of-sample estimates of the trend in output. Multivariate methods that incorporate information from inflation to estimate the output gap are not more reliable than their univariate counterparts.

Paper available at:


A stable predictive relationship between inflation and the output gap, often referred to as a Phillips curve, provides the basis for countercyclical monetary policy in many models. In this paper, we evaluate the usefulness of alternative univariate and multivariate estimates of the output gap for predicting inflation. Many of the ex post output gap measures we examine appear to be quite useful for predicting inflation. However, forecasts using real-time estimates of the same measures do not perform nearly as well. The relative usefulness of real-time output gap estimates diminishes further when compared to simple bivariate forecasting models which use past inflation and output growth. Forecast performance also appears to be unstable over time, with models often performing differently over periods of high and low inflation. These results call into question the practical usefulness of the output gap concept for forecasting inflation.

Paper available at:

*Paper available at:*

http://www.ofce.sciences-po.fr/pdf/revue/5-60.pdf


This paper provides an analysis of multivariate unobserved components models for the estimation of potential output and the output gap in the euro area. Bivariate models of output and inflation and multivariate model-based implementations of the production function approach are considered; according to the latter potential output is derived from the permanent components of the factors of production consistent with stable inflation, whereas the output gap results from the combination of the transitory components. This approach allows to measure the contribution of the various factors of production to potential output growth, and to assess the reliability of the output gap estimates. Various alternative statistical specifications for the separation of trend and cycle are considered entertaining different economic hypotheses. The paper also provides an assessment of the reliability of the alternative output gap estimates and analyses their predictive validity by means of a rolling forecast exercise that provides an evaluation of the capability to forecast future inflation.

*Freely available at:*


The structural rate of unemployment and associated non-accelerating inflation rate of unemployment (the NAIRU) are of major importance to the analysis of macro and
structural economic developments, although in practice these concepts are not well defined and there is considerable uncertainty and controversy concerning their measurement and policy use. The present paper reviews a range of conceptual and analytical issues and related empirical studies to examine the usefulness and limitations of such concepts. A reduced-form Phillips curve approach is found the most suitable conceptual framework for representing the NAIRU as currently used by the OECD in its policy analysis and surveillance work. Three distinct classes of NAIRU concept are identified, distinguished by the time-frame in which they are defined, which map directly into the broad requirements for macro and structural policy analysis. In line with a number of recent empirical studies, this general approach is applied...

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http://caliban.sourceoecd.org/vl=2307674/el=17/nw=1/rpsv/workingpapers/18151973/wp_5gsjvhj8334.htm


The paper investigates real-time output gap estimates for the euro area obtained from various unobserved components (UOC) models. Based on a state space modelling framework, three criteria are used to evaluate real-time estimates, i.e. standard errors, unbiasedness and conditional inflation forecasts. Real-time estimates from univariate moving average filters and from bivariate UOC models based on output and inflation are found to be rather uninformative. Extended models, which employ the information from cyclical indicators and factor inputs, however, improve substantially upon the former models in all criteria. The pessimism on the reliability of real-time output gap estimates expressed in earlier literature may therefore be overstated.

Freely available at:

This paper presents results from the estimation of a multivariate unobserved components model of cyclical activity. The model is motivated by a desire to let the data speak as much as possible, and hence to avoid imposing ad hoc and unjustifiable assumptions about trends and cycles. Estimated over the period 1970:1 to 1999:3 via the Kalman filter and maximum likelihood, the model identifies a common, trend-reverting component to real output, unemployment and capacity utilisation. The structure of the model allows an interesting factor interpretation to be put on the estimate of the output gap. These estimates are consistent with priors, but there is no consistent match to any one simple smoother such as the HP filter.

Freely available at:


What shocks account for the business cycle frequency and long run movements of output and prices? This paper addresses this question using the identifying assumption that only supply shocks, such as shocks to technology, oil prices, and labor supply affect output in the long run. Real and monetary aggregate demand shocks can affect output, but only in the short run. This assumption sufficiently restricts the reduced form of key macroeconomic variables to allow estimation of the shocks and their effect on output and price at all frequencies. Aggregate demand shocks account for about twenty to thirty percent of output fluctuations at business cycle frequencies. Technological shocks account for about one-quarter of cyclical fluctuations, and about one-third of output's variance at low frequencies. Shocks to oil prices are important in explaining episodes in the 1970's and 1980's. Shocks that permanently affect labor output account for the balance of fluctuations in output, namely, about half of its variance at all frequencies.

When monthly data on production, prices, and the money stock are interpreted, via a vector autoregression, as generated by dynamic responses to "surprises" in each of the variables, a remarkable similarity in dynamics between interwar and postwar business cycles emerges, though the size of the "surprises" is much larger in the interwar period. Furthermore, the money stock emerges as firmly causally prior, in Granger's sense, in both periods and accounts for a substantial fraction of variance in production in both periods.

When a short interest rate is added to the vector autoregression, the remarkable similarity in dynamics between periods persists, but the central role of the money stock surprises evaporates for the postwar period. While there are potential monetarist explanations for such an observation, none of them seem to fit comfortably the estimated dynamics. A non-monetarist explanation of the dynamics, based on the role of expectations in investment behavior, seems to fit the estimated dynamics better. That this explanation, which is consistent with a passive role for money, could account for so much of the observed postwar relation between money stock and income may raise doubts about the monetarist interpretation even of the interwar data.


Paper available at:

The paper first reviews the conceptual framework underlying different measures of structural unemployment as well as alternative empirical methods that have been used to provide estimates of them. Drawing on this review, it goes on to develop a method for estimating time-varying NAIRUs across a range of OECD countries using a Kalman filter. It then discusses the resulting econometric estimates, and the scope for their further refinement given the associated range of uncertainties. Recent trends in the NAIRU estimates are reviewed: they fell in many countries in the second half of the 1990s, although actual unemployment has remained well above the NAIRU for a majority of countries throughout much of the 1990s, particularly in Europe. Finally, the relevance of such measures to analysing inflation developments and monetary policy is discussed.

Paper available at:
http://www.ingentaconnect.com/content/oecd/02550822/2001/00002001/00000002/1301331ec006


This paper analyses the effect of measurement error in the output gap on efficient monetary policy rules in a simple estimated model of the US economy. While it is a well-known result that such additive uncertainty does not affect the optimal feedback rule in a linear-quadratic framework, it is shown that output gap uncertainty can have a significant effect on the efficient response coefficients in restricted instrument rules such as the popular Taylor rule. Output gap uncertainty reduces the response to the
current estimated output gap relative to current inflation and may partly explain why
the parameters in estimated Taylor rules are often much lower than suggested by
optimal control exercises which assume the state of the economy is known.

_Paper available at:_

_http://www.bis.org/publ/work60.pdf?noframes=1_

1.55 _Dimitz M.-A., Output Gaps in European Monetary Union. New Insights
from Input Augmentation in the Technological Progress, Economics Series
No. 102, July 2001._

Output gaps for ten European countries and the USA are estimated based on a CES
production function with input augmentation in the technological progress. The
substitution parameter is estimated from the coefficients of the labor and capital
demand functions. The estimation is done using Johansen's cointegration method. For
six of the eleven countries analyzed, the use of the Cobb Douglas form would not be
appropriate. The output gaps show a similar cyclical pattern for all countries. They
remain mostly within +/-3% for five countries and within +/-5% for another four.
Separating labor- and capital-augmenting technological progress gives insight into the
driving forces of growth.

_Paper available at:_


1.56 _Van Norden S., Why Is It So Hard to Measure the Current Output Gap?,
June 1995._

In order for time series estimates of the output gap to be useful to policy makers, this
paper argues that two factors will be critical. First, they must be able to produce an
estimate of the current output gap based only on past information. Put another way, to
evaluate the performance of such estimators, we should focus on their properties as
_filters_ rather than _smoothers_. Second, the decomposition of actual output into
potential output and the output gap must not be based on arbitrary assumptions about
the time-series behaviour of these variables. In general, this leads to a multiplicity of possible solutions that may differ greatly in their policy implications. The arbitrary selection of one of these creates arbitrary policy advice. A trivial but flexible estimator of the output gap (dubbed TOFU) can be constructed which satisfies both of the above criteria. It estimates the output gap as part of a larger economic relationship. A discussion of its properties shows that except under very strict circumstances, such time series estimates will produce better estimates of the output gap ex post than they will ex ante. Furthermore, under certain conditions, contemporary and historical data will be of no use in estimating the output gap whatsoever. This in turn places limits on the extent to which time series methods can hope to improve upon structural estimates of the output gap.

*Paper available at:*
[http://129.3.20.41/eps/mac/papers/9506/9506001.pdf](http://129.3.20.41/eps/mac/papers/9506/9506001.pdf)


We evaluate New Zealand's macroeconomic performance over the 1967-96 period, which witnessed numerous economic reforms. Using both index-number and econometric techniques, we decompose nominal GDP growth and the output gap into contributions from price level changes, productivity growth and changes in factor utilization. Changes in domestic prices accounted for four-fifths of the growth in nominal GDP, while capital accumulation and employment growth were the most important factors determining real-output growth. Deviations in the domestic price level around its long-run trend contributed most heavily to changes in the nominal output gap. The real gap was influenced in any year variously by deviations of the terms of trade and labour input from their long-run trends, as well as by productivity shocks.

*Paper available at:*

Potential output is the largest amount of products that can be produced by fully utilizing available labor and capital stock; the output gap is defined as the discrepancy between actual and potential output. If data on production factors contain measurement errors, total factor productivity (TFP) cannot be estimated accurately from the Solow residual (i.e., the portion of output that is not attributable to labor and capital inputs). This may give rise to distortions in the estimation of potential output and the output gap. The primary purpose of this paper is to discuss theoretically how measurement errors and quality changes in production factors affect estimates of potential output and the output gap. The main results are (1) that effects of quality changes in production factors can be left in the Solow residual for correct estimation of potential output and the output gap, but (2) that measurement errors in utilization of capital stock and labor should be removed. Estimation of Japan's output gap, in particular, may be distorted by the absence of data on capacity utilization in non-manufacturing sectors. To resolve this problem, we consider two definitions of output gap and compare their performance. The first definition (the conventional output gap) assumes capacity utilization to be 100 percent in non-manufacturing sectors. Then we fit a certain trend to the Solow residual and define the trend as TFP and the regression residual as the measurement error of capacity utilization in non-manufacturing sectors. The second definition (the new output gap) uses data on electricity consumption to directly estimate capacity utilization in non-manufacturing sectors. In this case, we can take the Solow residual to be TFP. Next, we compare the performance of the two definitions of output gap in terms of their consistency with the reference dates of business cycle and with various DIs in Short-Term Economic Survey of Enterprises in Japan published by the Bank of Japan, including the business conditions DI. We show that the new output gap is superior to the conventional output gap. Furthermore, when the new output gap is used in a Phillips curve, estimates of parameters are more stable than when we use the conventional output gap. These
results suggest that the new output gap is a suitable measure of slackness in the Japanese economy.

Paper available at:


Output gap estimates calculated in real-time are known to be often unreliable. Recent work has found that, without the benefit of hindsight, it can prove difficult for policymakers to pin down accurately the current position of the output gap. However, attention primarily has focussed on output gap point estimates alone. This paper considers output gap estimates and their uncertainty more generally. As is well known from the forecasting literature, if the outcome falls within the bounds of what was expected the fact that point forecasts are inaccurate need not mean forecasts more generally contain no useful information. In this sense, the unreliability of real-time output gap estimates need be neither surprising nor indeed lead to sub-optimal inference by users of the estimates. Interpreting real-time output gap estimates as forecasts, we explain the importance of providing measures of uncertainty, via interval or density forecasts, around real-time output gap estimates. We consider how this can be achieved. The importance of allowing, in particular, for parameter uncertainty is discussed. We then explain how ex post the accuracy of these measures of unreliability associated with real-time estimates can be evaluated statistically and a decision then made about their reliability. An application to the Eurozone illustrates the use of these techniques in the context of real-time output gap measurement. Simulated out-of-sample experiments reveal that not only can real-time point estimates of the Eurozone output gap be unreliable, but so can measures of uncertainty associated with them. This provides a serious challenge to both producers and users of output gap estimates.

The author evaluates the ability of a variety of output-gap estimators to accurately measure the output gap in a model economy. A small estimated model of the Canadian economy is used to generate artificial data. Using output and inflation data generated by this model, the author uses each output-gap estimation methodology to construct an estimate of the true output gap. He then evaluates the methodologies by comparing their respective estimates of the output gap with the true gap. The estimators are evaluated on the basis of correlations between the actual and estimated output gap, as well as the root-mean-squared estimation error. The author also varies the properties of potential output and the output gap in the data-generating process to test the robustness of his results. His findings indicate that an estimator that combines the Hodrick-Prescott filter with a Blanchard-Quah structural vector autoregression (SVAR) yields an estimate that is accurate compared with competing methods at the end-of-sample. He also finds that the performance of the SVAR relative to that of other methodologies is quite robust to violations in the identifying assumptions of the SVAR.


This paper assesses the statistical reliability of different measures of the output gap for the Euro-11 area and the US using output, inflation and unemployment systems. In
order to assess the reliability of an output gap estimate two criteria are adopted. Firstly, the estimate should have forecasting power over inflation. Secondly, the ex post statistical revisions of the output gap should not differ significantly from previously computed measures. As an additional check on reliability, we find out whether the estimate of the output gap is positively correlated with standard measures of capacity utilization. We find that under our multivariate specification, unobservable components (UC) type models of the output gap show temporal consistency between sequential and final estimates and are consistent with known cyclical indicators. On the other hand, our UC models for the output gap have limited forecasting power for inflation, since they underperform an arbitrary autoregressive model.

*Paper available at:*


The output gap - the difference between actual and potential output - is widely regarded as a useful guide to future inflationary pressures, as well as an important indicator of the state of the economy in its own right. Since the output gap is unobservable, however, its estimation is prone to error, particularly in real time. Errors result both from revisions to the underlying data, as well as from end-point problems that are endemic to econometric procedures used to estimate output gaps. These problems reduce the reliability of output gaps estimated in real time, and lead to questions about their usefulness. We examine 121 vintages of Australian GDP data to assess the seriousness of these problems. Our study, which is the first to address these issues using Australian data, is of interest for the method we use to obtain real-time output-gap estimates. Over the past 28 years, our real-time output-gap estimates show no apparent bias, when compared with final output-gap estimates derived with the benefit of hindsight using the latest available data. Furthermore, the root-mean-square difference between the real-time and final output-gap series is less than 2 percentage points, and the correlation between them is over 0.8. Our general
The conclusion is that quite good estimates of the output gap can be generated in real time, provided a sufficiently flexible and robust approach is used to obtain them.

*Paper available at:*

**1.63 Claus L. Is the output gap a useful indicator of inflation?, Discussion Paper No. DP2000/05, Reserve Bank of New Zealand, March 2000.**

One of the main indicators of inflationary pressures used by the Reserve Bank of New Zealand is the output gap. The output gap is not directly observable and estimates have to be inferred from the data. This paper evaluates whether the output gap, however measured, is a good indicator of inflationary pressures in New Zealand. The results suggest that the output gap provides a useful signal to the monetary authority. When the output gap is positive (negative) two times out of three inflation will increase (decrease) in the next quarter and three times out of five it will increase (decrease) the following year.

*Paper available at:*