Double conditioned potential output

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DOUBLE CONDITIONED POTENTIAL OUTPUT

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Abstract

The central point of this paper is that both – internal and external – equilibria ought to be involved in the estimation of potential output. If only the data on inflation, unemployment rate and wages are used for its evaluation, no certainty exists that such a level will correspond to a stable foreign trade balance.

Our attempt is based on the following methodological assumptions:

- the potential output is concomitantly associated with a constant inflation and sustainable relative foreign trade balance (ratio of net export to gross domestic product);
- all supply shocks affect this level, potential output being, therefore, a variable indicator;
- consequently, the output gap reflects exclusively the demand pressure.

The proposed computational algorithm comprises utilisation of orthogonal regression. It is exemplified on seasonally adjusted quarterly statistical series of the Romanian transition economy; this application shows that the output gap really contains significant regular and irregular cyclical components.

Key words: Potential Output, Output Gap, Orthogonal Regression, Cycle.

JEL: C 22, E 23, E 32.

I. Introduction

There are controversies around "potential output" and they are explainable. On one hand, this is an "invisible" indicator, which may not be unequivocally estimated; as it is well known, several computational algorithms were proposed, each of them generating different results, sometimes even contradictory ones. On the other hand, the question cannot be simply avoided or ignored; the analysts and especially the policy-makers need to know, within reasonable approximation, a desirable level of the real GDP, in proximity of which a given economy does not register major disequilibria and is developing in a predictable manner.

The stock of studies regarding this matter is already huge and it continues to rise. I do not aim to extendedly evaluate it, I will only emphasize some issues which are, in my opinion, particularly important for our approach as exposed below.

1. The first one concerns the observed indicators to which the potential output is related. From afar, the inflation is the most frequently involved issue, either in theoretical researches, or in empirical analyses (including macro models building).

The "Phillips Curve-Okun's Law" combination was for a long time on top (Gallic, Sterilizes and Viscous; Elmeskov and Pichelmann; Fair 1994; Karbuz; Mankiw 1995; Kawasaki; de Bondt, van Els and Stokman; Frisch; Kichian; Akerlof, Dickens and Perry; Schorderet; Abel and Bernanke; Proietti, Mussoy and Westermanny; Gerlach and Yiu; Ögünç and Ece).

NAIRU investigations have considerably extended this line (Layard, Nickell and Jackman; Staiger, Stock and Watson 1996 and 2001; Allen, Hall and J.Nixon; Holden; Whelan; Stiglitz; Blanchard and Katz; Gordon 1997 and 1999; Duarte and Andrade; Black and Fitzroy; Chaney; Stockhammer; Herz and Roger; Bårdsen and Nymoen; Nymoen).

NAWRU version has payed attention to the correspondence between output gap and wages as a main component of the production costs and inflation (Elmeskov; Elmeskov and MacFarlan; Ball; Holden; Duarte and Andrade; Johansen; Nymoen). AWSU has explored the same connection using the share of wages in added value (Gordon 1996, Holden and Nymoen).

As a conclusion, until now, the relationship between potential output and inflation has had priority. This is undoubtedly one of the most relevant expressions of the global economic environment. Nevertheless, it refers preponderantly to the internal dimension of the issue.

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The foreign trade balance is also a very important symptom of the economy status, reflecting the external side of equilibrium. This problem had not been completely uncared for, but it was discussed chiefly on the premises that the price index and the current trade balance are linked together by a stable clearing mechanism, which induces an univocal correlation between them (Layard, Nickell and Jackman; Holden). Obviously, domestic inflation and foreign trade balance deeply interact through exchange rate, wages, import prices, other production costs, in two words – economyc competitiveness. But this interdependence is mediated by institutional framework, shifting behaviours of firms and households, changing macroeconomic policies, unstable international context. Consequently, we do not have enough reasons to consider that a constant (even low) inflation is typically associated to a medium-long run sustainable net export. On the contrary, a lot of historical examples show that variable or steady price indices combine – during a representative period - with quite different configurations of the foreign trade balance (deficit, surplus, near zero). In this field, there are many influencing factors, whose analysis exceeds the goal of the present work.

I have only considered to pin-point this circumstance as a fundamental fact. Therefore, we do not have any certainty that a potential output deduced from data on inflation, unemployment rate and wages, will correspond to a stable foreign trade balance (moreover to null net export). Our attempt is to explicitly include in the determination of the potential output the evolution of net export, not only the movement of domestic prices. In other words, both – internal and external – equilibria will be simultaneously involved in the estimation of the discussed indicator.

Consequently, the potential output is the output level associated with:

- constant inflation and
- constant relative foreign trade balance, represented by the ratio of net export to gross domestic product.

That is why it will be called **double conditioned potential output**.

2. The temporal stability of the potential output is another essential question. The theory and practical applications evolved towards a flexible interpretation. If initially only long-run potential output was accepted (according to the natural growth rate), its medium and short-run levels have been subsequently admitted; for example, as a weighted average of the long-run and previous statistical levels (Holden) or, lately, in such a light acceptation as time-varying NAIRU (Gordon 1999). Due to this evolution, the concept became more accessible for empirical researches, but, in the same time, the difference between the potential output and the actual GDP ceased to be clear enough.

2.1. In fact, this question could be asked in this manner: "how does the potential output react to both demand and supply shocks?"

a) Regarding supply-side, according to the traditional expectations-augmented Phillips curve, inflation depends on its past level, on deviation of the output from its own natural rate (well-known gap), and on supply shocks (Mankiw). This refers to the short-run supply shocks, because the long-run ones intrinsically affect the equilibrium of the economic growth. But, there are many changes with perennial effects that gradually penetrate into economy (Kichian). In other words, there is a big class of long-run shocks which consist of step by step accumulated short-run shocks. The difficulty to unambiguously distinguish the short and long term supply-shocks is aggravated by the hysterezis phenomenon, which is often present in the labour market (Elmeskov and MacFarlan; Krugman; Bellmann; Blanchard and Pedru; Calmfors; Karamé; Betcherman; Gordon 2003). As a result, it seems realistic to accept that the potential output incorporates all supply shocks - positive or negative – with no relation to:

- their temporal influences (on short or long term),
- spatial sources (internal or from abroad), and
- nature of their impulses (technological developments, variation in quality of human capital, modification of market environment, changes in institutional framework, and so on).

In such interpretation, the potential output is clearly changing value, not only on long-run, but on medium and short term, as well. Therefore, it is related to Gordon's time-varying NAIRU.

b) Unlike supply shocks, the demand ones act preponderantly on short-run. There are, of course, shifts in preferences which could profoundly influence the structure of demand. Nevertheless, such modifications become observable only during extensive period, in any case longer than the possible duration of a given level of the potential output. This assumption would need a more detailed examination, but for the time being, it will be adopted as such. From it results that demand shocks affect only real output, the potential output remaining neutral to this type of changes. In other words, the difference between actual and potential outputs reflects exclusively a demand pressure. Such a statement could appear as an excessive simplification. However, it eliminates the uncertainties implied by the inclusion, among inflation determinants, of supply-shocks separately from the output gap. In this way, I think, the concept becomes more consistent with its original paradigm.

2.2. The dependence of potential output on supply-shocks not only on medium-long term, but on short-run too, has a key methodological implication. No matter in which manner it will be built, the computational algorithm must openly contain either parameters that are stable during the period considered representative for a given potential output, or more flexible parameters.

Under these circumstances, another question becomes noteworthy. Is there any difference between potential and actual outputs, from their variability point of view? It seems plausible to state that the potential output is less volatile than the actual one, at least by the strength of the fact that the last one is conditioned not only by the supply shocks, but by the demand ones, too. Thus, the usual hypothesis regarding the potential output constancy during two successive intervals (especially when these are relatively short) cannot be rejected. It will be also adopted in the below described scheme.

3. During the last decades the literature on the estimation methods of potential output has been very rich. Two approaches are dominant:

- the first one is global, potential output being determined as an aggregate indicator, on the basis of series of actual gross domestic product (as such or in combination with other variables);
- the second one is structural, emphasising the main factors on which potential output depends; in this case, a large variety of production functions are being used.

3.1. The global estimation has registered an impressive evolution, from a simple one towards more and more sophisticated algorithms (Beveridge and Nelson; Nelson and C.Plosser; Watson; Stock and Watson; King and Rebelo; Harvey and Jaeger; Kuttner; Baxter and King; Cogley and Nason; Mankiw; Conway and Hunt; Gerlach and Smets; de Brouwer; Driver, Greenslade and Pierse; Duarte and Andrade; Gerlach and Yiu; Guarda; Domenech and Gomez; Logeay and Tober; Rennison). It is worth mentioning, for instance, linear time trends, unvariate and multivariate filters, unobserved components models.

The great advantage of these methods consists in the possibility of approximating the potential output directly from statistically defined indicators, to which it is related. If only these methods are used, the projections can be obtained, as a rule, through the extrapolation of the identified characteristics of the past series. As a result, there are serious difficulties to integrate the globally estimated potential output into predictive macromodels.

3.2. Due to this situation, probably, the structural approach did not cease any moment to exert a great attraction. It is centred on neo-classical production function (Kawasaki; Ekstedt and Westberg; Zaman 2001 and 2002; Rõõm; Proietti, Mussoy and Westermanny). Without any doubt, such an approach is nearer to micro-foundations of economic activity and, besides that, may generate – under adequate investment and labour force relationships – more reliable forecastings. However, it is not also safe from some complications.

a) Beyond the fact that making a consistent time series regarding capital is not at all without troubles, how can the rate of capacity utilization be estimated - consonant with an unobservable indicator as the potential output – still remains an open question. For this reason, most models containing production functions do not include such a rate.

b) Natural (normal) employment (or unemployment) also cannot be directly approximated using available data. This explains why the methodologies based on production functions define it on the basis of global estimation (most of all NAIRU or NAWRU). Sometimes, the elasticity of output to labour input is determined imposing its equivalence with the share of wages in added value, which raises many queries.

3.3. A mixed approach is also possible. It integrates the core relationship which derives from a global estimation into a system, containing not only a production function, but domestic absorption, export and import, other macroeconomic determinants, too.

3.4. Also worth to be mentioned are the proposals to compare different procedures using the equations of inflation in which, except for the output gap, are incorporated some supply shock variables:

- changes in the relative price of imports, in the relative price of food and energy, and in the real exchange rate (Gordon 1997);
- unit labor costs and import prices adjusted for tariffs (de Brouwer);
- real oil prices and real import prices (Driver, Greenslade and Pierse).

In order to evaluate alternative output-gap estimators, Monte Carlo technique was also developed (Rennison).

4. Concluding this introductory section, central methodological assumptions of the present work are the following:

- the potential output is interpreted as double conditioned, which means the level of GDP concomitantly involves a constant inflation and sustainable net export;
- all supply shocks affect this level, potential output being, therefore, variable;
- output gap reflects exclusively the demand pressure.

II. Computational algorithm

1. Global estimation of the potential output derives from the definition of both mentioned conditions: price index and relative foreign trade balance.

The inflation is determined as follows:

$$P=P(-1)*(Y/Y_p)^{\beta} \qquad [1]$$

where P are prices, Y – actual output at constant prices, Y_p – potential output in the same prices as actual one, all variables expressed in indices (of course, with the same temporal reference). According to the theory, the coefficient β is positive due to the well known reasons [Appendix I].

Using the logarithms (small letters), the relationship [1] becomes

$$\Delta p=\beta*(y-y_p) \qquad [1a]$$

in which Δ is the first order difference operator.

The second condition may be represented as follows:

$$n_x=a+\gamma*(y-y_p) \qquad [1b]$$

in which n_x is the ratio of net export to GDP. Generally speaking, γ is negative: an enforcing domestic demand pressure stimulates imports and, subsequently, induces a deterioration of the foreign trade balance. Nevertheless, if the economic growth is based on an improved productive competitiveness or/and on a pro-export active policy, a positive correlation between Y and n_x is likely to exist, at least temporarily.

The constant term in [1b] can be interpreted as being the level of a relative foreign trade balance (possible under given international circumstances, including capital markets) around which the economy tends to stabilise in the given period.

Obviously, if $Y=Y_p$, then $P=P(-1)$ and $n_x=a$ are valid, corresponding to the mentioned characteristics of the double conditioned potential output.

Normally, these features could be formalised in other, more sophisticated, ways. I would prefer the simplest of them, not only from computational reasons; in such uncomplicated description, the weaknesses (or eventual advantages) of the here proposed approach may be easier identified.

2. The stochastic expressions of the relationships [1a] and [1b] are:

$$\Delta p=\beta*(y-y_p)+\varepsilon_p \qquad [2a]$$
$$n_x=a+\gamma*(y-y_p)+\varepsilon_n \qquad [2b]$$

It is assumed that both, ε_p and ε_n, are "white noise".

From [2a] and [2b], two estimations of the potential output can be deduced. One of them observes price restriction (y_{pp}) and the other one corresponds to the foreign trade balance condition (y_{pn}).

$$y_{pp}=y-\Delta p/\beta+\varepsilon_p/\beta \qquad [3a]$$
$$y_{pn}=a/\gamma+y-n_x/\gamma+\varepsilon_n/\gamma \qquad [3b]$$

If the potential output simultaneously presumes constant inflation and stable relative foreign trade balance, then [3a] and [3b] ought to be equal ($y_{pp}=y_{pn}=y_p$), which means:

$$a/\gamma+\Delta p/\beta-n_x/\gamma+\varepsilon=0 \qquad [4]$$

where $\varepsilon=(\varepsilon_n/\gamma-\varepsilon_p/\beta)$, again a "white noise".

Two regression-pairs are thus possible:

$$\Delta p=a_1+b_1*n_x+\varepsilon_1 \qquad [4a1]$$
$$a_1=A\Delta p-b_1*An_x \qquad [4a2]$$

in which $a_1=-a*\beta/\gamma$, $b_1=\beta/\gamma$, $\varepsilon_1=-\varepsilon*\beta$, and corresponding averages $A\Delta p$ and An_x, or

$$n_x=a_2+b_2*\Delta p+\varepsilon_2 \qquad [4b1]$$
$$a_2=An_x-b_2*A\Delta p \qquad [4b2]$$

in which $a_2=a$, $b_2=\gamma/\beta$, and $\varepsilon_2=\varepsilon*\gamma$, and An_x and $A\Delta p$ with the same significance.

As already known, the separate regressions [4a1] and [4b1] are not reversible, except the trivial case when the coefficient of correlation between Δp and n_x is equal to unity.

The problem becomes more complex when we cannot establish a reliable causal relationship between the given variables. In other words, when we do not know what coefficient, b_1 or b_2, should be used to estimate β and γ.

3. Such reversibility means that the relationships [4a1] and [4b1] ought to be valid in the same time with [4a2] and [4b2].

Putting the error terms aside, we have:

$$\Delta p=a_1+b_1*n_x=a_1+b_1*(a_2+b_2*\Delta p)=a_1+b_1*a_2+b_1*b_2*\Delta p=$$
$$=A\Delta p-b_1*An_x+b_1*(An_x-b_2*A\Delta p)+b_1*b_2*\Delta p=$$
$$=A\Delta p-b_1*An_x+b_1*An_x-b_1*b_2*A\Delta p+b_1*b_2*\Delta p=$$
$$=A\Delta p-b_1*b_2*A\Delta p+b_1*b_2*\Delta p=A\Delta p+b_1*b_2*(\Delta p-A\Delta p) \qquad [5]$$

Therefore,

$$\Delta p-A\Delta p=b_1*b_2*(\Delta p-A\Delta p) \qquad [5a]$$

and

$$b_1*b_2=1 \qquad [5b]$$

The orthogonal regression observes this condition [Malinvaud, Dissanaike and Wang, Saman]. In its classical form, the coefficients b_1 and b_2 are determined as follows:

$$b_1=\{(\sigma_p^2-\sigma_n^2)+[(\sigma_p^2-\sigma_n^2)^2+4*\sigma_{pn}^2]^\wedge(1/2)\}/(2*\sigma_{pn}) \qquad [6a]$$
$$b_2=\{(\sigma_n^2-\sigma_p^2)+[(\sigma_n^2-\sigma_p^2)^2+4*\sigma_{pn}^2]^\wedge(1/2)\}/(2*\sigma_{pn}) \qquad [6b]$$

where σ_p^2 is the variance of Δp, σ_n^2 – the variance of n_x, and σ_{pn} represents their covariance.

Substituting

$A=(\sigma_p^2-\sigma_n^2)$ and $B=[(\sigma_p^2-\sigma_n^2)^2+4*\sigma_{pn}^2]^\wedge(1/2)$ which is equivalent also to $[(\sigma_n^2-\sigma_p^2)^2+4*\sigma_{pn}^2]^\wedge(1/2)$, we have

$$b_1*b_2=[(A+B)/(2*\sigma_{pn})]*[(-A+B)/(2*\sigma_{pn})]=$$
$$=[(B+A)*(B-A)]/(2*\sigma_{pn})^2=(B^2-A^2)/(2*\sigma_{pn})^2 \qquad [7a]$$

which means

$$b_1*b_2=[(\sigma_p^2-\sigma_n^2)^2+4*\sigma_{pn}^2-(\sigma_p^2-\sigma_n^2)^2]/(2*\sigma_{pn})^2=(4*\sigma_{pn}^2)/(4*\sigma_{pn}^2)=1 \qquad [7b]$$

I do not pinpoint the problems associated to the classical form of orthogonal regression and the possibilities to improve it [Disunite and Wang]. At this moment, its property to generate reversible econometric coefficients is important.

4. We go back now to the initial parameters a, β and γ. Summing [3a] and [3b], and maintaining the assumption about their equality ($y_{pp}=y_{pn}=y_p$), the following formula of y_p results:

$$2*y_p=2*y-\Delta p/\beta+a/\gamma-n_x/\gamma+(\varepsilon_p/\beta+\varepsilon_m/\gamma)=2*y-\Delta p/\beta+(a-n_x)/\gamma+(\varepsilon_p/\beta+\varepsilon_m/\gamma) \qquad [8]$$

Including $\beta=b_1*\gamma$, potential output is approximated by

$$y_p=y+(a-\Delta p/b_1-n_x)/(2*\gamma)+\varepsilon \qquad [8a]$$

The first order difference Δy_p will be determined:

$\Delta y_p = y_p - y_p(-1) = y + (a - \Delta p/b_1 - n_x)/(2*\gamma) + \varepsilon - y(-1) - (a - \Delta p(-1)/b_1 - n_x(-1))/(2*\gamma) - \varepsilon(-1) =$
$= y - y(-1) - [(\Delta p - \Delta p(-1))/b_1 + n_x - n_x(-1)]/(2*\gamma) + (\varepsilon - \varepsilon(-1)) =$
$= \Delta y - (\Delta^2 p/b_1 + \Delta n_x)/(2*\gamma) + \Delta\varepsilon$ [9]

where Δ^2 is the second order difference operator.

Theoretically, it would be difficult to reject the conjecture that potential output should be less volatile than the actual one. According to the usual methodologies,

$$\Delta y_p = \Delta y - (\Delta^2 p/b_1 + \Delta n_x)/(2*\gamma) = 0 \quad [10]$$

the coefficient γ is deduced:

$$\gamma = (\Delta^2 p * b_1 + \Delta n_x)/(2*\Delta y) \quad [10a]$$

from which automatically β yields:

$$\beta = b_1 * \gamma \text{ or } \beta = \gamma/b_2 \quad [10b]$$

Therefore, both γ and β are variable, reflecting changeable factors which influence the level of potential output. Unlike these, the parameters a and b correspond to its relatively stable determinants.

The series of potential output can thus be approximated using the relationship [8a]:

$$y_p \approx y + [(a - \Delta p/b_1 - n_x)/2]/\gamma \quad [8b]$$

The main characteristic of this determination is its organic connection not only with inflation, but with foreign trade balance, too.

III. An Empirical Application (Romanian Case)

Some of the standard procedures for the determination of the potential output were already applied on the Romanian transition economy [Croitoru, Doltu, and Tarhoaca; Bucsa; Ghizdeanu and Neagu; Stanica; Albu 2004 with refference to natural unemployment rate]. The algorithm, described in the previous chapter, will be further exemplified.

1. The quarterly information will be used for gross domestic product (at current and constant prices), net export (at current prices), and consumer price index (more relevant for the present application than the GDP deflator). All variables are seasonally adjusted. The primary and derived indicators are presented in Appendices II and III.

2. The orthogonal regression (Appendix IV) generates the relationships:

$$\Delta p = -0.59218 - 10.1032 * n_x$$

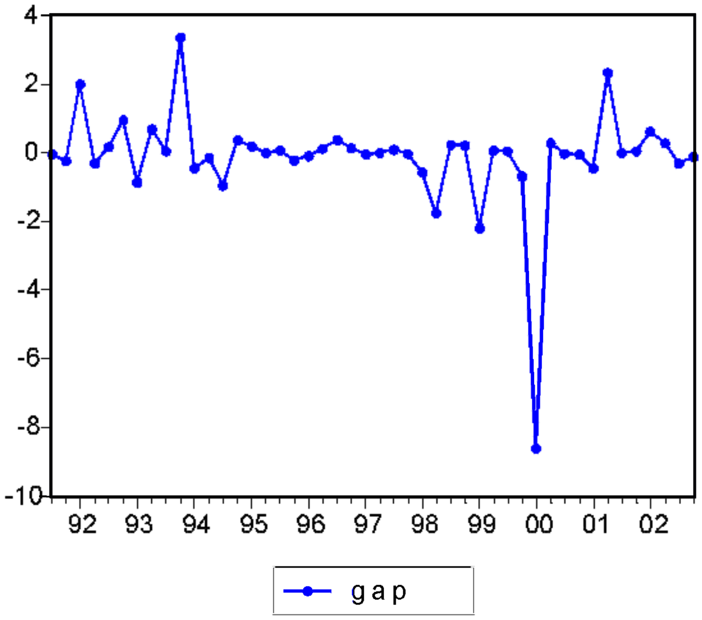
and

$$n_x = -0.05861 - 0.09898 * \Delta p$$

perfectly reversible [-10.1032*(-0.09898)=1].

Using the equations (10a) and (8b), the indices of potential output (Y_p) have been determined and, on this basis, the corresponding output gap (Appendix V). The results are presented in the Graph gap.

Graph gap

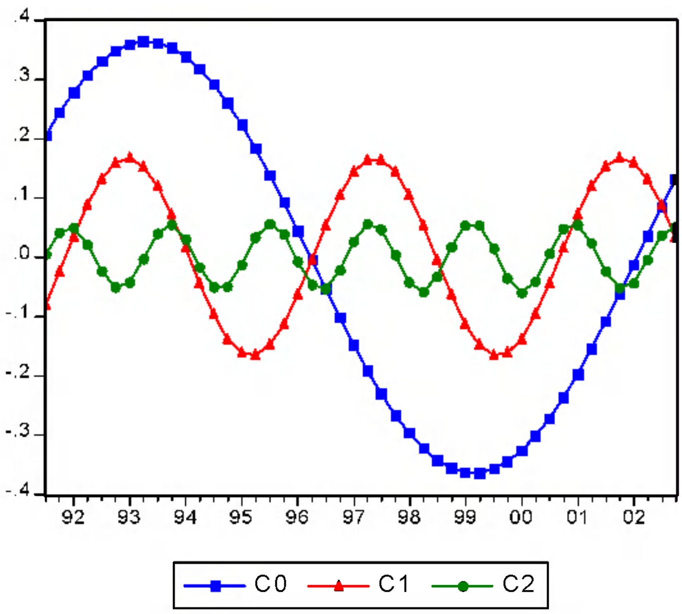


The sign of the gap clearly alternates, which is consistent with the rationale of the potential output.

3. In order to identify the possible determinants of these fluctuations, a cycle analysis has been performed. The gap series was divided into cyclical part (C0) and residuals (ResC0). The last series (ResC0) was then submitted to the same procedure, obtaining C1 and ResC1. This decomposition has been successively applied until the amplitude of cycle became zero (C11 in our case). Appendix VI contains all computational details.

3.1. The series C0, C1, and C2 may be characterised as regular cycles.

Grapf C012



a) We have no reasons to consider C0 – with a period of 11-11.5 years – as a classical long business cycle. In my opinion, it derives from specific transitional determinants. Its first segment (respectively 1991-1996) is characterised by positive output gaps, reflecting, probably, the "resistance" of the Romanian economy to restructuring processes involved by implementation of functional market mechanisms. The incoherence of macroeconomic and institutional policies promoted during the period 1997-1999 has pushed output gap towards significant negative levels. A certain recovery is then observed, but a new demand preassure wave becomes visible. The causes of such an evolution are complex and their examination exceeds the intended framework of the present work.

b) I think C1– with the period of 4-4.5 years – represents a typical electoral cycle. After 1989 Romania had two full election cycles - 1992-1996 and 1996-2000 – and one incomplete (2000-2003); they are characterised mainly by the variation of the nominal income policy. If this variation is expressed through global indexation coefficient (ratio of annual index of current nominal GDP to previous annual CPI), the following regularity appears, at least for this period (Dobrescu): for two consecutive years the coefficient's value is above unity, after which, again for two consecutive years, it is below unity. From this point of view, we distinguished , besides the elections year itself, one pre and another post-elections years; the experience shows that the second year after elections is the one that is least influenced by this major political event and, consequently, it can be conventionally named non-electoral year. The arithmetic averages (ELC) of the global indexation coefficient were computed for the corresponding years of electoral cycles. Their values will be compared with the evolution of output gap in C1.

Table no 1

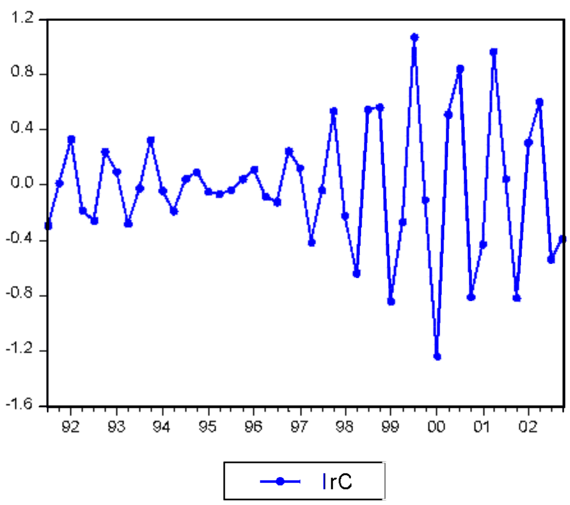
Position in electoral cycle	Years	ELC	Output gap in C1
Elections year	1992, 1996, and 2000	1.053196	Positive, increasing or passing from negative to positive
Post-electoral year	1993, 1997, and 2001	1.244457	Unambiguously positive
Non-electoral year	1994, 1998, and 2002	0.750399	Passing from positive to negative or positive but decreasing
Pre-election year	1995, 1999, and 2003	0.838702	Unambiguously negative

The output gap seems to be consistent with the demand preassure induced by nominal income policies.

c) As a regular cycle, C2 has a length of 1.8 years (approximately 7 quarters). Its amplitude is small enough. An attempt to explain such a cycle would be nowdays too risky. Supplementary investigations in this field are needed. The influence of this type of cycles is relatively weak.

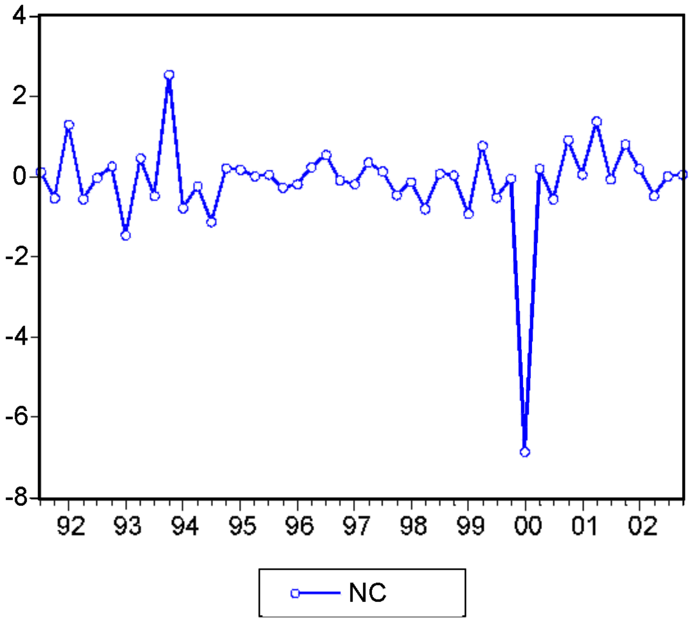
3.2. The cycles C3-C10 are undoubtedly irregular (Appendix VII). Summing their effects, an aggregate irregular cycle maybe obtained (Graph IrC).

Graph IrC



3.3. An important non-cyclical component is present, too (Graph NC).

Graph NC



4. The output gap and its main components have variable algebraic signs. As a result, the normalised modulus (Appendix VIII) have been used, yielding the following shares in determination of gap: 0.22293 for C0, 0.117961 for C1, 0.038352 for C2, 0.273448 for IrC, and 0.34731 for NC.

Bucharest, April 2004

Appendix I

Inflationary Pressure of the Potential Gap

Symbols:
Y – Output, constant prices
L – Employment, persons
K – Kapital, constant prices
MLP – Marginal labour productivity, constant prices
W – Wage on employed person, current prices
P – Level of current prices
GOS – Gross operating surplus
swy – Share of wages in value added (output)
ex - Expectations

Relationships:

|A1| $Y=A*L^{\alpha}*K^{1-\alpha}$

$0<\alpha<1$

|A2| $MLP=\partial Y/\partial L=\alpha*A*L^{\alpha-1}*K^{1-\alpha}$

|A3| $GOS=P^{ex}*Y-W^{ex}*L=P^{ex}*A*L^{\alpha}*K^{1-\alpha}-W^{ex}*L$

|A4| $\partial GOS/\partial L=\alpha*P^{ex}*A*L^{\alpha-1}*K^{1-\alpha}-W^{ex}$

|A5| $\partial^2 GOS/\partial L^2=(\alpha-1)*\alpha*P^{ex}*A*L^{\alpha-2}*K^{1-\alpha}$

From $0<\alpha<1$ yields $\partial^2 GOS/\partial L^2<0$; consequently, GOS admits a maximum.

|A6| MaxGOS results from $\partial GOS/\partial L=0$

$\alpha*P^{ex}*A*L^{\alpha-1}*K^{1-\alpha}-W^{ex}=0$

$\alpha*A*L^{\alpha-1}*K^{1-\alpha}=W^{ex}/P^{ex}$

Therefore, the condition for profit maximisation is

$W^{ex}/P^{ex}=MLP$

|A7| In equilibrium point (indicators with suffix p)

|A7.1| Share of wages in value added (output)

$swy_p=W^{ex}*L/(P^{ex}*Y)=L*(MLP/Y)=$

$=L*\alpha*A*L^{\alpha-1}*K^{1-\alpha}/(A*L^{\alpha}*K^{1-\alpha})=$

$=\alpha*A*L^{\alpha}*K^{1-\alpha}/(A*L^{\alpha}*K^{1-\alpha})=\alpha$

|A7.2| Employment

$\alpha*A*K^{1-\alpha}*P^{ex}/W^{ex}=L_p^{(1-\alpha)}$

$L_p=|\alpha*A*K^{1-\alpha}*P^{ex}/W^{ex}|^{1/(1-\alpha)}$

[A7.3| Output

$Y_p=A*L_p^{\alpha}*K^{1-\alpha}=A*|\alpha*A*K^{1-\alpha}*P^{ex}/W^{ex}|^{\alpha/(1-\alpha)}*K^{1-\alpha}=$

$=A*|\alpha*A*K^{1-\alpha}|^{\alpha/(1-\alpha)}*K^{1-\alpha}*|P^{ex}/W^{ex}|^{\alpha/(1-\alpha)}=B*|P^{ex}/W^{ex}|^{\eta}$

where $B=A*|\alpha*A*K^{1-\alpha}|^{\alpha/(1-\alpha)}*K^{1-\alpha}$ and $\eta=\alpha/(1-\alpha)$; both B and η are given.

Consequently, $Y>Y_p$ (with increasing wages) involves an accelerating inflation. If $Y<Y_p$, a reverse process becomes imminent. The coefficient β, therefore, must be positive.

Appendix II

Primary Statistical Data

Quarter	GDP	GDP95	NX	CPI
1991-1	348.32	17792.51	-20.18	1.4060
1991-2	488.92	17795.94	-15.62	1.4034
1991-3	607.05	17794.65	-8.32	1.2417
1991-4	759.61	16569.47	-40.28	1.3429
1992-1	1059.67	16025.54	-86.20	1.5032
1992-2	1342.45	16019.08	-82.46	1.2674
1992-3	1558.10	15990.47	58.33	1.1627
1992-4	2068.98	15785.39	-406.43	1.3451
1993-1	2537.26	15726.68	-220.89	1.3672
1993-2	3735.86	15803.90	-153.10	1.4652
1993-3	5107.14	15297.90	-115.83	1.4123
1993-4	8655.45	17968.91	-466.21	1.4429
1994-1	7947.30	13634.51	-107.57	1.2241
1994-2	10780.70	16584.40	-88.25	1.1857
1994-3	15219.90	18934.21	193.82	1.0760
1994-4	15825.30	18176.28	-1005.59	1.1053
1995-1	12696.60	14137.59	-675.94	1.0570
1995-2	15976.50	16670.70	-959.17	1.0391
1995-3	21205.50	21019.84	-521.91	1.0507
1995-4	22256.90	20307.36	-1827.36	1.0917
1996-1	17923.00	14684.20	-1333.02	1.0694
1996-2	22461.30	16978.70	-1810.07	1.0782
1996-3	33053.20	21611.10	-1696.63	1.1381
1996-4	35482.10	21709.50	-4252.16	1.1427
1997-1	39781.10	14619.63	-1820.36	1.5386
1997-2	53368.40	16005.17	-4347.53	1.3796
1997-3	74465.60	19728.13	-2169.54	1.0724
1997-4	85310.60	20091.76	-9145.56	1.1489
1998-1	64676.98	13139.40	-2481.38	1.1616
1998-2	81392.17	15440.56	-7127.81	1.0974
1998-3	107457.90	18981.94	-7764.68	1.0431
1998-4	117666.80	19489.12	-12006.80	1.0809
1999-1	89277.70	12971.07	-4546.50	1.0945
1999-2	114860.30	15277.70	-7081.71	1.1609
1999-3	158053.10	18984.61	-483.82	1.0883
1999-4	183539.10	19506.65	-13836.79	1.1070
2000-1	132296.10	13153.47	-3319.42	1.0990
2000-2	173736.70	15736.07	-12929.86	1.0910
2000-3	231106.80	19263.54	-7078.06	1.0919

Quarter	GDP	GDP95	NX	CPI
2000-4	266633.40	19915.76	-20190.61	1.0818
2001-1	196873.70	13745.00	-15053.62	1.0868
2001-2	261482.00	16552.66	-29180.88	1.0658
2001-3	322525.20	20463.05	-6526.88	1.0518
2001-4	386361.90	21038.82	-39859.38	1.0719
2002-1	260776.20	14181.68	-17048.66	1.0564
2002-2	335825.50	17479.28	-24529.63	1.0439
2002-3	410976.30	21355.22	-14911.41	1.0266
2002-4	504678.50	22175.17	-31002.67	1.0458

GDP - Gross domestic product, current prices, bill. ROL.
GDP95 - Gross domestic product, 1995 prices, bill. ROL.
NX - net export, current prices, bill. ROL.
CPI - Consumer price index, previous quarter = 1
The series have been computed with the assistance of C. Ivan-Ungureanu, C. Stanică, and G. Mihai.

Appendix III

Derived Indicators

Quarter	GDP95sa	IGDP95sa	y	Δy	CPIsa	p	Δp	Δ^2p	rnx	n_x	Δn_x
1991-1	21232.81	1.00000	0.00000		1.36445	0.31075			-0.05795	-0.06191	
1991-2	18704.82	0.88094	-0.12677	-0.12677	1.39296	0.33143	0.02068		-0.03194	-0.02449	0.03742
1991-3	16010.91	0.85598	-0.15551	-0.02874	1.29510	0.25859	-0.07284	-0.09352	-0.01371	-0.05222	-0.02773
1991-4	14681.80	0.91699	-0.08666	0.06885	1.33668	0.29019	0.03159	0.10443	-0.05303	-0.01802	0.03421
1992-1	19124.18	1.30258	0.26435	0.35101	1.45875	0.37758	0.08740	0.05580	-0.08134	-0.08531	-0.06729
1992-2	16837.21	0.88041	-0.12736	-0.39171	1.25795	0.22949	-0.14810	-0.23549	-0.06143	-0.05397	0.03133
1992-3	14387.58	0.85451	-0.15723	-0.02986	1.21274	0.19288	-0.03660	0.11149	0.03743	-0.00108	0.05290
1992-4	13987.04	0.97216	-0.02823	0.12899	1.33886	0.29182	0.09894	0.13554	-0.19644	-0.16142	-0.16035
1993-1	18767.53	1.34178	0.29400	0.32223	1.32684	0.28280	-0.00902	-0.10795	-0.08706	-0.09102	0.07040
1993-2	16611.04	0.88509	-0.12206	-0.41606	1.45432	0.37454	0.09173	0.10075	-0.04098	-0.03353	0.05749
1993-3	13764.43	0.82863	-0.18798	-0.06592	1.47304	0.38733	0.01279	-0.07895	-0.02268	-0.06119	-0.02766
1993-4	15921.81	1.15674	0.14560	0.33358	1.43612	0.36195	-0.02538	-0.03817	-0.05386	-0.01885	0.04234
1994-1	16270.83	1.02192	0.02168	-0.12392	1.18793	0.17221	-0.18974	-0.16436	-0.01354	-0.01750	0.00135
1994-2	17431.40	1.07133	0.06890	0.04721	1.17692	0.16290	-0.00931	0.18043	-0.00819	-0.00073	0.01676
1994-3	17036.24	0.97733	-0.02293	-0.09183	1.12226	0.11534	-0.04756	-0.03825	0.01273	-0.02577	-0.02504
1994-4	16105.56	0.94537	-0.05618	-0.03325	1.10016	0.09546	-0.01988	0.02768	-0.06354	-0.02853	-0.00275
1995-1	16871.19	1.04754	0.04644	0.10262	1.02580	0.02547	-0.06999	-0.05010	-0.05324	-0.05720	-0.02867
1995-2	17522.11	1.03858	0.03786	-0.00859	1.03138	0.03090	0.00543	0.07541	-0.06004	-0.05258	0.00462
1995-3	18912.81	1.07937	0.07638	0.03852	1.09585	0.09153	0.06063	0.05521	-0.02461	-0.06312	-0.01054
1995-4	17993.86	0.95141	-0.04981	-0.12618	1.08664	0.08309	-0.00844	-0.06908	-0.08210	-0.04709	0.01604
1996-1	17523.49	0.97386	-0.02649	0.02332	1.03782	0.03712	-0.04597	-0.03752	-0.07437	-0.07834	-0.03125
1996-2	17845.84	1.01840	0.01823	0.04472	1.07018	0.06783	0.03070	0.07667	-0.08059	-0.07313	0.00520
1996-3	19444.79	1.08960	0.08581	0.06758	1.18711	0.17152	0.10370	0.07299	-0.05133	-0.08984	-0.01671
1996-4	19236.25	0.98928	-0.01078	-0.09659	1.13734	0.12869	-0.04283	-0.14653	-0.11984	-0.08482	0.00502
1997-1	17446.43	0.90696	-0.09766	-0.08688	1.49319	0.40091	0.27222	0.31505	-0.04576	-0.04972	0.03510

Quarter	GDP95sa	IGDP95sa	y	Δy	CPIsa	p	Δp	$\Delta^2 p$	rnx	n_x	Δn_x
1997-2	16822.59	0.96424	-0.03641	0.06125	1.36936	0.31435	-0.08657	-0.35878	-0.08146	-0.07401	-0.02429
1997-3	17750.57	1.05516	0.05370	0.09011	1.11850	0.11198	-0.20236	-0.11580	-0.02913	-0.06764	0.00636
1997-4	17802.81	1.00294	0.00294	-0.05076	1.14352	0.13411	0.02213	0.22449	-0.10720	-0.07219	-0.00454
1998-1	15679.99	0.88076	-0.12697	-0.12991	1.12724	0.11978	-0.01434	-0.03647	-0.03837	-0.04233	0.02986
1998-2	16229.14	1.03502	0.03442	0.16139	1.08924	0.08548	-0.03430	-0.01996	-0.08757	-0.08012	-0.03779
1998-3	17079.19	1.05238	0.05105	0.01663	1.08802	0.08436	-0.00111	0.03319	-0.07226	-0.11077	-0.03065
1998-4	17268.83	1.01110	0.01104	-0.04001	1.07582	0.07309	-0.01128	-0.01017	-0.10204	-0.06702	0.04374
1999-1	15479.11	0.89636	-0.10941	-0.12045	1.06218	0.06033	-0.01276	-0.00148	-0.05093	-0.05489	0.01214
1999-2	16057.97	1.03740	0.03671	0.14612	1.15224	0.14171	0.08138	0.09414	-0.06165	-0.05420	0.00069
1999-3	17081.59	1.06375	0.06180	0.02508	1.13511	0.12673	-0.01498	-0.09636	-0.00306	-0.04157	0.01263
1999-4	17284.36	1.01187	0.01180	-0.04999	1.10180	0.09694	-0.02979	-0.01480	-0.07539	-0.04037	0.00120
2000-1	15696.78	0.90815	-0.09635	-0.10815	1.06650	0.06438	-0.03256	-0.00278	-0.02509	-0.02905	0.01132
2000-2	16539.75	1.05370	0.05231	0.14866	1.08292	0.07966	0.01528	0.04784	-0.07442	-0.06697	-0.03792
2000-3	17332.56	1.04793	0.04682	-0.00549	1.13884	0.13001	0.05036	0.03508	-0.03063	-0.06914	-0.00217
2000-4	17646.87	1.01813	0.01797	-0.02885	1.07675	0.07395	-0.05606	-0.10642	-0.07572	-0.04071	0.02843
2001-1	16402.68	0.92950	-0.07311	-0.09108	1.05474	0.05330	-0.02065	0.03541	-0.07646	-0.08042	-0.03972
2001-2	17398.05	1.06068	0.05891	0.13203	1.05789	0.05627	0.00298	0.02363	-0.11160	-0.10414	-0.02372
2001-3	18411.83	1.05827	0.05664	-0.00228	1.09702	0.09260	0.03632	0.03335	-0.02024	-0.05875	0.04540
2001-4	18641.98	1.01250	0.01242	-0.04421	1.06692	0.06478	-0.02782	-0.06414	-0.10317	-0.06815	-0.00940
2002-1	16923.80	0.90783	-0.09670	-0.10912	1.02515	0.02484	-0.03994	-0.01212	-0.06538	-0.06934	-0.00119
2002-2	18371.99	1.08557	0.08211	0.17880	1.03615	0.03552	0.01067	0.05061	-0.07304	-0.06559	0.00375
2002-3	19214.57	1.04586	0.04484	-0.03726	1.07077	0.06838	0.03286	0.02218	-0.03628	-0.07479	-0.00920
2002-4	19648.88	1.02260	0.02235	-0.02249	1.04092	0.04010	-0.02827	-0.06113	-0.06143	-0.02641	0.04838

GDP95sa - GDP95, Seasonal adjustment
IGDP95sa - Index of GDP95sa, previous quarter=1
y=log(IGDP95sa)
$\Delta y = y - y(-1)$

CPIsa - CPI, Seasonal adjustment

$p=\log(CPIsa)$

$\Delta p=p-p(-1)$

$\Delta^2 p=\Delta p-\Delta p(-1)$

$rnx=NX/GDP$

$n_x=rnx$, Seasonal adjustment

$\Delta nx=n_x-n_x(-1)$

Appendix IV

Orthogonal Regression

Quarter	Δp	n_x	ResΔp	Resn_x
1991-2	0.02068	-0.02449	0.36544	0.03617
1991-3	-0.07284	-0.05222	-0.00825	-0.00082
1991-4	0.03159	-0.01802	0.44176	0.04372
1992-1	0.08740	-0.08531	-0.18229	-0.01805
1992-2	-0.14810	-0.05397	-0.10123	-0.01002
1992-3	-0.03660	-0.00108	0.54472	0.05391
1992-4	0.09894	-0.16142	-0.93978	-0.09302
1993-1	-0.00902	-0.09102	-0.33644	-0.03330
1993-2	0.09173	-0.03353	0.34519	0.03416
1993-3	0.01279	-0.06119	-0.01324	-0.00131
1993-4	-0.02538	-0.01885	0.37640	0.03725
1994-1	-0.18974	-0.01750	0.22567	0.02233
1994-2	-0.00931	-0.00073	0.57548	0.05696
1994-3	-0.04756	-0.02577	0.28421	0.02813
1994-4	-0.01988	-0.02853	0.28410	0.02812
1995-1	-0.06999	-0.05720	-0.05570	-0.00552
1995-2	0.00543	-0.05258	0.06635	0.00656
1995-3	0.06063	-0.06312	0.01509	0.00149
1995-4	-0.00844	-0.04709	0.10802	0.01069
1996-1	-0.04597	-0.07834	-0.24524	-0.02428
1996-2	0.03070	-0.07313	-0.11599	-0.01148
1996-3	0.10370	-0.08984	-0.21179	-0.02097
1996-4	-0.04283	-0.08482	-0.30762	-0.03045
1997-1	0.27222	-0.04972	0.36206	0.03583
1997-2	-0.08657	-0.07401	-0.24211	-0.02397
1997-3	-0.20236	-0.06764	-0.29361	-0.02906
1997-4	0.02213	-0.07219	-0.11500	-0.01139
1998-1	-0.01434	-0.04233	0.15020	0.01486
1998-2	-0.03430	-0.08012	-0.25159	-0.02491
1998-3	-0.00111	-0.11077	-0.52804	-0.05227
1998-4	-0.01128	-0.06702	-0.09625	-0.00953
1999-1	-0.01276	-0.05489	0.02489	0.00246
1999-2	0.08138	-0.05420	0.12595	0.01246
1999-3	-0.01498	-0.04157	0.15720	0.01556
1999-4	-0.02979	-0.04037	0.15452	0.01529
2000-1	-0.03256	-0.02905	0.26610	0.02633
2000-2	0.01528	-0.06697	-0.06914	-0.00685
2000-3	0.05036	-0.06914	-0.05596	-0.00554
2000-4	-0.05606	-0.04071	0.12485	0.01235

Quarter	Δp	n_x	ResΔp	Resn_x
2001-1	-0.02065	-0.08042	-0.24102	-0.02386
2001-2	0.00298	-0.10414	-0.45704	-0.04524
2001-3	0.03632	-0.05875	0.03498	0.00346
2001-4	-0.02782	-0.06815	-0.12415	-0.01229
2002-1	-0.03994	-0.06934	-0.14829	-0.01468
2002-2	0.01067	-0.06559	-0.05981	-0.00592
2002-3	0.03286	-0.07479	-0.13060	-0.01293
2002-4	-0.02827	-0.02641	0.29705	0.02940
Average	-0.00576	-0.05804		

Cov.Matrix	Δp	n_x
Δp	0.00561	-0.00050
n_x	-0.00050	0.00086

Coefficients	Values
b1	-10.10300
a1	-0.59220
b2	-0.09900
a2	-0.05860

ResΔp=Δp-(a1+b1*n_x)

ADF Test Statistic	-6.33421	1%	Critical Value*	-2.61320
		5%	Critical Value	-1.94800
		10%	Critical Value	-1.61950

*MacKinnon critical values for rejection of hypothesis of a unit root.

Augmented Dickey-Fuller Test Equation

Dependent Variable: D(RES]p

Method: Least Squares

Sample: 1991:3 2002:4

Included observations: 46

Variable	Coefficient	Std. Error	t-Statistic	Prob.
RESΔp(-1)	-0.93678	0.14789	-6.33421	0

R-squared	0.47134	Mean dependent var	-0.00149
Adjusted R-squared	0.47134	S.D. dependent var	0.39916
S.E. of regression	0.29023	Akaike info criterion	0.38519
Sum squared resid	3.79041	Schwarz criterion	0.42494
Log likelihood	-7.85930	Durbin-Watson stat	1.97272

$Resn_x = n_x - (a2 + b2 * \Delta p)$

ADF Test Statistic	-6.33418	1% Critical Value*	-2.61320
		5% Critical Value	-1.94800
		10% Critical Value	-1.61950

*MacKinnon critical values for rejection of hypothesis of a unit root.

Augmented Dickey-Fuller Test Equation

Dependent Variable: D($RESn_x$)

Method: Least Squares

Sample: 1991:3 2002:4

Included observations: 46

Variable	Coefficient	Std. Error	t-Statistic	Prob.
$RESn_x(-1)$	-0.93677	0.14789	-6.33418	0

R-squared	0.47134	Mean dependent var	-0.00015
Adjusted R-squared	0.47134	S.D. dependent var	0.03951
S.E. of regression	0.02873	Akaike info criterion	-4.24051
Sum squared resid	0.03713	Schwarz criterion	-4.20076
Log likelihood	98.53176	Durbin-Watson stat	1.97272

Appendix V

Output gap

Quarter	γ	y_p	$IGDP95sa_p$	gap
1991-3	-15.95257	-0.15508	0.85634	-0.04261
1991-4	-7.41398	-0.08414	0.91931	-0.25236
1992-1	-0.89894	0.24468	1.27722	1.98549
1992-2	-3.07697	-0.12423	0.88318	-0.31303
1992-3	17.97395	-0.15893	0.85306	0.17027
1992-4	-5.92942	-0.03773	0.96297	0.95407
1993-1	1.80163	0.30274	1.35357	-0.87089
1993-2	1.15420	-0.12899	0.87898	0.69568
1993-3	-5.84000	-0.18831	0.82836	0.03293
1993-4	0.64149	0.11265	1.11924	3.35010
1994-1	-6.70552	0.02615	1.02650	-0.44560
1994-2	-19.12680	0.07044	1.07298	-0.15359
1994-3	-1.96796	-0.01339	0.98670	-0.94932
1994-4	4.24677	-0.05995	0.94181	0.37809
1995-1	2.32674	0.04465	1.04566	0.17934
1995-2	44.10041	0.03779	1.03852	0.00622
1995-3	-7.37706	0.07566	1.07860	0.07128
1995-4	-2.82889	-0.04762	0.95349	-0.21822
1996-1	7.45845	-0.02547	0.97485	-0.10169
1996-2	-8.60299	0.01721	1.01736	0.10212
1996-3	-5.57987	0.08209	1.08555	0.37251
1996-4	-7.68915	-0.01221	0.98786	0.14298
1997-1	18.11659	-0.09716	0.90741	-0.04982
1997-2	29.39309	-0.03630	0.96435	-0.01162
1997-3	6.52703	0.05285	1.05427	0.08426
1997-4	22.38739	0.00329	1.00330	-0.03520
1998-1	-1.53288	-0.12120	0.88586	-0.57574
1998-2	0.50776	0.05226	1.05365	-1.76804
1998-3	-11.00329	0.04869	1.04989	0.23679
1998-4	-1.83023	0.00905	1.00909	0.19954
1999-1	-0.11245	-0.08724	0.91645	-2.19248
1999-2	-3.25215	0.03615	1.03681	0.05608
1999-3	19.65954	0.06132	1.06324	0.04712
1999-4	-1.50776	0.01883	1.01901	-0.70013
2000-1	-0.18204	-0.00631	0.99371	-8.61009
2000-2	-1.75322	0.04950	1.05074	0.28190
2000-3	32.46836	0.04706	1.04818	-0.02388
2000-4	-19.12735	0.01858	1.01876	-0.06129
2001-1	2.18188	-0.06858	0.93372	-0.45204

Quarter	γ	y_p	$IGDP95sa_p$	gap
2001-2	-0.99403	0.03586	1.03651	2.33199
2001-3	63.98352	0.05666	1.05830	-0.00292
2001-4	-7.22229	0.01195	1.01202	0.04698
2002-1	-0.55554	-0.10279	0.90231	0.61166
2002-2	-1.41938	0.07928	1.08250	0.28348
2002-3	3.13087	0.04795	1.04911	-0.30989
2002-4	-14.80665	0.02353	1.02381	-0.11811

$\gamma=(-\Delta^2 p*10.1032+\Delta n_x)/(2*\Delta y)$
$y_p=y+(-0.05861+\Delta p/10.1032-n_x)/(2*\gamma)$
$IGDP95sa_p=\exp(y_p)$
$gap=100*(IGDP95sa-IGDP95sa_p)/IGDP95sa_p$

Appendix IV

Cycle Decomposition

Quarter	gap	C0	ResC0	C1	ResC1	C2	ResC2	C3	ResC3	C4	ResC4	C5	ResC5	C6
1991-3	-0.04261	0.20541	-0.24802	-0.08092	-0.16711	0.00510	-0.17221	-0.00130	-0.17091	-0.00017	-0.17074	-0.30455	0.13381	5.951E-05
1991-4	-0.25236	0.24387	-0.49623	-0.02507	-0.47117	0.04183	-0.51300	0.00347	-0.51647	-0.00548	-0.51100	0.01143	-0.52243	-0.00023
1992-1	1.98549	0.27792	1.70757	0.03392	1.67365	0.04924	1.62441	-0.00026	1.62466	0.00398	1.62068	0.33082	1.28987	0.00057
1992-2	-0.31303	0.30696	-0.61999	0.08867	-0.70865	0.02086	-0.72951	-0.00361	-0.72590	0.00303	-0.72893	-0.16767	-0.56126	-0.00025
1992-3	0.17027	0.33045	-0.16017	0.13230	-0.29247	-0.02316	-0.26931	0.00217	-0.27148	-0.00617	-0.26531	-0.23347	-0.03184	-1.416E-05
1992-4	0.95407	0.34797	0.60611	0.15935	0.44675	-0.05134	0.49810	0.00271	0.49539	0.00093	0.49446	0.25440	0.24006	0.00011
1993-1	-0.87089	0.35920	-1.23010	0.16644	-1.39654	-0.04307	-1.35347	-0.00375	-1.34972	0.00581	-1.35553	0.10278	-1.45831	-0.00065
1993-2	0.69568	0.36395	0.33173	0.15268	0.17905	-0.00326	0.18232	-0.00091	0.18322	-0.00481	0.18803	-0.27518	0.46321	0.00021
1993-3	0.03293	0.36213	-0.32920	0.11978	-0.44899	0.03960	-0.48858	0.00432	-0.49290	-0.00300	-0.48990	-0.03605	-0.45385	-0.00020
1993-4	3.35010	0.35376	2.99633	0.07188	2.92445	0.05459	2.86987	-0.00123	2.87110	0.00710	2.86400	0.30065	2.56335	0.00114
1994-1	-0.44560	0.33901	-0.78461	0.01497	-0.79958	0.02991	-0.82950	-0.00388	-0.82561	-0.00151	-0.82410	-0.05206	-0.77204	-0.00034
1994-2	-0.15359	0.31813	-0.47172	-0.04381	-0.42791	-0.01640	-0.41151	0.00356	-0.41507	-0.00627	-0.40879	-0.19352	-0.21528	-9.575E-05
1994-3	-0.94932	0.29151	-1.24083	-0.09710	-1.14372	-0.05120	-1.09253	0.00208	-1.09461	0.00557	-1.10018	0.03947	-1.13965	-0.00051
1994-4	0.37809	0.25962	0.11847	-0.13823	0.25670	-0.04933	0.30603	-0.00508	0.31110	0.00278	0.30833	0.10917	0.19916	8.858E-05
1995-1	0.17934	0.22304	-0.04371	-0.16204	0.11834	-0.01221	0.13055	0.00051	0.13004	-0.00758	0.13762	-0.01919	0.15681	6.974E-05
1995-2	0.00622	0.18244	-0.17621	-0.16555	-0.01066	0.03375	-0.04441	0.00533	-0.04974	0.00218	-0.05192	-0.05376	0.00184	8.186E-07
1995-3	0.07128	0.13854	-0.06726	-0.14831	0.08106	0.05578	0.02528	-0.00343	0.02870	0.00641	0.02230	-0.03349	0.05579	2.481E-05
1995-4	-0.21822	0.09213	-0.31035	-0.11249	-0.19786	0.03802	-0.23588	-0.00406	-0.23181	-0.00655	-0.22527	0.04957	-0.27483	-0.00012
1996-1	-0.10169	0.04407	-0.14576	-0.06258	-0.08318	-0.00699	-0.07619	0.00591	-0.08209	-0.00227	-0.07982	0.09623	-0.17605	-7.83E-05
1996-2	0.10212	-0.00480	0.10692	-0.00483	0.11174	-0.04726	0.15901	0.00138	0.15763	0.00831	0.14932	-0.11591	0.26523	0.000118
1996-3	0.37251	-0.05357	0.42608	0.05353	0.37255	-0.05403	0.42657	-0.00720	0.43377	-0.00321	0.43699	-0.13045	0.56744	0.00025
1996-4	0.14298	-0.10138	0.24437	0.10518	0.13918	-0.02223	0.16141	0.00221	0.15920	-0.00647	0.16567	0.24189	-0.07622	-3.39E-05
1997-1	-0.04982	-0.14736	0.09754	0.14366	-0.04611	0.02578	-0.07189	0.00681	-0.07869	0.00774	-0.08643	0.11352	-0.19995	-8.893E-05
1997-2	-0.01162	-0.19068	0.17906	0.16413	0.01493	0.05585	-0.04092	-0.00588	-0.03505	0.00150	-0.03655	-0.39556	0.35901	0.00016
1997-3	0.08426	-0.23055	0.31481	0.16404	0.15077	0.04627	0.10450	-0.00452	0.10903	-0.00912	0.11814	-0.00192	0.12006	5.34E-05

Quarter	gap	C0	ResC0	C1	ResC1	C2	ResC2	C3	ResC3	C4	ResC4	C5	ResC5	C6
1997-4	-0.03520	-0.26626	0.23105	0.14340	0.08766	0.00343	0.08423	0.00870	0.07553	0.00463	0.07090	0.54157	-0.47067	-0.00021
1998-1	-0.57574	-0.29716	-0.27858	0.10479	-0.38336	-0.04236	-0.34100	0.00065	-0.34165	0.00641	-0.34806	-0.21929	-0.12878	-5.727E-05
1998-2	-1.76804	-0.32269	-1.44535	0.05305	-1.49840	-0.05828	-1.44011	-0.00983	-1.43029	-0.00923	-1.42106	-0.62283	-0.79823	-0.00036
1998-3	0.23679	-0.34239	0.57918	-0.00534	0.58452	-0.03252	0.61704	0.00404	0.61300	-0.00049	0.61349	0.52835	0.08514	3.786E-05
1998-4	0.19954	-0.35591	0.55545	-0.06305	0.61851	0.01648	0.60203	0.00859	0.59344	0.00994	0.58350	0.52496	0.05854	2.604E-05
1999-1	-2.19248	-0.36301	-1.82947	-0.11287	-1.71660	0.05394	-1.77054	-0.00838	-1.76216	-0.00611	-1.75604	-0.84541	-0.91064	-0.00041
1999-2	0.05608	-0.36354	0.41962	-0.14855	0.56817	0.05347	0.51469	-0.00516	0.51985	-0.00625	0.52610	-0.26363	0.78973	0.00035
1999-3	0.04712	-0.35751	0.40463	-0.16561	0.57024	0.01466	0.55558	0.01117	0.54441	0.01039	0.53402	1.05582	-0.52180	-0.00023
1999-4	-0.70013	-0.34502	-0.35511	-0.16192	-0.19319	-0.03517	-0.15802	0.00033	-0.15835	-0.00030	-0.15805	-0.09085	-0.06719	-2.989E-05
2000-1	-8.61009	-0.32630	-8.28379	-0.13795	-8.14584	-0.06027	-8.08557	-0.01185	-8.07372	-0.01052	-8.06320	-1.17895	-6.88426	-0.00306
2000-2	0.28190	-0.30169	0.58359	-0.09669	0.68028	-0.04159	0.72188	0.00492	0.71696	0.00703	0.70993	0.52055	0.18938	8.423E-05
2000-3	-0.02388	-0.27163	0.24774	-0.04332	0.29106	0.00560	0.28546	0.00927	0.27619	0.00558	0.27061	0.83992	-0.56931	-0.00025
2000-4	-0.06129	-0.23666	0.17537	0.01548	0.15989	0.04754	0.11234	-0.00889	0.12123	-0.01037	0.13160	-0.79260	0.92421	0.00041
2001-1	-0.45204	-0.19742	-0.25462	0.07234	-0.32697	0.05512	-0.38209	-0.00500	-0.37709	0.00136	-0.37845	-0.44392	0.06547	2.912E-05
2001-2	2.33199	-0.15461	2.48660	0.12014	2.36646	0.02408	2.34238	0.01085	2.33153	0.00913	2.32240	0.92148	1.40092	0.00062
2001-3	-0.00292	-0.10901	0.10609	0.15288	-0.04679	-0.02318	-0.02362	-2.85E-05	-0.02359	-0.00723	-0.01636	0.03186	-0.04822	-2.145E-05
2001-4	0.04698	-0.06144	0.10842	0.16647	-0.05805	-0.05261	-0.00544	-0.01026	0.00482	-0.00392	0.00873	-0.81105	0.81978	0.00036
2002-1	0.61166	-0.01276	0.62442	0.15920	0.46522	-0.04405	0.50927	0.00455	0.50471	0.00941	0.49530	0.29591	0.19939	8.868E-05
2002-2	0.28348	0.03615	0.24732	0.13198	0.11534	-0.00479	0.12013	0.00771	0.11242	-0.00244	0.11486	0.61229	-0.49743	-0.00022
2002-3	-0.30989	0.08441	-0.39430	0.08823	-0.48253	0.03665	-0.51918	-0.00767	-0.51151	-0.00729	-0.50423	-0.50459	0.00037	1.634E-07
2002-4	-0.11811	0.13114	-0.24924	0.03342	-0.28267	0.05113	-0.33380	-0.00394	-0.32986	0.00705	-0.33691	-0.37038	0.03347	1.489E-05

Quarter	ResC6	C7	ResC7	C8	ResC8	C9	ResC9	C10	ResC10	C11	ResC11	IrC	NC
1991-3	0.13375	5.946E-05	0.13369	5.99E-05	0.13363	5.93E-05	0.13357	0.01439	0.11919	0	0.11919	-0.29140	0.11919
1991-4	-0.52219	-0.00023	-0.52196	-0.00023	-0.52173	-0.00023	-0.52150	0.00715	-0.52864	0	-0.52864	0.01564	-0.52864
1992-1	1.28929	0.00057	1.28872	0.00058	1.28814	0.00057	1.28757	-0.00301	1.29058	0	1.29058	0.33382	1.29058
1992-2	-0.56101	-0.00025	-0.56076	-0.00025	-0.56051	-0.00025	-0.56026	-0.01235	-0.54791	0	-0.54791	-0.18160	-0.54791
1992-3	-0.03183	-1.415E-05	-0.03181	-1.425E-05	-0.03180	-1.41E-05	-0.03178	-0.01711	-0.01467	0	-0.01467	-0.25464	-0.01467
1992-4	0.23996	0.00011	0.23985	0.00011	0.23974	0.00011	0.23964	-0.01536	0.25499	0	0.25499	0.24310	0.25499
1993-1	-1.45766	-0.00065	-1.45702	-0.00065	-1.45636	-0.00065	-1.45572	-0.00761	-1.44811	0	-1.44811	0.09464	-1.44811
1993-2	0.46301	0.00021	0.46280	0.00021	0.46259	0.00021	0.46239	0.00337	0.45901	0	0.45901	-0.27670	0.45901
1993-3	-0.45365	-0.00020	-0.45344	-0.00020	-0.45324	-0.00020	-0.45304	0.01327	-0.46631	0	-0.46631	-0.02228	-0.46631
1993-4	2.56221	0.00114	2.56107	0.00115	2.55992	0.00114	2.55879	0.01824	2.54055	0	2.54055	0.32931	2.54055
1994-1	-0.77170	-0.00034	-0.77136	-0.00035	-0.77101	-0.00034	-0.77067	0.01607	-0.78674	0	-0.78674	-0.04275	-0.78674
1994-2	-0.21518	-9.566E-05	-0.21509	-9.637E-05	-0.21499	-9.53E-05	-0.21489	0.00770	-0.22260	0	-0.22260	-0.18892	-0.22260
1994-3	-1.13915	-0.00051	-1.13864	-0.0005102	-1.13813	-0.00050	-1.13763	-0.00375	-1.13387	0	-1.13387	0.04135	-1.13387
1994-4	0.19907	8.85E-05	0.19898	8.915E-05	0.19889	8.82E-05	0.19880	-0.01388	0.21268	0	0.21268	0.09335	0.21268
1995-1	0.15674	6.968E-05	0.15668	7.02E-05	0.15660	6.94E-05	0.15654	-0.01885	0.17539	0	0.17539	-0.04484	0.17539
1995-2	0.00184	8.179E-07	0.00184	8.243E-07	0.00184	8.15E-07	0.00184	-0.01670	0.01854	0	0.01854	-0.06295	0.01854
1995-3	0.05576	2.479E-05	0.05574	2.497E-05	0.05571	2.47E-05	0.05569	-0.00812	0.06381	0	0.06381	-0.03853	0.06381
1995-4	-0.27471	-0.00012	-0.27459	-0.00012	-0.27447	-0.000122	-0.27434	0.00371	-0.27805	0	-0.27805	0.04218	-0.27805
1996-1	-0.17597	-7.823E-05	-0.17590	-7.881E-05	-0.17582	-7.8E-05	-0.17574	0.01433	-0.19007	0	-0.19007	0.11389	-0.19007
1996-2	0.26511	0.00012	0.26499	0.00012	0.26488	0.00012	0.26476	0.01965	0.24511	0	0.24511	-0.08610	0.24511
1996-3	0.56719	0.00025	0.56694	0.00025	0.56668	0.00025	0.56643	0.01750	0.54894	0	0.54894	-0.12236	0.54894
1996-4	-0.07619	-3.387E-05	-0.07616	-3.412E-05	-0.07612	-3.38E-05	-0.07609	0.00856	-0.08465	0	-0.08465	0.24606	-0.08465
1997-1	-0.19986	-8.885E-05	-0.19977	-8.951E-05	-0.19968	-8.85E-05	-0.19959	-0.00380	-0.19579	0	-0.19579	0.12391	-0.19579
1997-2	0.35885	0.00016	0.35869	0.00016	0.35853	0.00016	0.35837	-0.01487	0.37324	0	0.37324	-0.41417	0.37324
1997-3	0.12001	5.335E-05	0.11995	5.374E-05	0.11990	5.32E-05	0.11985	-0.02042	0.14027	0	0.14027	-0.03577	0.14027
1997-4	-0.47046	-0.00021	-0.47025	-0.00021	-0.47004	-0.000208	-0.46983	-0.01821	-0.45162	0	-0.45162	0.53585	-0.45162

Quarter	ResC6	C7	ResC7	C8	ResC8	C9	ResC9	C10	ResC10	C11	ResC11	IrC	NC
1998-1	-0.12872	-5.722E-05	-0.12866	-5.765E-05	-0.12860	-5.7E-05	-0.12855	-0.00893	-0.11962	0	-0.11962	-0.22138	-0.11962
1998-2	-0.79787	-0.00035	-0.79752	-0.00036	-0.79716	-0.000353	-0.79681	0.00395	-0.80076	0	-0.80076	-0.63935	-0.80076
1998-3	0.08510	3.783E-05	0.08506	3.811E-05	0.08502	3.77E-05	0.08499	0.01555	0.06944	0	0.06944	0.54760	0.06944
1998-4	0.05852	2.601E-05	0.05849	2.621E-05	0.05847	2.59E-05	0.05844	0.02129	0.03714	0	0.03714	0.56488	0.03714
1999-1	-0.91023	-0.00040	-0.90983	-0.00041	-0.90942	-0.00040	-0.90902	0.01887	-0.92789	0	-0.92789	-0.84266	-0.92789
1999-2	0.78938	0.00035	0.78903	0.00035	0.78867	0.00035	0.78832	0.00912	0.77920	0	0.77920	-0.26451	0.77920
1999-3	-0.52157	-0.00023	-0.52133	-0.00023	-0.52110	-0.000231	-0.52087	-0.00441	-0.51646	0	-0.51646	1.07204	-0.51646
1999-4	-0.06716	-2.986E-05	-0.06713	-3.009E-05	-0.06710	-2.98E-05	-0.06707	-0.01646	-0.05061	0	-0.05061	-0.10741	-0.05061
2000-1	-6.88120	-0.00306	-6.87814	-0.00308	-6.87505	-0.003048	-6.87201	-0.02236	-6.84964	0	-6.84964	-1.23592	-6.84964
2000-2	0.18930	8.415E-05	0.18921	8.476E-05	0.18913	8.39E-05	0.18904	-0.01939	0.20844	0	0.20844	0.51344	0.20844
2000-3	-0.56906	-0.00025	-0.56880	-0.00025	-0.56855	-0.000252	-0.56830	-0.00914	-0.55916	0	-0.55916	0.84462	-0.55916
2000-4	0.92380	0.00041	0.92338	0.00041	0.92297	0.00041	0.92256	0.00446	0.91810	0	0.91810	-0.80576	0.91810
2001-1	0.06544	2.909E-05	0.06541	2.931E-05	0.06538	2.9E-05	0.06535	0.01611	0.04924	0	0.04924	-0.43133	0.04924
2001-2	1.40030	0.00062	1.39967	0.00063	1.39905	0.00062	1.39843	0.02150	1.37692	0	1.37692	0.96546	1.37692
2001-3	-0.04820	-2.143E-05	-0.04818	-2.158E-05	-0.04816	-2.14E-05	-0.04814	0.01864	-0.06677	0	-0.06677	0.04316	-0.06677
2001-4	0.81942	0.00036	0.81905	0.00037	0.81869	0.00036	0.81832	0.00885	0.80947	0	0.80947	-0.81492	0.80947
2002-1	0.19931	8.86E-05	0.19922	8.926E-05	0.19913	8.83E-05	0.19904	-0.00407	0.20311	0	0.20311	0.30616	0.20311
2002-2	-0.49721	-0.00022	-0.49699	-0.00022	-0.49677	-0.00022	-0.49655	-0.01515	-0.48140	0	-0.48140	0.60153	-0.48140
2002-3	0.00037	1.632E-07	0.00037	1.637E-07	0.00037	1.62E-07	0.00037	-0.02022	0.02058	0	0.02058	-0.53976	0.02058
2002-4	0.03345	1.487E-05	0.03344	1.498E-05	0.03342	1.48E-05	0.03341	-0.01754	0.05095	0	0.05095	-0.38475	0.05095

C0+ResC0=gap

C1+ResC1=ResC0
C2+ResC2=ResC1
C3+ResC3=ResC2
C4+ResC4=ResC3
C5+ResC5=ResC4
C6+ResC6=ResC5
C7+ResC7=ResC6
C8+ResC8=ResC7
C9+ResC9=ResC8

C10+ResC10=ResC9
C11+ResC11=ResC10
IrC=C3+C4+C5+C6+C7+C8+C9+C10+C11
NC=ResC11
gap=C0+C1+C2+IrC+NC

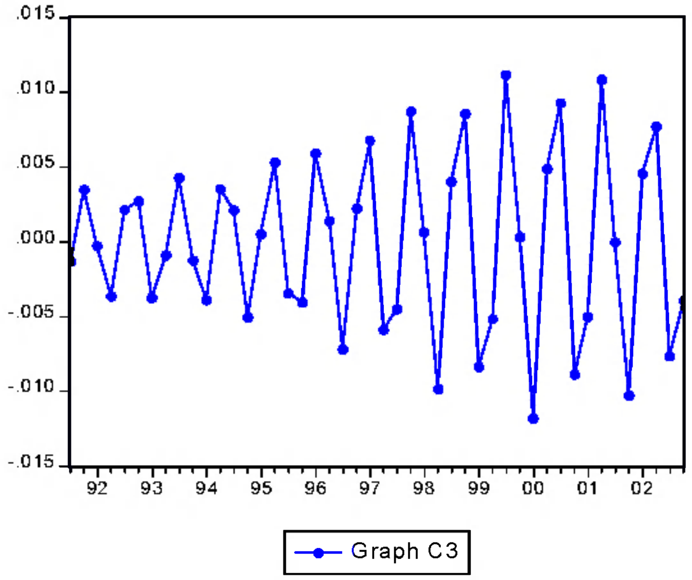
The main parameters of identified cycles

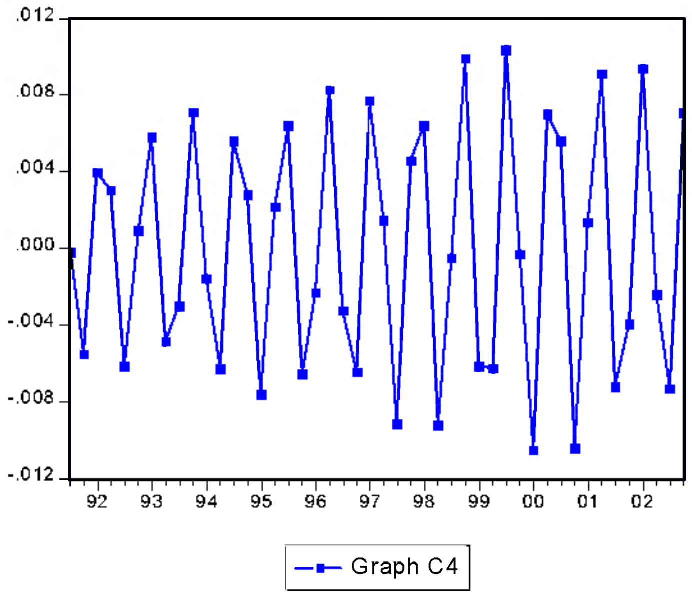
Cycle	Period, quarters	Period, years	Amplitude
C0	46.71710	11.67930	0.36412
C1	17.65720	4.41431	0.16672
C2	7.19596	1.79899	0.05131
C3	3.49590	0.87398	0.00939
C4	3.27878	0.81970	0.00863
C5	3.55251	0.88813	0.67754
C6	8.68987	2.17247	0.00001
C7	8.55930	2.13983	0.00001
C8	8.60162	2.15040	0.00001
C9	8.62310	2.15578	0.00001
C10	10.01070	2.50268	0.02009
C11			0

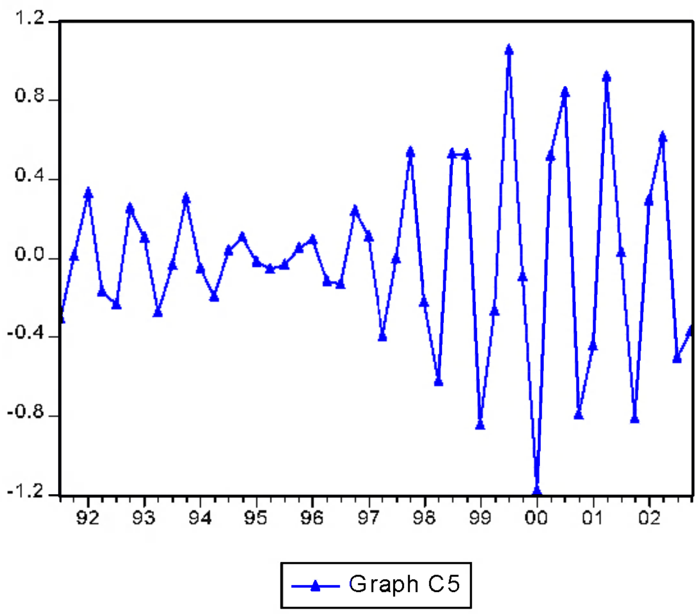
Computations have been performed by C. Stanică on STAMP 5.00.

Appendix VII

Graphs of Cycles C3-C10







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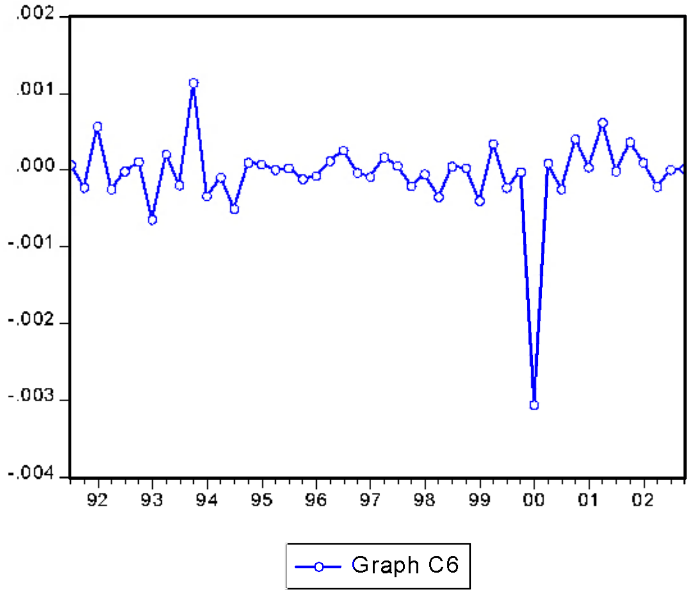
Graph C5



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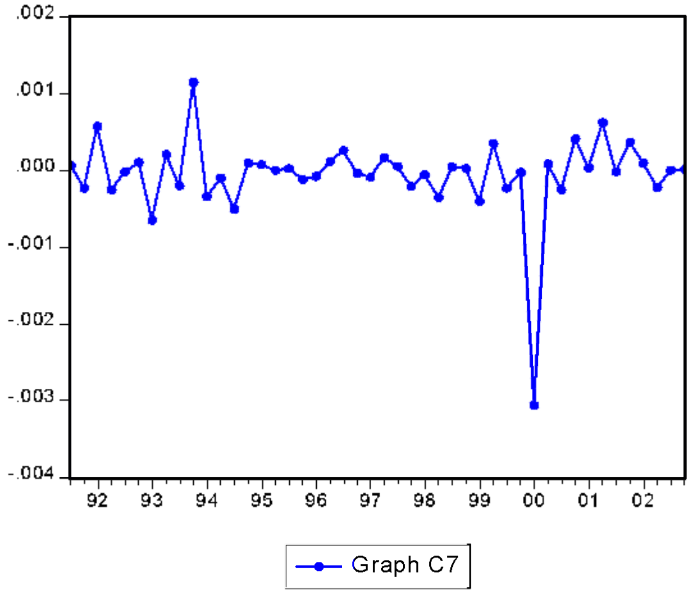
Graph C6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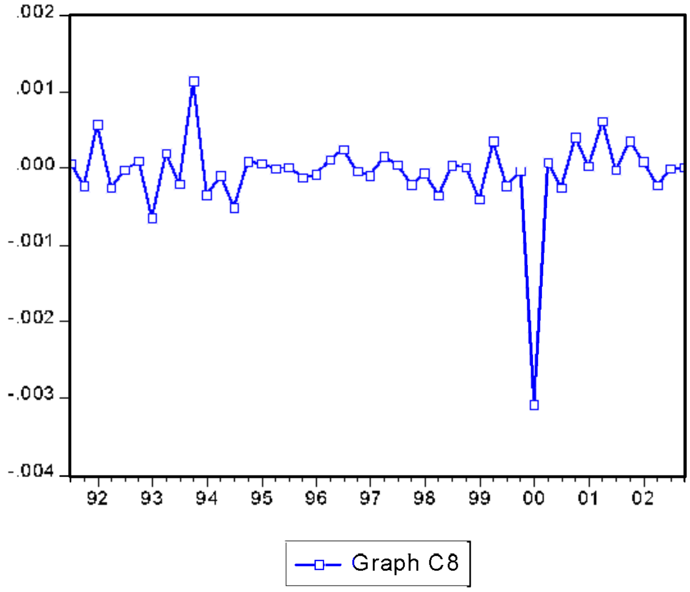
Graph C7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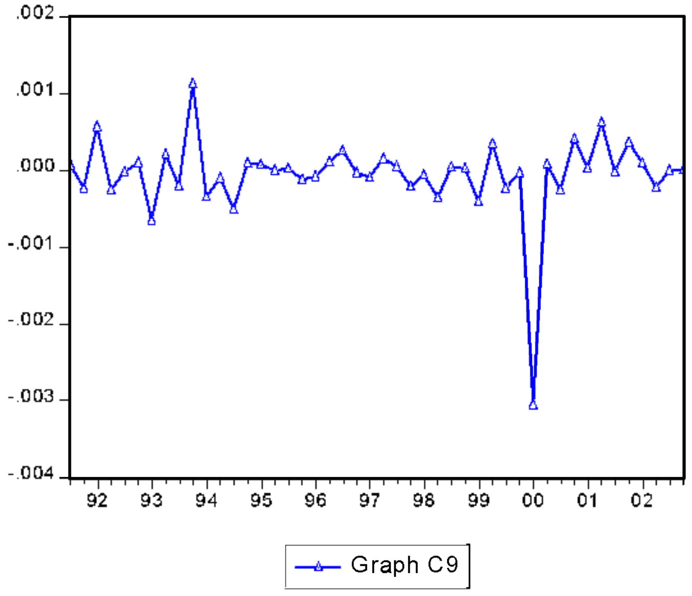
Graph C8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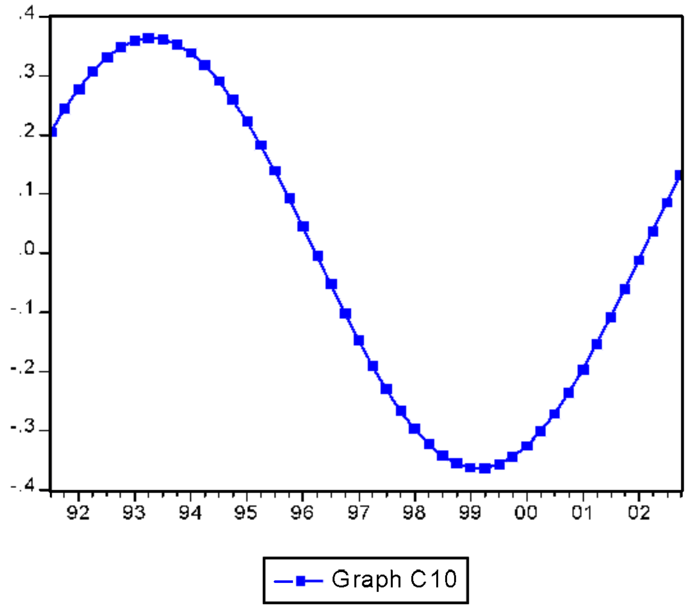
Graph C9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Graph C10

Appendix VIII

Shares of main output gap components

Quarter	Mgap	MC0	MC1	MC2	MIrC	MNC	MTot	Q	shMC0	shMC1	shMC2	shMIrC	shMNC
1991-3	0.04261	0.20541	0.08092	0.00510	0.29140	0.11919	0.70201	0.06070	0.29260	0.11526	0.00726	0.41509	0.16978
1991-4	0.25237	0.24387	0.02507	0.04183	0.01564	0.52864	0.85505	0.29515	0.28521	0.02932	0.04892	0.01830	0.61826
1992-1	1.98549	0.27792	0.03392	0.04924	0.33382	1.29058	1.98549	1.00000	0.13998	0.01709	0.02480	0.16813	0.65001
1992-2	0.31303	0.30696	0.08867	0.02086	0.18160	0.54791	1.14600	0.27315	0.26785	0.07737	0.01820	0.15847	0.47811
1992-3	0.17027	0.33045	0.13230	0.02316	0.25464	0.01467	0.75521	0.22546	0.43755	0.17518	0.03067	0.33718	0.01942
1992-4	0.95407	0.34797	0.15935	0.05134	0.24310	0.25499	1.05676	0.90283	0.32928	0.15079	0.04858	0.23005	0.24130
1993-1	0.87089	0.35920	0.16644	0.04307	0.09464	1.44811	2.11147	0.41246	0.17012	0.07883	0.02040	0.04482	0.68583
1993-2	0.69568	0.36395	0.15268	0.00326	0.27670	0.45901	1.25561	0.55406	0.28986	0.12160	0.00260	0.22037	0.36557
1993-3	0.03293	0.36213	0.11978	0.03960	0.02228	0.46631	1.01010	0.03260	0.35851	0.11859	0.03920	0.02205	0.46165
1993-4	3.35010	0.35376	0.07188	0.05459	0.32931	2.54055	3.35010	1.00000	0.10560	0.02146	0.01629	0.09830	0.75835
1994-1	0.44560	0.33901	0.01497	0.02991	0.04275	0.78674	1.21339	0.36723	0.27939	0.01234	0.02465	0.03524	0.64838
1994-2	0.15359	0.31813	0.04381	0.01640	0.18892	0.22260	0.78986	0.19445	0.40277	0.05547	0.02077	0.23918	0.28182
1994-3	0.94932	0.29151	0.09710	0.05120	0.04135	1.13387	1.61503	0.58780	0.18050	0.06013	0.03170	0.02560	0.70208
1994-4	0.37809	0.25962	0.13823	0.04933	0.09335	0.21268	0.75321	0.50197	0.34469	0.18353	0.06549	0.12393	0.28236
1995-1	0.17934	0.22304	0.16204	0.01221	0.04484	0.17539	0.61753	0.29041	0.36119	0.26241	0.01978	0.07261	0.28402
1995-2	0.00623	0.18244	0.16555	0.03375	0.06295	0.01854	0.46322	0.01344	0.39384	0.35738	0.07286	0.13590	0.04002
1995-3	0.07128	0.13854	0.14831	0.05578	0.03853	0.06381	0.44497	0.16019	0.31134	0.33331	0.12536	0.08660	0.14340
1995-4	0.21822	0.09213	0.11249	0.03802	0.04218	0.27805	0.56288	0.38768	0.16368	0.19986	0.06755	0.07493	0.49399
1996-1	0.10169	0.04407	0.06258	0.00699	0.11389	0.19007	0.41759	0.24352	0.10552	0.14986	0.01674	0.27272	0.45516
1996-2	0.10212	0.00480	0.00483	0.04726	0.08610	0.24511	0.38810	0.26313	0.01236	0.01244	0.12178	0.22186	0.63156
1996-3	0.37251	0.05357	0.05353	0.05403	0.12236	0.54894	0.83243	0.44749	0.06436	0.06431	0.06490	0.14699	0.65944
1996-4	0.14298	0.10138	0.10518	0.02223	0.24606	0.08465	0.55951	0.25555	0.18120	0.18799	0.03973	0.43978	0.15129
1997-1	0.04982	0.14736	0.14366	0.02578	0.12391	0.19579	0.63650	0.07827	0.23152	0.22570	0.04050	0.19467	0.30761
1997-2	0.01162	0.19068	0.16413	0.05585	0.41417	0.37324	1.19807	0.00970	0.15916	0.13700	0.04662	0.34569	0.31154
1997-3	0.08426	0.23055	0.16404	0.04627	0.03577	0.14027	0.61690	0.13659	0.37373	0.26591	0.07501	0.05798	0.22738
1997-4	0.03521	0.26626	0.14340	0.00343	0.53585	0.45162	1.40055	0.02514	0.19011	0.10239	0.00245	0.38260	0.32246
1998-1	0.57574	0.29716	0.10479	0.04236	0.22138	0.11962	0.78531	0.73313	0.37840	0.13343	0.05395	0.28190	0.15232

Quarter	Mgap	MC0	MC1	MC2	MIrC	MNC	MTot	Q	shMC0	shMC1	shMC2	shMIrC	shMNC
1998-2	1.76804	0.32269	0.05305	0.05828	0.63935	0.80076	1.87413	0.94339	0.17218	0.02830	0.03110	0.34115	0.42727
1998-3	0.23679	0.34239	0.00534	0.03252	0.54760	0.06944	0.99728	0.23743	0.34333	0.00535	0.03260	0.54909	0.06963
1998-4	0.19954	0.35591	0.06305	0.01648	0.56488	0.03714	1.03748	0.19233	0.34306	0.06078	0.01588	0.54448	0.03580
1999-1	2.19248	0.36301	0.11287	0.05394	0.84266	0.92789	2.30036	0.95310	0.15780	0.04907	0.02345	0.36631	0.40337
1999-2	0.05608	0.36354	0.14855	0.05347	0.26451	0.77920	1.60927	0.03485	0.22590	0.09231	0.03323	0.16437	0.48420
1999-3	0.04712	0.35751	0.16561	0.01466	1.07204	0.51646	2.12628	0.02216	0.16814	0.07789	0.00689	0.50419	0.24290
1999-4	0.70013	0.34502	0.16192	0.03517	0.10741	0.05061	0.70013	1.00000	0.49279	0.23127	0.05023	0.15341	0.07229
2000-1	8.61009	0.32630	0.13795	0.06027	1.23592	6.84964	8.61009	1.00000	0.03790	0.01602	0.00700	0.14354	0.79554
2000-2	0.28191	0.30169	0.09669	0.04159	0.51344	0.20844	1.16185	0.24264	0.25966	0.08322	0.03580	0.44192	0.17940
2000-3	0.02388	0.27163	0.04332	0.00560	0.84462	0.55916	1.72432	0.01385	0.15753	0.02512	0.00325	0.48983	0.32428
2000-4	0.06129	0.23666	0.01548	0.04754	0.80576	0.91810	2.02355	0.03029	0.11695	0.00765	0.02350	0.39819	0.45371
2001-1	0.45204	0.19742	0.07234	0.05512	0.43133	0.04924	0.80545	0.56122	0.24510	0.08982	0.06844	0.53551	0.06113
2001-2	2.33199	0.15461	0.12014	0.02408	0.96546	1.37692	2.64121	0.88293	0.05854	0.04549	0.00912	0.36554	0.52132
2001-3	0.00292	0.10901	0.15288	0.02318	0.04316	0.06677	0.39499	0.00738	0.27597	0.38705	0.05867	0.10926	0.16905
2001-4	0.04698	0.06144	0.16647	0.05261	0.81492	0.80947	1.90490	0.02466	0.03225	0.08739	0.02762	0.42780	0.42494
2002-1	0.61166	0.01276	0.15920	0.04405	0.30616	0.20311	0.72528	0.84335	0.01759	0.21950	0.06073	0.42213	0.28005
2002-2	0.28348	0.03615	0.13198	0.00479	0.60153	0.48140	1.25586	0.22572	0.02879	0.10510	0.00382	0.47898	0.38332
2002-3	0.30989	0.08441	0.08823	0.03665	0.53976	0.02058	0.76964	0.40264	0.10967	0.11464	0.04762	0.70132	0.02675
2002-4	0.11811	0.13114	0.03342	0.05113	0.38475	0.05095	0.65140	0.18131	0.20132	0.05131	0.07850	0.59065	0.07822
									AshMC0	AshMC1	AshMC2	AshMIrC	AshMNC
									0.22293	0.11796	0.03835	0.27345	0.34731

Mgap, MC0, MC1, MC2, MIrC, and MNC are moduli of the corresponding indicators (gap, C0, C1, C2, IrC, and NC)

Mtot=MC0+MC1+MC2+MIrC+MNC

Q=Mgap/Mtot

shMC0=MC0*Q/Mgap

shMC1=MC1*Q/Mgap

shMC2=MC2*Q/Mgap

shMIrC=MIrC*Q/Mgap

shMNC=MNC*Q/Mgap

AshMC0=Sum(shMC0)/46

AshMC1=Sum(shMC1)/46

AshMC2=Sum(shMC2)/46

AshMIrC=Sum(shMIrC)/46

AshMNC=Sum(shMNC)/46

References

Abel, A.B. and B.S. Bernanke (2001): "Macroeconomics", Fourth Edition, Addison Wesley.

Akerlof, G.A., W.T. Dickens, and G.L. Perry (2000): "Near-Rational Wage and Price Setting and the Long-Run Phillips Curve", Brookings Papers on Economic Activity, 1.

Albu L.L. (1997): "Strain and Inflation-Unemployment Relationship in Transitional Economics: A Theoretical and Empirical Investigation", CEES Working Papers, December, University of Leicester, Centre for European Economic Studies, Leicester.

Albu L.L. (2004): "Dinamica ratei naturale a şomajului în perioada tranziţiei", Oeconomica, IRLI, 1, pp.123-139.

Allen, C. and S. Hall (1997): "Macroeconomic Modelling in a Changing World", John Wiley and Sons; C. Allen and J. Nixon: "Two Concepts of the NAIRU".

Ball, L. (1996): "Disinflation and the NAIRU", NBER Working Paper 5520.

Bårdsen, G. and R. Nymoen (2003): "Testing Steady-State Implications for the NAIRU", Working Paper Series No. 16/2002, Department of Economics, N-7491 Trondheim, Norway, [www.svt.ntnu.no/iso/wp/wp.htm].

Baxter, M. and R.G. King (1995): "Measuring Business Cycles: Approximate Band-Pass Filters for Economic Time Series", NBER, Working Paper 5022.

Bellmann, L. (1996): "Wage Differentiation and Long-Term Unemployment- An International Comparison", IAB Labour Market Research Topics 19.

Betcherman, G. (2000): "Structural Unemployment: How Important Are Labour Market Policies and Institutions?", Canadian Public Policy – Analyse de Politiques. Vol. XXVI Supplement/Numero Special 1.

Beveridge, S. and C.R. Nelson (1981): "A New Approach to Decomposition of Economic Time Series into Permanent and Transitory Components with Particular Attention to Measurement of the Business Cycle", Journal of Monetary Economics, 7(2), pp. 151-174.

Black, A.J. and F.R. Fitzroy (2000): "Earnings Curves and Wage Curves", Working Paper 00-7 Department of Accountancy & Finance, University of Aberdeen, Scotland.

Blanchard, O. and P. Pedru (1998): "What Hides Behind an Unemployment Rate: Comparing Portuguese and US Unemployment", Working Paper 6636, NBER.

Blanchard, O.J. and L. Katz (1999): "Wage Dynamics: Reconciling Theory and Evidence", NBER Working Paper Series 6924, National Bureau of Economic Research, or The American Economic Review, 89, May, pp. 69-74.

Blanchflower D. and A. Oswald (1995): "An Introduction to the Wage Curve", Journal of Economic Perspectives, 9:3, pp. 153-167.

Bondt de, G.J., P.J.A. van Els and A.C.J. Stokman (1997): "EUROMON, A Macroeconometric Multi-Country Model for the EU", De Nederlandsche Bank NV [http://www.unibw-hamburg.de/WWEB/math/uebe/zuhause.engl.html].

Bryan, M. F. and Cecchetti, S. G. (1994), "Measuring Core Inflation", in N. G. Mankiw, ed., Monetary Policy, University of Chicago Press.

Bucsa, D. (2002): "Output Gap Estimation Using Unobserved Component Models", Dissertation Paper, Supervisor - PhD. Professor M. Alter, The Academy of Economic Studies Bucharest, Doctoral School of Finance and Banking.

Calmfors, L. (1998): "Monetary Union and Precautionary Labour-Market Reform", Seminar Paoer No.659, Institute for International Economic Studies, Stockholm University.

Clark, P.K. (1987): "The Cyclical Component of U. S. Economic Activity", Quarterly Journal of Economics, 102(4), pp. 797-814.

Claus, I. (2000): "Estimating Potential Output: A Structural VAR Approach", Reserve Bank of New Zealand Discussion Paper 00/3.

Clements, M.P. and D.F. Hendry (1998): "Forecasting Economic Time Series", Cambridge University Press.

Cochrane, J.H. (1994): "Permanent and Transitory Components of GNP and Stock Prices", Quarterly Journal of Economics, 109(1), pp. 421-465.

Cogley, T. and J. Nason (1995): "Effects of the Hodrick-Prescott Filter on Trend and Difference Stationary Time Series", Journal of Economic Dynamics and Control ,19, pp. 253-78.

Cogdon, P. (2001): "Bayesian Statistical Modelling", Wiley Series in Probability and Statistics, John Wiley and Sons Ltd.

Conway, P. and B. Hunt (1997): "Estimating Potential Output: A Semi-Structural Approach", Reserve Bank of New Zealand, Discussion Paper No. G97/9.

Croitoru, L., C. Doltu and C. Tarhoaca (2001): "Gap-ul produsului intern brut şi inflaţia: cazul României", Qeconomica, IRLI, 2, pp.5-10.

de Brouwer, G. (1998): "Estimating Output Gaps". Research Discussion Paper 9809, Economic Research Department, Reserve Bank of Australia.

Dissanaike G. and S. Wang (2003): "A Critical Examination of Orthogonal Regression and An Application to Tests of Firm Size Interchangeability" [http://les1.man.ac.uk/sapcourses/Semstuff/Ort-wang.PDF].

Dobrescu E. (2000): "Macromodels of the Romanian Transition Economy", Third Edition, EXPERT Publishing House, Bucharest.

Dolado, J. and J. Jimeno (1995): "Why is Spanish Unemployment so High?". CEPR Discussion Paper, No 1184.

Domenech, R. and V. Gomez (2003): "Estimating Potential Output, Core Inflation and the NAIRU as Latent Variables", University of Valencia.

Dornbusch, R. and S. Fischer (1994): "Macroeconomics", Sixth Edition, McGraw-Hill.

Driver, R.L., J. Greenslade, and R. Pierse (2000): "Goldilocks And New Paradigm Economics: The Role of Expectations in Fairytales", Bank of England.

Duarte, M.A.S. et J.S. Andrade (2000): "Le Taux de Chômage Naturel comme un Indicateur de Politique Economique? Une application à l'économie portugaise", Faculdade de Economia, Universidade de Coimbra.

Ekstedt, H. and L. Westberg (1988): "Interaction Between Economic Growth and Financial Flows: Presentation of a Model Analysing the Impact of Short-Term Financial Disturbances on Economic Growth", H. Motamen, Ed., Economic Modelling in the OECD Countries, London, New York 1988, pp. 219-244 [http://www.unibw-hamburg.de/WWEB/math/uebe/zuhause.engl.html].

Elmeskov, J. (1993): "High and Persistent Unemployment: Assessment of the Problem and its Causes", OECD Working Paper 132.

Elmeskov, J. and M. MacFarlan (1993): "Unemployment Persistence", OECD Economic Studies, No. 21, Paris, pp. 59-87.

Elmeskov, J. and K. Pichelmann (1993): "Unemployment and Labour Force Participation-trends and Cycles", General Distribution OCDE/GD (93)95, Economics Department, Working Papers No.130.

Estrella, A. and F. Mishkin (1998): "The Role of the NAIRU in Monetary Policy: Implications of Uncertainty and Model Selection", Paper for NBER Conference on Monetary Policy Rules, Florida, January 15–17.

Evans, G.E. (1989): "Output and Unemployment Dynamics in the United States: 1950-1985", Journal of Applied Econometrics, 4, pp. 213-237.

Fair, R.C. (1994): "Testing Macroeconometric Models", Cambridge, Mass., London [http://www.unibw-hamburg.de/WWEB/math/uebe/zuhause.engl.html].

Fisher, I. (1926): "A Statistical Relation Between Unemployment and Price Changes", International Labour Review, Vol 13(6), pp. 785–792, reproduced in Journal of Political Economy, 1973, Vol 81(2), March/April, Part I, pp. 496–502.

Frisch, H. (1997): "Teorii ale inflatiei", Sedona, Timisoara.

Friedman, M. (1968): "The Role of Monetary Policy", American Economic Review, 58, March, pp.1-17.

Galli, G., D.Terlizzese, I. Visco, "Un modello trimestriale per la pre-visione e la politica economica", in Le proprieta di breve e di lungo periodo del modello della banca d'Italia, Politica Economica, No.1, 1989, p. 37 [http://www.unibw-hamburg.de/WWEB/math/uebe/zuhause.engl.html].

Garratt, A. and R.G. Pierse (1996): "Common Stochastic Trends, Cycles and Sectoral Fluctuations: A Study of Output in the UK", [http://www.econ.surrey.ac.uk/WorkingPapers/econ696.pdf].

Gerlach, S. and F. Smets (1999): "Output Gaps and Monetary Policy in the EMU Area", European Economic Review, 43, pp. 801-812.

Gerlach, S. and M. Yiu (2002): "Unobservable-Component Estimates of Output Gaps in Five Asian Economies", Hong Kong Institute for Monetary Research.

Ghizdeanu, I. and M. Neagu (2003): "Estimarea produsului intern brut potential". Academia Romana, Seminarul de Modelare Macroeconomica, Caiet de Studii No.1, pp.25-32.

Giorno, C., P. Richardson, D. Roseveare and P. van den Noord (1995a): "Potential Output, Output Gaps and Structural Budget Balances", OECD Economic Studies, No 24, pp. 167–209.

Gordon, R.J. (1996): "Macroeconomic Policy ~ The Presence of Structural Maladjustment", Working Paper 5739, NBER.

Gordon, R. J. (1997). "The Time-Varying NAIRU and its Implications for Economic Policy". Journal of Economics Perspectives, 11(1), pp.11-32.

Gordon, R.J. (1999): "Foundations of the Goldilocks Economy: Supply Shocks and the Time-Varying NAIRU", Northwestern University and NBER.
Gordon, R.J. (2003): "Hi-Tech Innovation and Productivity Growth: Does Supply Create Its Own Demand?", Working Paper 9437, NBER.
Greene, W.H. (1997): "Econometric Analysis", New York University.
Guarda, P. (2002): "Potential Output and the Output Gap in Luxembourg: Some Alternative Methods", Cahier d 'Etudes - Working Paper, No. 4, Banque Centrale du Luxembourg.
Harvey, A.C. (1990): "The Econometric Analysis of Time Series", Second Edition, The MIT Press.
Herz, B. and W. Röger (2002): "Traditional versus New-Keynesian Phillips Curves: Evidence from Output Effects" Bayreuth University European Commission, June.
Holden, S. (1997): "The Unemployment Problem - A Norwegian Perspective", OCDE/GD 28, Economics Department, Working Papers No. 172.
Holden, S. and R. Nymoen (2002): "Measuring Structural Unemployment: NAWRU Estimates in the Nordic Countries", The Scandinavian Journal of Economics, 104 (1), pp. 87–104.
Johansen, K. (2002) "Regional Wage Curves - Empirical Evidence from Norway", Department of Economics, Norwegian University of Science and Technology Dragvoll, N-7491 Trondheim, Norway.
Karamé, F. (1999): "Unemployment Persistence: the Hysteresis Assumption Revisited. A Nonlinear Unobserved Components Approach", EUREQua - Université Paris I; first version T2M99 Conference in Montreal.
Karbuz, S. (1994): "A Small Scale Macroeconometric Model for the Turkish Economy, Macroeconomic Decision Support for Turkey", Ph.D. Dissertation, Technische University Wien, [http://www.unibw-hamburg.de/WWEB/math/uebe/zuhause.engl.html].
Kawasaki, K. (1997): "Macroeconomic Performance of the Scandinavian Model", Economic Research Institute, Economic Planning Agency, Discussion Paper No.72, Tokyo. March [http://www.unibw-hamburg.de/WWEB/math/uebe/zuhause.engl.html].
Kichian, M. (1999): "Measuring Potential Output within a State-Space Framework", Bank of Canada Working Paper 99-9.
King, G.K. and S. Rebelo (1993): "Low Frequency Filtering and Real Business Cycles", Journal of Economic Dynamics and Control, 17(1-2), pp. 207-33.
Krugman, P. (1994): "Past and Prospective Causes of High Unemployment", Federal Reserve Bank of Kansas City's 1994 symposium on "Reducing Unemployment: Current Issues and Policy Options," Jackson Hole, Wyoming, August, Federal Reserve Bank of Kansas City - Economic Review · Fourth Quarter.
Kuttner, K.N. (1994): "Estimating Potential Output as a Latent Variable", Journal of Business and Economic Statistics, Vol. 12, No.3, July, pp. 361–68.
Layard R., S. Nickell and R. Jackman (1991): "Unemployment: Macroeconomic Performance and the Labour Market", Oxford University Press, First published 1991. Paperback reprinted 1992, 1993.
Lindbeck, A. (1996): "The West European Employment Problem", (Faff.doc) For Weltwirtschaftliches Archiv, A. L.13/8; The Bernard-Harms-Prize Lecture, held in Kiel, Germany on June 29, 1996.
Logeay, C. and S. Tober (2003): "Time-varying Nairu and real interest rates in the Euro Area", Deutsches Institut für Wirtschaftsforschung (DIW Berlin), Discussion Papers 351.
Maddala, G.S. and I.M. Kim (2000): "Unit Roots, Cointegration and Structural Change", Cambridge University Press.
Malinvaud E. (1964): "Methodes statistiques de l'econometrie", DUNOD, Paris.
Mankiw, N.G. ed. (1995): "Monetary Policy", The University of Chicago Press.
Nymoen, R. (2003): "Macroeconometric Modelling of Inflation Dynamics and Unemployment Equilibrium", University of Oslo, Department of Economics.
Ögünç, F . and Ece, D. (2002): "Measurement of Potential Output for Turkey: Unobserved Components Model", Central Bank of the Republic of Turkey.
Peracchi, F. (2001): "Econometrics", John Wiley and Sons Ltd.
Pindyck, R.S. and D.L. Rubinfeld (1998): "Econometric Models and Economic Forecasts", McGraw-Hill International Editions.
Proietti, T., A. Mussoy and T. Westermanny (2002): "Estimating Potential Output and the Output Gap for the euro area: a Model-Based Production Function Approach", University of Udine and European University Institute, Department of Economics.
Quah, D., and S. Vahey (1995): "Measuring Core Inflation", Economic Journal, 105(432), pp. 1130-1144.
Rennison, R. (2003): "Comparing Alternative Output-Gap Estimators: A Monte Carlo Approach", Bank of Canada Working Paper 2003-8.

Rõõm, M. (2001): "Potential Output Estimates for Central and East European Countries Using Production Function Method", Eesti Pank, Tallinn.

Saman C. (2003): "The Total Least Squares: Computational and Statistical Aspects and Algorithms", Romanian Journal of Economic Forecasting, No.3, 2003, pp.107-117.

Schorderet, Y. (2001): "Revisiting Okun's Law: An Hysteretic Perspective", University of California, San Diego, Department of Economics, Discussion Paper 2001-13.

Staiger, D., J.H. Stock and M.W. Watson (1996): "How Precise Are Estimates of the Natural Rate of Unemployment", NBER, Working Paper 5477.

Staiger D., J. Stock and M.W. Watson (2001): "Prices, Wages and the US NAIRU in the 1990s", NBER Working Paper 8320.

Stănică, C. (2004): „Metode statistice de estimare a PIB-ului potențial. Cazul României", Romanian Academy-Institute for Economic Forecasting, Manuscript.

Stiglitz, J. (1997): "Reflections on the Natural Rate Hypothesis", The Journal of Economic Perspectives, 11, issue 1, pp. 3-10.

Stock, J.H. and M.W. Watson (1988): "Variable Trends in Economic Time Series", Journal of Economic Perspectives, 2(3), pp. 147-74.

Stockhammer, E. (2002): "Explaining European Unemployment: Testing the NAIRU Story and a Keynesian Approach", Department of Economics, University of Economics and Business Administration, Wien.

Verbeek, M. (2000): "A Guide to Modern Econometrics", John Wiley and Sons Ltd.

Whelan, K. (1997): "Wage Curve vs. Phillips Curve: Are There Macroeconomic Implications?", Division of Research and Statistics, Federal Reserve Board.

Zaman, C. (2001): "Two Possible Alternatives for Building the PREG Macro Scenarios", TACIS, Planet E&Y, Poverty Reduction and Economic Growth Project.

Zaman, C. (2002): "The Output Gap and the Potential GDP of the Yugoslav Economy", Policy and Legal Advice Centre-An EU-funded project managed by European Agency for Reconstruction.