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Output-Gaps in the PIIGS Economies: An Ingredient of a Greek Tragedy

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Abstract

The Fiscal Compact has created new responsibilities in terms of quantitative measures of excess demand in the economy. The concept of structural budget balance is dependent on cycle values. As a consequence one of the primary responsibilities of economics is to build a good indicator of the magnitude of short term disequilibrium. Knowledge of the magnitude of the excess demand in the economy is essential for an appropriate application of the Fiscal Compact. The usual empirical concepts of output gap are not sufficiently well designed to give an accurate view of the negative excess demand when there are output breaks in the economy. The information produced by different (quasi-) official output gaps is quite often misleading, contributing to a rise in the unemployment rate. We propose a solution that might contribute to solve this problem that is clearly a crucial one for the PIIGS in times of crisis.

Key words: Structural deficit, output gap, Cobb-Douglas production function filter, Beveridge and Nelson filter and Hodrick-Prescott filter.

JEL: C01, E62, H30, H63.

Introduction

The *ekkyklêma* of the ancient Greek tragedy - the brutal violence creating millions of useless unemployed men and women - must be placed at the front of the stage in order to be seen by policy-makers, since the pretence by economists and politicians to use rigorous economic concepts hides the violence of policy actions. News of increased and sever poverty acts as a *katharsis* for all employed and entrepreneurs in activity.

The academic economist has a responsibility in this tragedy (Howard Stein, 2012). Our paper will treat only the use of the concept of output gap or cyclical deviation to measure excess demand or the inverse, the level of inactivity in the economy. It is important to

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remember that neither economists nor politicians know 'the' output-gap value (João Sousa Andrade and António Portugal Duarte, 2012). The reference to an indicator based on output-gap values by a legal text, as is the case of the Fiscal Compact (European Comission, 2012) is a new and very strange situation. Our thesis is that the use of this concept as is calculated by the European Commission tends to hide inactivity and this phenomenon is aggravated in times of negative output ruptures. Crises are characterized by these ruptures but we can also experience ruptures in the absence of crises. In such instances, unemployment may increase to intolerable levels, yet the economist decision-maker indicator output gap may say that "it's all right". And if we have a problem of budget deficit it's sufficient to reduce public expenditures (Gary Dymski, 2011).

To measure the level of inactivity in macroeconomics, we use two concepts: potential output and actual output. Supposing that the concept of actual output has a correspondent empirical measure, we have only the question of potential output. The concept of potential output is past-dependent, that is to say, current potential output depends on past actual output values, but at the same time, actual values only coincide with extrapolation values of potential output by accident (Javier Andrés et al., 2005). This result implies that we must have a method by which to evaluate the calculation of output gaps based on potential output, and not one which is dependent on the ability of potential output to generate future actual output values.

The use of the indicator output gap must have a high level of information about the disequilibrium in the economy. In a short period of time, if the output gap is negligible, then the unemployment rate is also negligible, even if we take into consideration the presence of the natural rate of unemployment, and at the same time the movements in one value must have the same correspondence in the other. With these two conditions, the output gap gives a transparent and realistic picture of what happens in the economic stage without the need for the *ekkyklêma*. We propose to evaluate output gap indicators in terms of the explanation of the unemployment rate. We apply our thesis to the PIIGS (Portugal, Italy, Ireland, Greece and Spain) economies.

In section 1, we present the reasons why we need the concept of potential output and the associated concept of output gap or cyclical values, together with some of the associated problems of their empirical estimations. This section is divided into two sub-sections, one concerning the structural public budget balance, and the other focusing on the empirical concept of output gap. In section 2, we present the production function (PF) methodology and the times series filters Beveridge-Nelson (B-N) and Hodrick-Prescott (H-P) for the estimation of the potential output, focusing mainly on the last filter. The methodology and results of the empirical application to PIIGS are presented in section 3. The conclusion follows in section 4.

Potential Output, Output Gaps and Cyclical Values: A Review

The cycle values we need in order to express global excess demand are a deviation time series, i.e. a measure of the cycle relative to a trend or potential output. Our calculated values are deviations from that trend or potential output (Michael Artis and Toshihiro Okubo, 2010). In this paper we use the expressions 'cycle' and 'output gap' interchangeably.

We need the concept of output gap not only for policy decisions, or institutional obligations, but also to evaluate the consequences of policies and institutional reforms. In the case of the European Union, an important condition for a well-functioning Monetary Union is an increased synchronised cycle (Agustin Duarte and Ken Holden, 2003), and this must also be evaluated in terms of cyclical or output gap values (Jeffrey A. Frankel and Andrew K. Rose, 1998). If the cycle values are not adequate, policy decisions are based on inappropriate information.

The structural public budget balance and the relevance of the output gap

The structural budget balance (IMF, 1993), (OECD, 1994) and (Directorate-General for Economic and Financial Affairs European Community, 1995) is the fiscal position (i.e. the public finance situation) after the exclusion of temporary factors that can be expected to even out over time. A government's budget balance reflects the influence of both temporary and permanent factors. However, it is important to disentangle temporary factors from permanent influences on the budget balance in order to assess the medium-term orientation of fiscal policy (IMF, 1999) and (Houses of the Oireachtas, 2012). This can be done through the use of a fiscal policy indicator in which the government budget balance is adjusted for changes in the economic cycle. When the economy is weak, as it is now, the structural budget balance indicator has to consider increases in expenditure resulting from a negative output gap. This increase in expenditure is in part automatic, resulting from a rise in unemployment benefits and other social transfers. The inverse is true for positive output gaps for which there will be a reduction in those expenditures. Additionally, revenues will drop with negative gaps and increase with positive gaps, in an automatic and progressive way. The elimination of automatic effects on the budget balance is supposed to indicate what the government intended to do in a discretionary way.

The implementation of a sustainable fiscal policy, conducive to achieving the goals of growth and stabilisation in European economies, should therefore, imply not only the integration of common reasonable principles, but also take into account different country evolutions of potential output over time (João Sousa Andrade and António Portugal Duarte, 2011). Under these circumstances, the application of the Maastricht Treaty, and the Stability and Growth Pact (SGP) criterion of zero structural deficits in the medium-term, is understandable in terms of the safeguard of financial stability by seeking to remove excessive pressure on capital markets in Europe. But these criteria have radically changed the conception of fiscal policy: the goal of full employment was abandoned in favour of a trend indicator that should allow the action of automatic multipliers and discretionary fiscal policy over the calculated economic cycle. In reality, the most relevant fact is the very concept of fiscal policy as well as the changing of its goal, and not so much the question of a more or less restrictive fiscal policy. The structural budget balance has been part of the fiscal governance of the Euro area and has played an enhanced role since the revised Stability and Growth Pact was adopted in 2005.

In 2009, Germany changed its Constitution to prevent excessive public indebtedness (Deficit Rule Reform Team Federal Ministry of Finance, 2009)) and (Lars P. Feld and Thushyanthan Baskaran, 2010). The rule applied in the past, of a budget financed by public debt equivalent to public investment, did not reveal itself as an impediment to the growing State indebtedness. According to the new rule, in 2016, for the Federal State, and in 2020, for the Regional States (Länder), the budget evaluated by the structural balance must be in equilibrium. By equilibrium we must understand a value up to the maximum of -0.35%. In accordance with the new treaty (European Comission, 2012) besides the -3% value of the actual budget balance the structural budget must be less than -0.5 or 1% depending on the debt-to-GDP ratio. This target is called 'Golden Rule' (M. Dalton, 2011). This idea of equilibrium was also aroused by French economists (Fondapol, 2010).

The idea behind this model of constrained fiscal policy behaviour is that economic fluctuations must have a zero average over time, or cancel each other out. The principle of an indicator adjusted for economic fluctuations has thus gained the status of a Constitutional or legal rule and, at the same time, the old idea of a full employment budget is definitively put aside (João Sousa Andrade and António Portugal Duarte, 2011). The position expressed by the Deutsche Bundesbank is clearly against the possibility of empirical identification of asymmetric cycles due precisely to the difficulty that the existence of such cycles might create for the new fiscal rule: "In this context, it is important to avoid making parameter and methodological changes that would induce asymmetries." (Deutsche Bundesbank, 2011). This new concept requires besides other things the determination of the economy's position in the economic cycle and the length of that cycle. In this context, the structural deficit indicator could make fiscal policy pro-cyclical. If estimates of trend output fall when growth is weak, then the desire to balance the structural budget imposes fiscal tightening in bad times.

The empirical concept of output gap

Friedman in both 1968 and 1993, proposed ceiling values (Milton Friedman, 1968) and (Milton Friedman, 1993) for the determination of potential output. His rather ad hoc method has the limitation of being author-dependent and does not depend on a well-known and accepted empirical methodology. Potential output was considered by (Qingwei Wang et al., 2009), reprint on (Arthur Okun, 1970), as the level of output consistent with constant inflation, being coherent with Keynesian analysis. At the same time, the relation between output growth and the unemployment gap was considered an empirical regularity. At the time, Okun proposed a value for this gap that represents the equilibrium value, or the natural rate of unemployment (Qingwei Wang, Hans-Michael Trautwein, Andreas Schrimpf, Margit Kraus, Marcus Kappler, Friedrich Heinemann and Sebastian Hauptmeier, 2009). According to Okun, the output gap was path dependent on its own value, the presence of a positive or negative gap being responsible for the reduction in investment and hence, in future potential values. One problem with Okun's concept, however, is the presence of the concept of a natural rate of unemployment.

In his much known paper, (Milton Friedman, 1968), p.8, defined the natural unemployment rate as "the level that would be ground out by the Walrasian system of general equilibrium equations, provided there is imbedded within them the actual structural characteristics of the labor and commodity markets, including market imperfections, stochastic variability in demands and supplies, the cost of gathering information about job vacancies and labor availabilities, the cost of mobility, and so on." This definition was quickly abandoned in favour of a more restricted and empirical operational one, reducing the analysis to a sole equilibrium, a labour market equilibrium, even when the declared intention is to respect Friedman's definition of a Walras system 'suitably extended' (Robert Hall, 1979). The homogeneity postulate apparently absent of employment supply in the General Theory of Keynes, (Wassily Leontief, 1936) and (James Tobin, 1947), has pushed the concept of unemployment equilibrium to the long-run horizon, to a stable equilibrium value. The new generations of economists were born in the time of the NAIRU.

The recognition that output values are best characterised as integrated series (Charles Nelson and Charles Plosser, 1982) implies that trend output or the permanent component of output determination is a difficult empirical task. Trend output cannot be represented as a deterministic series due to the presence of a stochastic permanent component. The essential problem we are facing is the decomposition between a permanent and a transitory component of output (Chantal Dupasquier et al., 1999). Nowadays, the potential output is, in most cases, determined by production function methods or time series methods. In principle, the first is preferred in terms of its dependence on economic analysis concepts. The second method is preferred because its application to different countries is not dependent on the author's preferences, and it can be applied in an automatic way to different economies without apriori judgments.

In our neo-Wickellian economic world (Michael Woodford, 2003) policy measures are almost synonymous with interest rate changes, and rules are almost synonymous with a single rule, a (John Taylor, 1993) rule type. This is a reasonable simplification of the behaviour of policy-makers (Richard Clarida et al., 1998). The output gap is just one of the two variables of this simple rule which translates the central role of this variable to policy decisions.

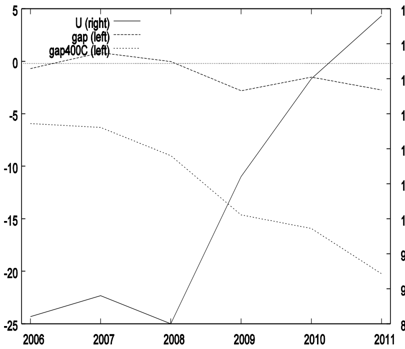
A gap measure must have a low degree of uncertainty to have utility to policy and analysis. Particularly, real time measures must have high information content. These characteristics are absent or poor for the euro area (Massimiliano Marcellino and Alberto Musso, 2010) and (Massimiliano Marcellino and Alberto Musso, 2011) and also for other developed economies (Athanasios Orphanides and Simon van Norden, 2002), (Edward Nelson and Kalin Nikolov, 2002), (Jean-Philippe Cayen and Simon van Norden, 2005), (Tom Bernhardsen et al., 2005) and (Rafael Cusinato et al., 2012).

As a consequence, economic policy decisions can be based on wrong information and have negative effects (Glenn Rudebusch, 2002), (Michael Ehrmann and Frank Smets, 2003), (Athanasios Orphanides, 2003) and (Edward Nelson and Kalin Nikolov, 2004). To analyse the pressure on production factors and consumption prices, we need a concept of output gap that takes into account excess demand in the economy. It is true that in the nominal income monetary policy strategy (Bennet McCallum, 1998), (Bennet McCallum, 2001) and (Glenn Rudebusch, 2002), we do not really need a concept of output gap for monetary policy. Either way this strategy has never been central in monetary policy and even if it had been, we need the output gap indicator to measure structural public balances. (Giuseppe Parigi and Stefano Siviero, 2001) show that cyclical movements of capacity utilisation (CU) correspond approximately to those measured with H-P or PF, and (Francesca D'Auria et al., 2010) attribute the advantage of not being subject to further revisions to the use of CU. But this corresponds to a complex trade-off between the problems posed by national-accountant revisions (GDP) and forever-errors (CU) which are impossible to measure. The case for data manipulation can, in principle, be disregarded when we study integrated economies in the EU or belonging to the OECD, (Roel Beetsma and Massimo Giuliodori, 2008) and (Andrew Hughes et al., 2012).

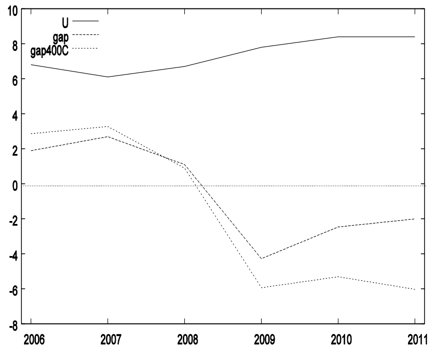
The Potential Output: Production Function and Time Series Filters

The measurement of potential output is far from simple, and being unobservable, can only be derived from a purely statistical analysis. We propose to evaluate output gap indicators in terms of the explanation of the unemployment rate. We apply our thesis to the PIIGS (Portugal, Italy, Ireland, Greece and Spain) economies. As it is known the recent behaviour of these economies is notorious different from those of the centre and north Europe (Michael Bergman, 2011).

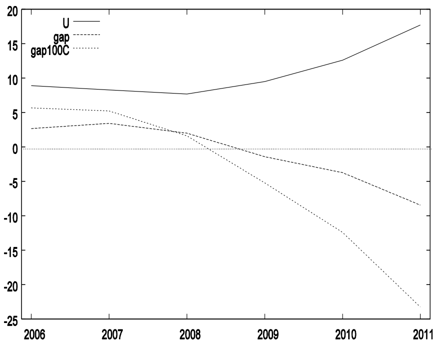
In Figures 1 to 5 we have the curve of unemployment rate, the GAP measured by the Production Function method (hereafter gap) and a new GAP that we propose in the paper. As we can easily see the gap doesn't give a good image of what has been happened to unemployment. Its information content is misleading and hides the evolution of the unemployment rate. The gap that we propose has a behaviour much more near the actual unemployment rate giving a better idea of its evolution.



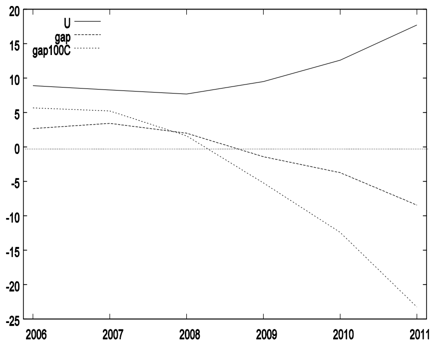
Source: Authors' calculations.
Figure 1 Portuguese Gaps and U



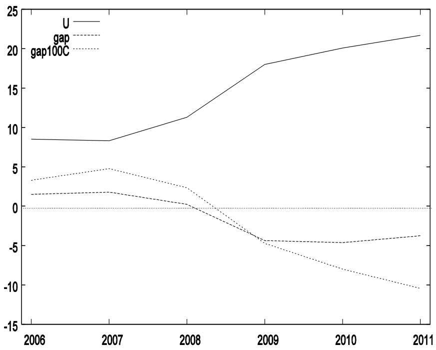
Source: Authors' calculations.
Figure 2 Italy Gaps and U



Source: Authors' calculations.
Figure 3 Ireland Gaps and U



Source: Authors' calculations.
Figure 4 Greece Gaps and U



Source: Authors' calculations.
Figure 5 Spain Gaps and U

This section is divided into two parts. In the first we present the PF methodology which is directly anchored on economic theory, and in the second we present the time series filters, the B-N and the H-P methods, which are purely a statistical construction.

Production Function Methodology

Following the ECOFIN Council meetings of July 2002/May 2004, the PF methodology for the estimation of output gaps is currently applied by the European Commission to all of the 'old' EU-15 member states, with these fifteen countries accepting the use of the PF approach as the reference method for the assessment of their annual stability and convergence programmes. For a short transition period, during which the PF method will be periodically reviewed, the H-P filter approach is only used as a back-up method. A modified PF methodology is also now usually applicable to the recently 12 acceded member states, where the H-P filter method is used in parallel with the PF approach in the assessment process. This modified PF structure tries to overcome a number of serious statistical problems associated with the availability of only short time series for the 'new' member states. For this reason, a common starting date of 1995 was generally imposed for all 12 countries since too many transitional issues were biasing the pre-1995 data (Francesca D'Auria, Cécile Denis, Karel Havik, Kieran Mc Morrow, Christophe Planas, Rafal Raciborski, Werner Röger and Alessandro Ross, 2010).

The basic idea behind the potential output calculated by the PF methodology is to obtain the production associated with permanent components of factor inputs in a context of stable inflation. This apparently simple process has two drawbacks. The first one is the type of function to be used, and the second is the so-called context of stable inflation. Why should only one type of production function – the Cobb-Douglas function – be used in all EU countries? The answer is simple: for political reasons. A uniform solution is needed for the diversity of situations. In fact, it is important that the PF methodology respects some basic principles given the politically sensitive nature of budgetary surveillance purposes. On the other hand, the representation by the Cobb-Douglas production function needs a stable income distribution. And so, the recent divergent evolution in terms of income distribution poses another problem for the robustness of this solution. The second drawback is related to the context of stable inflation and is addressed by introducing the concept of NAWRU. And how is it possible to accept the volatility of NAWRU in a context of stable and low, and very low inflation? Its values are impossible to accept but at the same time the PF procedure needs this volatility to generate cycles tending to null in the medium term.

This approach focuses in principle on the potential supply of production factors of an economy and has the apparent advantage of being based on economic theory (Francesca D'Auria, Cécile Denis, Karel Havik, Kieran Mc Morrow, Christophe Planas, Rafal Raciborski, Werner Röger and Alessandro Ross, 2010). Potential output is obtained by a combination of factor inputs multiplied by technological level or total factor productivity (TFP), given that the capital stock is not detrended and the proposed parameters for the PF.

In more formal terms (Francesca D'Auria, Cécile Denis, Karel Havik, Kieran Mc Morrow, Christophe Planas, Rafal Raciborski, Werner Röger and Alessandro Ross, 2010) and (European Comission, 2012):

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

Y is the output, real GDP; L and K, labour and capital; U_L and U_K, L and K corrected for the degree of excess capacity utilisation; and E_L and E_K, L an K adjusted for the level of efficiency. TFP is set equal to:

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

Factor inputs are measured in physical units. For labour, total hours worked are used. For capital, a comprehensive measure is used, which includes spending on structures and equipment by both the private and government sectors. Output elasticities are represented by α and $(1 - \alpha)$ for labour and capital respectively. For the period 1960-2003 the average was $\alpha = 0.63$ but the more usual $\alpha = 0.65$ is used instead.

An H-P filter with $\lambda=100$ is applied in order to determine a smooth trend for TFP. With respect to capital, no distinction is made between actual and potential capital since a normal level of capacity utilisation is implicitly defined by the TFP trend. Potential employment is determined by multiplying population of working age by the trend participation rate and by one minus the NAWRU value:

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

The NAWRU is thus obtained in such a way to produce a symmetric cycle. But nevertheless, the results are not completely symmetrical and the cycle length is considered too long for policy purposes (Deutsche Bundesbank, 2011).

The Time Series B-N and H-P Method

The Beveridge-Nelson, (Stephen Beveridge and Charles R. Nelson, 1981) and (Charles Nelson, 2008) decomposition is an alternative to the PF and to the time series Baxter-King method (Marianne Baxter and Robert G. King, 1999), and Hodrick-Prescott (Robert Hodrick and Edward Prescott, 1980) published as (Robert Hodrick and Edward Prescott, 1997) for the calculation of trend and cycle values of a time series. The series is assumed not to follow a deterministic path in the long run but to be I(1), a difference-stationary process. The estimated trend is the predicted future values of the original series following a random walk with drift, and the cycle values are stationary. This trend component as a random walk with drift is not commonly accepted to represent the permanent component of output. Another problem is the fact that in many cases, the variance of the trend is even greater than that of the cycle which results from most variations in GDP being caused by trend shocks. When applied to economic geographical areas a new problem is present, even if we take the solution of a general representation (Paul Newbold, 1990) ARIMA(p,1,q) for output solved by an acceptable optimisation rule, and there are no unique representation, each region or country will have its own representation. We will have no practical hypothesis to use the same typical empirical representation in all countries, and by changing each representation the gap picture is also changed.

In spite of the interesting theoretical solution of B-N, the most popular method of detrending is the H-P filter. The calculation of trend output by the H-P method (Robert Hodrick and Edward Prescott, 1980) consists in solving the following problem of minimisation, where *Y* stands for actual real GDP and *Y** for the trend

$$Min \sum_{t=1}^{T} (lnY_t - lnY^*_t)^2 \qquad (4)$$

subject to

$$\sum_{t=2}^{T-1}\left[(lnY^*_{t+1} - lnY^*_t) - (lnY^*_t - lnY^*_{t-1})\right]^2 < \epsilon \quad (5)$$

ϵ is a sufficiently small number. The solution of that problem leads us to the minimisation of the Langrangean

$$\sum_{t=1}^{T}(lnY_t - lnY^*_t)^2 + \lambda \cdot \sum_{t=2}^{T-1}\left[(lnY^*_{t+1} - lnY^*_t) - (lnY^*_t - lnY^*_{t-1})\right]^2 \quad (6)$$

where, λ, stands for the Lagrange multiplier.

This parameter is at the centre of all polemics because it is the pivot variable for the retention of cycle types through the calculation of the trend.

From a strictly econometric point of view we know that it is not possible to construct an ideal filter without distorting the original characteristics of the series when we have a finite number of observations. As a consequence, we must be aware of the limitations of the filter that we use for detrending (Mark Meyer and Peter Winker, 2005), and this applies equally to potential output as to the output gap component (Charles Nelson and Heejoon Kang, 1981).

The H-P filter won two important tests. The test of time which was the result of the fire of discussion about the filter. And the H-P undesirable properties about problems of spurious cycles are not particularly compelling, (Morten Ravn and Harald Uhlig, 2002) and (Regina Kaiser and Agustín Maravall, 1999). Nevertheless, we must be concerned if the dynamics obtained with such output gap values are an artificial creation of the potential output or permanent component removal operation, and therefore, care must be taken about the chosen λ. (Robert Hodrick and Edward Prescott, 1980) used 1600 for quarterly data; they show that λ can be interpreted as the variance of the cycle, σ_c^2, divided by the variance of the acceleration in the trend component, σ_g^2, supposing both variables are zero mean identically independent distributed (iid) variables. The value of λ must be constrained to $\lambda = \sigma_c^2 / \sigma_g^2$, and based on the argument that a 5% deviation from trend for these values is relatively moderate corresponding to an $1/8\%$ change in the trend, the value of $\lambda = 1600$ follows.

The value of 1600 for quarterly data is frequently used, but for annual data the first papers began to diverge. (David Backus et al., 1992) proposed the value of 100 for the smoothing parameter of annual data, meaning that the standard value for quarterly data of 1600 must be multiplied by the square of the alternative sampling frequency. (Isabel Correia et al., 1992) and (Thomas Cooley and Lee Ohanian, 1991) used a value of 400 for annual data, multiplying the smoothing parameter, 1600, by the new frequency of the data relative to the quarterly data frequency. (Morten Ravn and Harald Uhlig, 2002) from a frequency-domain perspective, propose to adjust the smoothing parameter by multiplying the reference value with the fourth power of the observation frequency ratios, which means a value of 6.25 for annual data. The choice of this smooth parameter has consequences at the level of actual cyclical values. (Laure Turner and Hervé Boulhol, 2011) show that with a value of 30, 91% of short cycles amplitude will be included in the calculated cycle and 41% of long cycles also; and with 100, we will have 97% and 70% for the short and long cycle amplitudes included in the calculated cycle.

(Robert King and Sérgio Rebelo, 1993) and (Jurgen Ehlgen, 1998) show that the H-P filter corresponds to an optimal decomposition in orthogonal components that we know as cycle and trend values. This optimality is applied to midpoints for any I(1) or I(2) series, (Emi Mise et al., 2005). The problem of sub optimality end points denounced by (Marianne Baxter and Robert G. King, 1999), (Mikael Apel and Jan Hansen, 1996), (Pierre St-Amant and Simon van Norden, 1997) and (Emi Mise, Tae-Hwan and Paul Newbold, 2005), is quite simply that the result of the trend-filter is no more than a moved-average of the original series and so current values have too much weight (Carine Bouthevillain, 2002). To solve this problem we use the common practice introduced by (Regina Kaiser and Agustín Maravall, 1999) of using forecast-augmented series.

One of the advantages of the H-P filter is its dependence only on data frequency, which means that the cycle's values extraction method is independent of economies specifications as pointed out by (Mikael Apel and Per Jansson, 1999). (Kristian Jönsson, 2009) proposes improving trend extraction by imposing judgment, and concludes that new H-P values with judgment can improve the correlation between cyclical values and CPI inflation during the period 1981Q1 to 2007Q4 for Sweden. This exercise of judgment in the trend extraction is very near our proposal as we demonstrate below. The same applies to the papers of (George Evans, 1989b) and (George Evans, 1989a) where in order to obtain an Okun's equation instead of using mean growth rates for output following a Beveridge-Nelson decomposition, policy-chosen growth rates were used.

Empirical Application to PIIGS

The empirical part of this study applies to the PIIGS economies, Portugal (PRT), Ireland (IRE), Italy (ITA), Greece (GRE) and Spain (SPN). All values in this section are from the AMECO European Data Base: GDP at 2000 prices, unemployment rate and PF gap. All other gap indicators were calculated and created by us. After developing a better gap indicator, we proposed to evaluate the information contents of different gap measures using two different methods. The first proposed method consists in the estimation of a dynamic model of unemployment with each of the gap measures as dependent variables; the second is the accuracy analysis of forecast values for unemployment based on the above dynamic model.

The different gap $\left(y_y - y_t^T\right)$ measures used are:

1. gap, meaning the gap published by the European Commission and based on the Production Function method;
2. gap625, meaning the gap measured with the H-P trend with a $\lambda = 625$, (Morten Ravn and Harald Uhlig, 2002) and (Michael Artis and Toshihiro Okubo, 2010);
3. gap100 and gap400, where we now have $\lambda = 100$, (David Backus, Patrick Kehoe and Finn Kydland, 1992), and $\lambda = 400$, (Isabel Correia, João Neves and Sérgio Rebelo, 1992) and (Thomas Cooley and Lee Ohanian, 1991);
4. gap625C, gap100C and gap400C, corresponding to H-P trends that were corrected by us taking in account ruptures on the GDP evolution since 1960 to 2011.

To 'correct' the traditional gap measures we take into account a country specific rupture point and then propose a transformation of the trend H-P values. We take as a rupture point the last year of positive growth in the neighborhood of the current crises. The years detected are: 2001 for Portugal, 2007 for Spain, and 2006 for Greece, Ireland, and Italy. We forecast the trend GDP for the period after the rupture based on the series from 1990 to that year. We choose this year as one with not too much optimistic projection of trend values because the average growth rate of output was greater before that year than after. The model used for this forecast, with the GDP trend values (in logs), includes a constant, a time trend and the lagged value of the dependent variable. The aim of this lagged value is to take into account the inertia concerning the evolution of trend output. This solution supposes a trend-reverting behaviour for output (John Campbell and Gregory Mankiw, 1987). We used in our estimation the procedure developed by (Jae Ki, 2009) for the statistical software R. This procedure uses the correction of (Paul Shaman and Robert Stine, 1988) for the bias caused by the auto-regressive model. With these forecast values we replace the 'old' trend H-P values by these corrected output gap values.

Dynamic models for the unemployment rate

To obtain the best fitted model for the unemployment rate in terms output gap values we estimate the following model:

$$U_t = \beta_0 + \beta_1 \cdot \left(y_t - y_t^T\right)_t + \beta_2 \cdot \left(y_t - y_t^T\right)_{t-1} + \gamma \cdot U_{t-1} \qquad (7)$$

With this formulation we solve two problems: the problem of the unit root characteristic of the unemployment rate by the dynamisation of the equation, and the lagged characteristic of unemployment relative to the activity level is also solved.

The results with the dynamic model for unemployment in terms of the best BIC (Schwarz) criterion estimated from 1965 to 2011 are in Table 1. The second line for each country corresponds to the corrected gap, except for Spain where the estimation period does not include the corrected gap values.

Table 1

BIC Results for Different Output Gap Measures

	$\lambda=6.25$	$\lambda=100$	$\lambda=400$	PF Gap
PRT	117.49	114.13	112.87	110.7
	109.35	104.18	***104.01***	
ITA	75.09	70.08	66.39	71.02
	81.14	73.24	***69.37***	
IRE	170.48	159.83	151.7	149.66
	159.99	154.39	***149.13***	
GRE	150.26	141.99	135.56	135.43
	112.18	***110.22***	124.04	
SPN(*)	153.57	143.76	***137.67***	135.19

(*) Regression for 1965-2006. Using the entire period the gap H-P coefficients have the wrong sign.

Source: Authors' calculations.

As we can see, generally fitted models are better for greater λ, with the exception of Greece; the correction of the gaps produces better results than the non-corrected values; and for Spain the gap produces slightly better fitted models than the gaps based on corrected H-Ps.

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Forecasting results

We continue to use the dynamic model for the unemployment rate. The models are estimated for the period 1965-2006 and the forecast for 2007-2011. We compare two models, one with the PF gap and the other with our corrected measure of the gap based on the H-P.

From several forecasting quality indicators (Robert S. Pindyck and Daniel L. Rubinfeld, 1998) we retain only two:

Mean Percentage Error: $M\%E = \frac{1}{T} \cdot \sum_{t=1}^{T} 100 \cdot \frac{e_t}{y_t}$, and the

(Henri Theil, 1966)'U: $U = \frac{1}{T} \cdot \sum_{t=1}^{T-1} \left(\frac{y^F_{t+1} - y_{t+1}}{y_t} \right)^2 \cdot \left[\frac{1}{T} \cdot \sum_{t=1}^{T-1} \left(\frac{y_{t+1} - y_t}{y_t} \right)^2 \right]^{-1}$.

The results are in Table 2. The table is divided in two parts where each part refers to the two gap variables in comparison, the PF gap and the best corrected H-P gap. The years of the dynamic forecast and the actual and prediction values are in the first three columns. We also include the standard deviation of the forecast as well as the interval for 95% probability in the fourth and fifth columns of each part of the Table.

Table 2

Forecasting Values for the Unemployment Rate

	PRT, GAP				PRT, hp400		
Year	U%	prediction	s.e.	95% interval	prediction	s.e.	95% interval
2007	8.9	8.3	0.67	6.9 - 9.7	8.7	0.65	7.4 - 10
2008	8.5	8.4	0.93	6.5 - 10.3	9.4	0.87	7.6 - 11.1
2009	10.6	8.9	1.1	6.7 - 11.2	10.7	1.02	8.6 - 12.7
2010	12	8.9	1.24	6.4 - 11.4	11.1	1.13	8.8 - 13.4
2011	12.9	9.2	1.35	6.5 - 12	12.2	1.22	9.8 - 14.7
M%E	15.71				0.64		
Theil's U	1.60				0.47		

	ITA, GAP				ITA, hp400		
Year	U%	prediction	s.e.	95% interval	prediction	s.e.	95% interval
2007	6.1	6.4	0.47	5.5 - 7.4	6.4	0.44	5.5 - 7.3
2008	6.7	6.2	0.66	4.9 - 7.6	6.4	0.59	5.2 - 7.6
2009	7.8	7	0.8	5.4 - 8.6	7.5	0.69	6.1 - 8.9

2010	8.4	7.7	0.91	5.9 - 9.5	8.7	0.77	7.1 - 10.2
2011	8.4	8.2	1.01	6.2 - 10.3	9.8	0.83	8.1 - 11.5
M%E	4.53				-3.14		
Theil's U	0.82				0.89		

	IRE, GAP				IRE, hp400		
Year	U%	prediction	s.e.	95% interval	prediction	s.e.	95% interval
2007	4.6	3.9	1.04	1.8 - 6	4.9	1.05	2.7 - 7
2008	6.3	4.8	1.4	1.9 - 7.6	7.1	1.47	4.2 - 10.1
2009	11.9	7.1	1.64	3.8 - 10.4	10.1	1.78	6.5 - 13.7
2010	13.7	8.5	1.82	4.8 - 12.2	11	2.03	6.9 - 15.1
2011	14.4	9.1	1.95	5.2 - 13.1	11.5	2.24	7 - 16
M%E	30.93				7.06		
Theil's U	1.04				0.47		

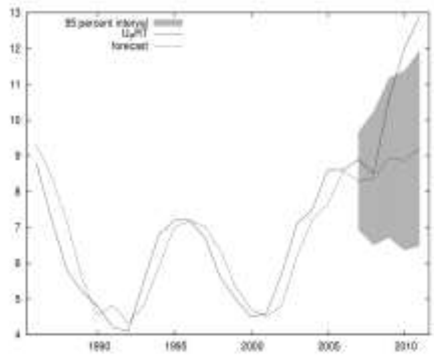
	GRE, GAP				GRE, hp400		
Year	U%	prediction	s.e.	95% interval	prediction	s.e.	95% interval
2007	8.3	8.8	0.66	7.5 - 10.1	8.7	0.64	7.4 - 10
2008	7.7	8.9	0.93	7 - 10.8	8.8	0.89	7 - 10.6
2009	9.5	9.3	1.13	7 - 11.6	9.6	1.08	7.4 - 11.8
2010	12.6	9.7	1.29	7.1 - 12.3	10.7	1.23	8.2 - 13.2
2011	17.7	10.4	1.43	7.5 - 13.3	12.7	1.35	9.9 - 15.4
M%E	8.91				4.70		
Theil's U	1.17				0.81		

	SPN, GAP				SPN, hp400		
Year	U%	prediction	s.e.	95% interval	prediction	s.e.	95% interval

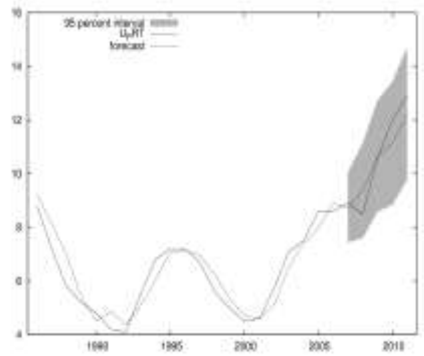
2007	8.3	8.4	1.11	6.5 - 10.2	7.8	1.18	5.4 - 10.2
2008	11.3	9.5	1.5	7 - 12	9.4	1.63	6.1 - 12.7
2009	18	13.1	1.76	10.1 - 16	13.7	1.96	9.8 - 17.7
2010	20.1	14.5	1.95	11.2 - 17.8	15.8	2.22	11.3 - 20.3
2011	21.7	15.1	2.09	11.5 - 18.6	17.5	2.44	12.5 - 22.4
M%E	20.17				17.37		
Theil's U	0.94				0.77		

Source: Authors' calculations.

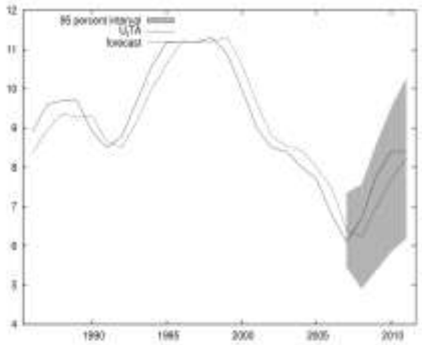
For Spain we use the HP100C because with HP400C we have a wrong sign on this variable. Our conclusion about forecasting results is that the models with H-P corrected perform better than those with the (PF) gap. The forecast with gap fails systematically what doesn't happen with the corrected gap. The only exception is Italy for which we can say the models are equivalent. These results are well confirmed by graphical analysis (Figures 6-15).



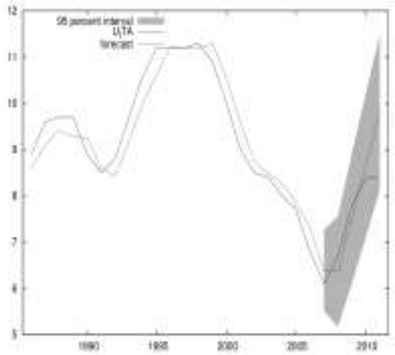
Source: Authors' calculations.
Fig. 6 PRT U forecast with gap



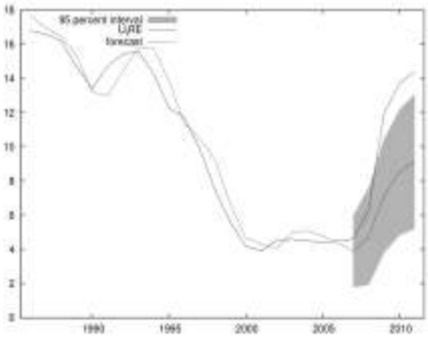
Source: Authors' calculations.
Fig. 7 PRT U forecast with gap400C



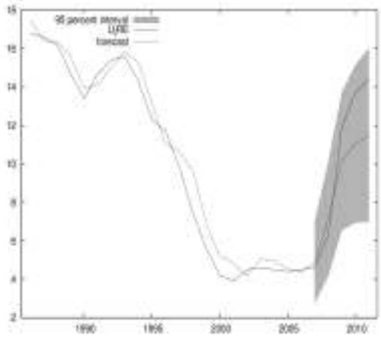
Source: Authors' calculations.
Fig. 8 ITA U forecast with gap



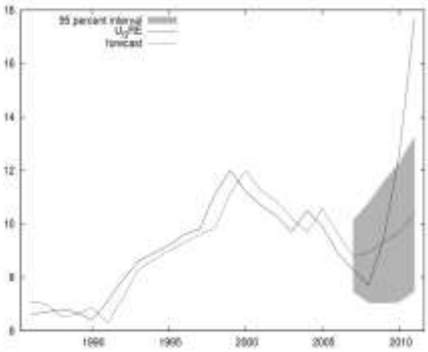
Source: Authors' calculations.
Fig. 9 ITA U forecast with gap400C



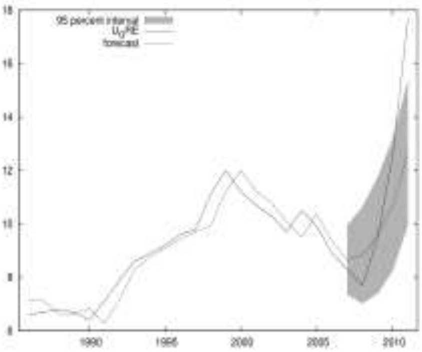
Source: Authors' calculations.
Fig. 10 IRE U forecast with gap



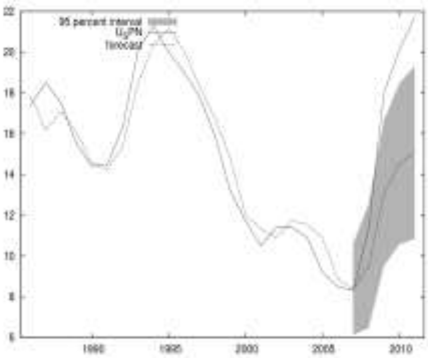
Source: Authors' calculations.
Fig. 11 IRE U forecast with gap400C



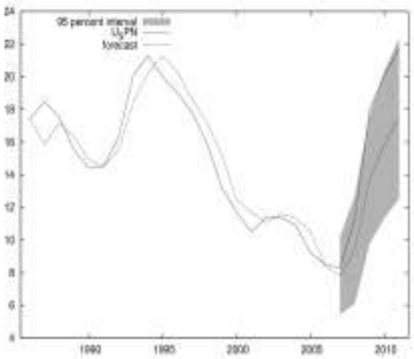
Source: Authors' calculations.
Fig. 12 GRE U forecast with gap



Source: Authors' calculations.
Fig. 13 GRE U forecast with gap100C



Source: Authors' calculations.
Fig. 14 SPN U forecast with gap



Source: Authors' calculations.
Fig. 15 SPN U forecast with gap100C

Conclusion

The question is asked of how we can accept the idea that the macroeconomic disequilibrium is slight and not growing significantly when unemployment reaches unacceptable values. We concentrate on the cyclical nature of this crisis for PIIGS and not on the systemic and structural nature of it (Kosta Josifidis et al., 2010). The traditional output gap measures must not be used as indicators of negative excess demand in the economy in current times. Output ruptures cause the uselessness of these gaps. The information content of these gaps allows policy-makers to have a good conscience: nothing must be done at the macroeconomic level;

the disequilibrium creating unemployment is like a back stage phenomenon in a Greek Tragedy. And if a problem of unemployment is recognised, this concerns only the labour market and not all the economy.

We demonstrate that the PF gap and the H-P gaps with different smooth parameters are not good indicators of macroeconomic disequilibrium. We also demonstrate that a greater value for the smoothing parameter produces better indicators. We propose to replace the usual calculations of the H-P gap. Because the trend is time dependent, we must attribute reasonable values to it, the permanent part of the filter, when we recognise the presence of ruptures in output values. We gave in this paper an example of this solution and we must accept that the corrected H-P gaps are a better series because their information content is superior to the non-corrected gaps.

With this proposal, the Greek tragedy is transformed: the horror of unemployment is put at the front of the stage. The growing importance attributed to structural public budget balances following the change in the German Constitution and the Fiscal Compact gives an important role to this problem of gaps values calculations.

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