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Title: **ON KEYNESIAN EFFECTS OF (APPARENT) NON-KEYNESIAN FISCAL POLICIES**

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Central Banks are often accused of being obsessed with inflation. This is untrue. If they are obsessed with anything, it is with fiscal policy.
(Mervin King, Governor of Bank of England)

Abstract

The aim of the paper is to evaluate the robustness of the theory that claims for restrictive effects of expansionary fiscal policy. It shows that such so-called "non-Keynesian effects" may arise as a consequence of a synchronous and opposite monetary policy intervention. The paper demonstrate this conclusion through a stylized model – supported by an empirical investigation on ECB and FED reaction functions - in which Central Banks take into account deficit spending as an element that generate inflation expectations. The econometric analysis shows also that the ECB reacts asymmetrically to deficit spending variations while the FED has a linear reaction to this indicator.

Keywords: Fiscal policy, Monetary policy, Central Banks Policy strategies.
JEL classification: E52, E58, E62, E63

1. The Background.

Theoretical settings of fiscal policy have changed dramatically since early 90s in comparison with the previous decades. Previously public deficit was considered strictly as a tool for stabilization of aggregate demand and income; after then such an instrumental role has been more and more criticized. The final outcome of this theoretical reconsideration is a new conventional wisdom that connects counter-intuitive effects to public deficit spending.
The aim of the paper is an evaluation of the theoretical robustness of such new orthodoxy that became a new ruling paradigm and a very popular conjecture in mainstream academy. New theoretical foundations appear in two mirror approaches, thought as equivalent at all: "Keynesian effects of non-Keynesian fiscal policy", and "non-Keynesian effects of Keynesian fiscal policy".
The first one regards the hypothesis that a fiscal contraction could arise positive effects on production and income, a phenomenon now labelled as "Keynesian effects of non-Keynesian fiscal policy"; the second, usually thought similar to previous one, holds that an increase in public deficit spending may create negative quantity effects on production and income, according to a theory of "non-Keynesian effects of Keynesian fiscal policy".

The two phenomena are, from a theoretical point of view, quite different, but, irrespective of superficial equivalence, the common starting point of such conventional wisdom is the failure of "old-fashioned" Keynesian belief in a positive fiscal multiplier.
The struggle against this model is not a recent phenomenon. Opponents to basic keynesism appear since the first, pioneer exposition of a positive fiscal multiplier carried on by Keynes in the late 20's through argumentations included in the Treasury View[1]. This disagreement reappears in the late 60's with Friedman monetarist approach to natural rate of unemployment approach, it continues with the "crowding-out" argumentations arriving to Rational Expectations Models and Ricardian equivalence.
It must be stressed that all these positions theorized low or null fiscal multiplier whereas new positions, in the early 90's, assume negative fiscal multipliers, that is Non-Keynesian effects of Keynesian fiscal policies and vice versa.
The germinal work of the new approach was provided by Giavazzi and Pagano in 1990[2], arising a flow of countless contributions still uninterrupted, with new researches by old pioneers, supported now by new scholars.[3]
Such contributions have to be analysed very carefully because they constitute a constant benchmark for all the successive studies on negative effects of fiscal policy and because new conventional positions of policymakers, particularly within Euro Area, refer, constantly and explicitly, to the Giavazzi and Pagano position.
Our paper offers a different view to interpretative hypotheses of Non-Keynesian View (hereafter NKV), and we shall try to argue that:

i. *Keynesian effects are produced by a peculiar (well known in the 80's) policy mix determined by an essential role played by monetary and exchange rate policies and not by "pure non-Keynesian fiscal policies";*
ii. *Possible success of "intrinsic pure non-Keynesian fiscal policies" depends on very severe and unreal analytical conditions;*
iii. *European policy makers, and namely European Central Bank and European Committee, have been embracing such a theoretical approach without deepening all its limits.*

In this paper we try to develop this alternative approach using the following structure. Section 2 analyzes the main theoretical foundations of Non-Keynesian View passing to, in section 3 to a review of the empirical literature of the NKV approach. In section 4 we comment the framework conditions that usually help NK policies to reach counter-intuitive results. In section 5 a model containing the fiscal policy transmission mechanisms is presented in its structural relations. Through this model we derive the validity condition of NKV outcomes and show the relevance of monetary policy cooperation in order to reach these results. In section 6 we try to check empirically the consistency of our conjectures, particularly the relevance of monetary framework. Section 7 concludes the paper.

2. The Tale of a Fiscal Counter-Revolution.

During the 80's the growing budget deficit and the very high public debt triggered a deep revision of the direct relation between public expenditure and growth. Academics agreed on the fact that there was the need to consolidate public finances because of the instability effects of real monetary and financial markets. The institutional claims coming from ongoing EMU gave a further push to this stream of studies.
But, even if economists agreed on negative effects on growth of increasing fiscal imbalances, they, at same time, feared the negative results of fiscal restrictions. Therefore, when economists started to

[1] Peden G.C., 1984
[2] Giavazzi and Pagano, 1990.
[3] Giavazzi et al, 1999, 2000 and 2005.

observe successful fiscal consolidations – i.e. the contemporary presence of budget deficits reductions and income growth – they concluded that there were no doubts left on what economic policy had to do.
The work considered as the most relevant for the subject matter was Giavazzi and Pagano (1990). It was a very successful econometric analysis in which the authors observed a consumption increase during fiscal restriction. It paved the way to the general conclusion – or, as they call it, to the non-conventional wisdom - that retrenchments can be expansionary. This is what we call the non-Keynesian view.
Following this first publication, in a new article Giavazzi-Pagano (1995), they extended the results of fiscal consolidations to fiscal expansions[4]. They found that "fiscal policy changes *can* have non-Keynesian effects if they are sufficiently *large* and *persistent"*[5]. These results were further consolidated in Giavazzi Pagano Iappelli (1999) Giavazzi Pagano Iappelli (2000) e Giavazzi Pagano Iappelli, (2005), where they estimated the saving function instead of the consumption one.
The theoretical foundations of their empirical results are based on a composition of Modigliani life-cycle theory or Friedman permanent income theory and Ricardian-equivalence theory as in Barro (1974). If consumers a) have rational expectation and b) are not liquidity constrained tend to smooth the consumption – or saving - through time, following the expected flow of actualized disposable income. If therefore during fiscal retrenchment we observe an increase of consumption, it is the proof that private individuals have revised their permanent income upward and that – they state – the cause of this revision is the consolidation of public finances.
Investigating more deeply their works, a progressive consolidation of their non Keynesian view comes out. In Giavazzi Pagano (1990) the positive effects on consumption were observable because of "two simultaneous policy shocks: a fall in current disposable income, due to the increase in current taxes, and a wealth effect due to an unanticipated fall in nominal and real interest rates"[6]. They admit that the expansionary effect is not the result of a pure fiscal restriction but of its indirect effect on interest rates. In Giavazzi Pagano (1995) the observed negative effect on income of fiscal expansions is caused - in their view - by the downward revision of private individuals permanent income. It is considered certain the conclusion that the reduction of permanent income is *univocally* determined by the expansionary fiscal policy.
But the stream of studies was so successful that they continue to extend and reinforce their conclusions through testing the saving function. In Giavazzi-Pagano-Iappelli (1999), Giavazzi Pagano-Iappelli (2000) e Giavazzi-Pagano-Iappelli-Benedetti, (2005), which differ from each other for the width of the sample considered. Econometric analysis allows them to conclude that:
a) national saving non linearly increases or reduces when there is a fiscal consolidation and contraction respectively;
b) that the non linearity arises because of the fact that fiscal episodes are not sufficiently large and persistent as predicted by the theory of permanent income;
c) that the fiscal consolidations are more effective than fiscal expansions;
d) variation of net taxes are more effective then variations of public consumption;
e) the level of public debt is not, finally, a good predictor of non Keynesian effects.
In a few words, while at the beginning the core of their NKV was the fiscal and monetary policy mix, through the years, it has become the pure fiscal policy. The opposite effect of fiscal interventions is assured by a kind of "super-Barro effect" according to which the fiscal contraction or expansion does not have a null outcome, but a more than proportional autonomous negative effect on permanent income[7].

[4] Non-Keynesian effects of fiscal restrictions are very often estimated, while the contrary has not find a wide consensus in the empirical literature.
[5] Giavazzi Pagano (1995) abstract. The first but not the second italic is our.
[6] Givazzi Pagano (1990), p. 14

[7] "Finite horizon models suggest that an increase in net taxes should raise national saving (>0), whereas an increase in government consumption should reduce it . In the benchmark infinite horizon model with lump-sum taxes, taxes have no effect on national saving this is the Ricardian equivalence proposition. Also, in the infinite horizon model, for a given

This last position have limits that cannot be easily overcome: non Keynesian effects of Keynesian policies cannot derive simply from the relation between fiscal stance and saving or consumption[8]. In order to make them verified it is necessary to suppose – beside the hypotheses of rational expectations and no-liquidity constrain that the fiscal policy intervention: a) has to be unanticipated; otherwise individuals would have already discounted the movement of disposable income and b) has positive effects on the real value of private assets or c) is financed through debt because this predicts a further tax movement in order to pay interests on public bonds or d) causes interest rates movements in the same direction. In all these cases the fiscal policy cause an opposite movement of income through the channels of the consolidated theory – in one word through the rate of interest real or nominal, actual or expected

The literature coming after empirically investigated on the non-Keynesian results of fiscal policies, in particular fiscal restrictions. Results were found to operate through the general effects on reserve wage and competitiveness (Alesina an Perotti 1995 and 1997), but only if fiscal consolidations were conducted without raising taxes or cutting public investments (Alesina and Perotti 1995, 1997, Alesina and Ardagna 1998). The effects on the other components of aggregate demand were investigated also, especially the investment channel[9]. The literature considered to be relevant the initial level of debt, the persistency of reduction and the dynamic of interest rates (Blanchard and Perotti 1999, and Ardagna 2004). Differently from the Giavazzi- Pagano-Jappelli contributions this "non-Keynesian literature" relies on the indirect effects of the reduction or expansion of public spending on supply and demand without identifying an autonomous capacity of increasing or reducing permanent income.

It is therefore an empirical re-proposition of an old debate about the crowding-out effects of expansionary fiscal policies.

3. The Empirical Literature of a Fiscal Counter-Revolution.

The empirical literature about NK effects of fiscal policy can be divided in three main categories based on different approaches. The first approach is based on simulations of macroeconomic models. The second approach uses cross-section and panel analysis in order to analyze the relationships between fiscal policy and output. These contributions estimate the reaction of consumption interest rates, exchange rates and investments to fiscal policies. The third approach is the VAR one.

3.1 Behavioural Equations Estimates

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path of pre-tax income, Y, government consumption does not affect national saving either. […]" But in the regression they find that "t he coefficient of *T/Y** is positive and statistically different from zero at the 1 percent level in each regression. [And] the coefficient of *G/Y** is negative and also statistically different from zero at the 1 percent level in both regressions. [Therefore] contrary to the predictions of infinite horizon models with non-distortionary taxes, the fall in private consumption does not fully compensate the increase in government consumption, thereby reducing national saving" Giavazzi, Pagano Jappelli (2005) p.15.

[8] This circumstance is recognized by the same authors: " Expansionary fiscal contractions can be explained by the effects of fiscal policy on the market value of wealth and on expectations about future taxes. A fiscal contraction often reduces interest rates, raising the market value of stocks, bonds and real estate, thus stimulating aggregate demand. It can also drastically change people's view of the future and therefore the estimate of their human capital. For instance, in a high-debt country a fiscal correction may prevent a financial crisis, thus improving confidence and increasing consumption and investment" Gavazzi, Pagano Jappelli (1998) p.1, (1999) p.2, (2000) p. 2.

[9] Perotti (2004b) "In fact, government investment appears to crowd out private investment, specially in dwelling and inmachinery and equipment. "

Beginning with Giavazzi and Pagano (1990) a large number of empirical studies has reached the conclusion that contractionary (expansionary) fiscal policies may have positive (negative) effects on households consumption. These studies analyze fiscal consolidations episodes through the effects on behavioural functions. All studies try to isolate the channels through which the fiscal contractions may have positive effects on output. This literature has focused mainly on consumption, although there are some studies analyzing the effects of fiscal policy on investments and interest rates.
These studies are based on some strong theoretical assumptions. Most households make inter-temporal optimizations in order to decide their consumption level, and they have no-liquidity constraints.
The strongest evidence of expansionary fiscal contractions are in Giavazzi and Pagano (1990); the authors find that Denmark in 1983-86 and Ireland in 1987-89 are bright examples on non-Keynesian effects of fiscal policies.
Giavazzi and Pagano (1995) try to extend their previous results and to evaluate whether the coefficients change in different situations. Non-Keynesian effects seem to rise in adjustment periods. The authors find that the effects on private consumption of taxes is 0.05, the coefficient for transfers is -0.07, while the effect of public consumption is -0.02. In normal times the behaviour of consumption seems to be purely Keynesian. Thus, it seems difficult to conclude that such small coefficients in the consumption reaction to fiscal policies could result in expansionary fiscal contractions.
Giavazzi et al (2000) conclude that large fiscal policies have stronger effects[10]. They analyze consumption, estimating a saving behavioural function and making a distinction between bad and good times. The results do not seem to give evidence for non-Keynesian effects of fiscal policies even in bad times.
Hjelm (2002) tries to extend the conclusion drawn for Ireland and Denmark in Giavazzi and Pagano (1990), while Kamps (2001) tries to do the same for the results in Giavazzi et al (2000).
Kamps (2001) does not find NK effects, except in three cases with country-specific consumption equations. Nevertheless, the author admits that a richer specification is needed in order to make the results less fragile.
Hjelm (2002), analyzes a panel of 19 countries spanning the period 1970-97. The estimation of the share of consumers that are credit constrained shows low levels, ranging from 0.1 to 0.14. Surprisingly, the impact of fiscal policy on consumption is not negative, and sometimes barely positive.
It seems that this kind of analysis has some limits that prevent it from being completely convincing. Since most of these studies focus on some episodes of fiscal contractions, it seems that a sample selection bias may arise. Hemming et al (2002) suggest that handpicking specific country-cases, could provide stronger results with respect to a larger cross-section of countries.
Measurement errors can also occur since most of these papers use fiscal deficits as a basis for assessing fiscal policy change. They do not take into account fiscal policies with strong output effects but with small budgetary impact.
A richer specification, could have given different results. Other variables could explain the relationship between fiscal policy and the economic activity (e.g. inflation, exchange rates, unemployment rates, wealth effect, and interest rates).
Another problem, is the absence of a variable (or a set of variables) controlling for the interaction between fiscal and monetary policy. Ahrend et al (2006) assess how and in what circumstances fiscal consolidations are affected by the choices of monetary policy. Surprisingly, there are not so many papers studying the effects of monetary policy and/or exchange rate variations on a consolidation policy. Fiscal consolidation can be assisted by a shift in monetary stance since a decrease in the interest rates can compensate the depressive effect of fiscal contraction on the demand. On the other hand, monetary expansion can reduce interest payments on public debt.

[10] The same conclusion is reached by Gavazzi and Pagano (1995) and Cour et al (1996).

Ahrend et al (2006) conclude that the reaction of the central bank can be very important in determining the results of a fiscal consolidation. These results seem to have a very strong theoretical implication. Fiscal plans have to be implemented in the central bank projections and the response of the central bank should influence the result of a fiscal policy.

3.2 Macroeconomic Model Simulations

Estimates from simulations of macroeconomic models do not give unique results about fiscal multipliers. Nevertheless, given its technical complexity, this approach permits to specify some aspects that are not taken into account with other methodologies. One of these concerns the specification of the reaction in terms of monetary policy. Nevertheless, this literature has some common features, one of them is that most of the analysis show that short-term multipliers are positive.

Richardson (1998) uses the INTERLINK model in order to analyze some short and long run macroeconomic aspects. The author investigates the response in terms of output from an increase in public expenditure. The experiment evidences positive multipliers that decrease over time. Moreover, different assumptions about the reactions in terms of monetary policy show different results. Nevertheless, the incidence of different monetary regimes seems to have relevance only in the short-run (Dalsgaard et al, 2001 and IMF, 1996).

Another clear evidence is that the range of multipliers estimated is narrower in the long-run (McKibbin , 1996 and Bryant et al, 1993). As evidenced in Roeger e in't Velt (2002) and Barrel et al (2002), the multipliers constantly reduce over time and reach zero in the long-run. Hunt and Laxton (2002), and Dalsgaard et al (2001) find negative long-run multipliers for the same group of countries using INTERLINK and MULTIMOD models.

Many macro models simulations show that in the short-run spending changes multipliers are bigger than tax changes. A MULTIMOD model simulation in IMF (1996) shows that for the USA the spending multiplier is 1.1 and the tax multiplier is 0.7.

It seems clear that the specification of the models and their assumptions are crucial in determining different results. Wallis (2003) makes a comparison of the QUEST, NiGEM, MULTIMOD and AWM models, and all the short-run multipliers are positive.

The main difference between the models seems to be the specification of the consumption function. In AWM the consumption function is based on present income . In the simulations of NIGEM model the consumption is not function of temporary income changes and consumers are completely backward looking. MULTIMOD models consider liquidity constraints, and these levels change with different specifications of the model.

Concluding, there is evidence that public expenditure cuts reduce output. Nevertheless, the estimates of future incomes and how they are used for the forecasts, the estimates of consumption, the predictability level of the economy by the agents are all points that sometimes are not stressed and explained in an exhaustive way.

3.3 VAR Approach Literature

The time series-based empirical literature studying the effects of fiscal policy shocks uses mainly VAR models to represent the economy. The main differences among all these studies concern the VAR specification and the shocks identification strategies.

Fatas and Mihov (2001 a, b) solve the identification problem using the recursive approach (based on the Cholesky decomposition) introduced by Sims (1980). Fatas and Mihov (2001 a) show that an increase in government expenditure is accompanied by an increase in private consumption and employment. Although the results are in line with the Keynesian theory, the spending multiplier values are small.

Blanchard and Perotti (2002) show that an increase in public expenditure is followed by an increase in output, and that an increase in taxes is followed by a reduction in the output. Moreover, long run multiplier still remains positive and close to unity.
Several papers have used the Blanchard and Perotti (2002) approach. Kuttner and Posen (2002) find a spending multiplier of 2.0 and a tax multiplier of 2.5 for Japan. Perotti (2002) analyzes a sample containing five countries, he finds out that impact and peak spending multipliers are always positive, although the peaks are reached in different periods ranging from 1 quarter (Germany) to 17 (UK and Canada). The evidence about the sign of long-run multipliers is more mixed, depending on the sub-samples considered. Nevertheless, this article suffers of some statistical weakness since some series are non-stationary and the trend correction could have been not sufficient to correct it.
Mountford and Uhlig (2002) use a different approach imposing sign restrictions directly on the impulse-response functions. They analyze USA data and they find that shocks to government expenditure are substitute for private investment rather than private consumption, since the latter is not reduced after an increase in government spending. Moreover, they argue that the fiscal policy reacts to cycles but does not to monetary policy.
Ramey and Shapiro (1998) introduce the fiscal dummy variable approach, also known as the narrative approach, in order to analyze the effects of large military spending in the USA. Their idea is to consider defense spending as a proxy for government expenditure. They conclude that consumption falls after an increase in military spending while the increase in GDP is not statistically significant. On the other hand, other fiscal shocks can occur around the same time, polluting the identification of the military expenditure shock.
As already evidenced, all these papers differ each other in the VAR specification and in the identification of the fiscal shock. It can be argued that the different results of such studies can be due to the specification and identification choices. Caldara and Kamps (2006) test whether such differences can explain the different results. All the implemented approaches agree in showing a positive reaction of GDP to a positive government shock. They conclude that, with an appropriate VAR specification, the recursive and Blanchard-Perotti identification schemes have only minor differences in their impulse-response functions.
VAR literature shows that there is a positive relationship between government expenditure and output and that the multiplier is not negative even in the long run. The results about the relationship between government expenditure and consumption are more controversial. Nevertheless, even in papers where consumption decreases after a positive shock in public expenditure the fiscal multiplier is positive. Thus, concluding from a negative relationship between consumption and fiscal policy that the latter has negative effects on output, could not be correct.

Apart form theoretical robustness of contributions, as well as their shortcomings, NKV setting shows the following features:

i) it aims at undermining the positive value of Keynesian fiscal multiplier;
ii) Ricardian Equivalence Approach becomes a practical tool to propose radical departures in policy making: A fiscal retrenchment can not be further considered as a cause of recession;
iii) the model key variable is private consumption (or saving). Keynesian effects of non-keynesian fiscal policies are supposed to arise through private consumption variations, whereas in Keynesian approach the adjustment burden is carried on by investment.

iv) *By a single step, NKV liquefies arguments of dispute on Keynesian fiscal policies, even those pertaining the struggle, in the late 20s, between Keynes and the so called "Treasury View"*[11].

NKV approach benefited of a large academic and "policy" acceptance, hard to be understood by a pure theoretically point of view.

Doubtful economists were few; surely Blinder (2004), Fitoussi (2002, 2004 and 2005), Solow (2005) and Krugmann (2005), partly Wyplosz (2005 and 2006)and no one in younger scholars.

The results was a huge effort of brains and econometrics technicalities aimed at strengthening the empirical consistency of NKV approach, never considering its theoretical coherence.

4. Ceteris are not Always Paribus.

As well as major shortcoming of IS-LM approach were founded in neglect of public budget constraint and, hence, of interdependence between fiscal and monetary policy, NKV lacks of considering monetary effects of fiscal stance variations. The Central Bank, following a fiscal shock, can decide, three different behaviours: a neutral feedback, when the Central Bank maintains a conduct in determining its instrumental variable and intermediate targets independent from fiscal policy; an antagonist approach, when it operates on its instrumental variables aiming at frustrating decisions engaged by fiscal authority); a cooperative stance when monetary policy cooperates to achieve targets of public deficit variations (Allsopp and Vines 2005, Allsopp 2002).

The monetary policy instrument for a central bank is the interest rate (Romer 2000 and 2006). It can be assessed without considering the definition of its intermediate and final targets. The interest rate is determined by the reaction function of the central bank. Thus, it follows that:

i. a complete evaluation of fiscal policy effects that are assumed by NKV should consider those associated with those determined through interest rate variations decided by the central bank in presence of a new fiscal policy setting,

ii. Considering the interest rate would permit a distinction between pure (in the sense of policies without any monetary feedback) or policies applied with a co-operative or antagonistic central bank behaviour;

iii The validity of NKV (that is the presence of keynesian effects with non-keynesian fiscal policies, or non-Keynesian effects through Keynesian fiscal policies) depends on the assumption of the presence of pure fiscal policies. Otherwise we should start from a monetary and fiscal policy mix.

Analyzing the first paper of NKV (Giavazzi and Pagano, 1990), it seems clear that episodes of fiscal policy retrenchements that should have caused non-Keynesian effects are policy mix instead, in which monetary and currency policies have played a crucial role: "…reviewing the key facts about the Danish and Irish experiments, highlighting the importance of the monetary and exchange rate policies that accompanied the fiscal stabilisation"(p.6); "cuts in spending and tax increases were accompanied ….by complementary monetary and exchange rate policies"(p.7); "the removal of controls on capital inflows by Danish authorities was equivalent to a positive demand shock"(p.27);..we also found that part of the expansionary effects of the fiscal contractions analyzed here must be attributed to the concomitant monetary disinflation….it is remarkable that in both our cases of "expansionary contractions" the shift in fiscal and exchange rate policy was preceded by a sizable devaluation"(P.28)[12].

[11] Then Keynes proposed a public works program financed by government bonds in the electoral program of Lloyd George. The Treasury, a British institution "more than a ministry" (Peden), disagreed, supposing negative effects because of dis-saving created by public sector and for the attributes of inefficiency of government expenditure

[12] Italics added.

This approach doesn't change in successive works: fiscal retrenchments are always analysed for their apparent features, as if ceteris were paribus and not regarding other phenomena, such as central bank reaction on interest and exchange rates.
But if ceteris are not paribus it is significant to examine the effects of fiscal policies on monetary policy, hence on "the reaction function of central bank" (hereafter CBRF)[13].
Actually, cases examined by GP, throughout all their contributions, are canonical examples of interactions between monetary and fiscal policies, where interest and exchange rates are affected by public deficit variations.
The notion that the reaction function of monetary authorities depends on fiscal policy, too (Allsopp and Vines, 2000) and its stance will be, more or less, enhanced by antagonistic or co-operative monetary policy reaction function (Taylor, 1996), is not new in literature. Debate on "optimal policy mix", i.e. on effectiveness of fiscal contractions harmonized with benign monetary policy goes back in the 70's and 80's. The debate in US on optimal combination of monetary and fiscal policy in '70 and '80 is fundamental to understand that the theory of economic policy is richer than the debate that originated the NKV (Okun 1972, Carlson 1982, Tobin 1982,Blinder 1985)[14], a conscious debate would be wrong to label such a case as "pure fiscal policy" or "non-Keynesian effect".
Understanding interdependence of policies and reaction of Central Bank to public deficit variations involves analysis of monetary authorities Loss Function, that is the behavioural equation underlying the reduced form equation of Taylor Rule, because a rigorous Taylor Rule must be derived explicating Central Bank model of the economy and its weights to possible deviations from selected targets. We therefore assume that Reaction Function of Central Bank becomes a cornerstone to analyse effects (Keynesian or non-Keynesian) of fiscal policies.
The starting point is the awareness that, empirically, fiscal policy results are strictly influenced by monetary policy behaviour. Ahrend et al (2006) investigate in such relationship considering episodes of fiscal consolidation in 24 OECD countries[15]**.**The main findings, for our aims, can be summarized as follows:

i. Consolidation is more likely to be pursued if, ceteris paribus, it is assisted by an easing monetary policy, especially in the early stage of the policy. Moreover it seems to be likely to be successful if the monetary policy reacts more than what predicted by a Taylor rule;

ii. Consolidation has higher probability to succeed when interest rates are falling. Interest rate variable does not affect that a consolidation period is started, but declining nominal and real short-term interest rates are associated with a higher likelihood that the adjustment is pursued, and with a greater success. The most convincing explanation for this result is that falling interest rates can encourage the continuation of consolidation, because the interest rate variable is picking up a reaction of monetary authorities.

More generally, monetary authorities seem to adopt asymmetric behaviour when fiscal stance changes, increasing or lowering public deficit amount[16].
A *fiscal retrenchment is, usually, encouraged by the central bank:* in such a case non-keynesian fiscal policy is "helped" by interest and exchange rate policies that arise Keynesian effects: "If the central bank continues to follow its previous interest rate policy in the face of decline in the long-run real interest rate, then it will set an interest rate which is too high; this will have the effect of reducing demand in the economy.(Taylor, 1995). More:"..To the extent that fiscal plans are expected to be implemented, they can normally be expected to be factored into central banks' macroeconomic projections." (Ahrend et al. 2006). On the opposite, *a fiscal expansion is feared by monetary*

[13] Meyer (2000), explicitly stressed the effects of public surplus on the formulation and conduct of monetary policy connection.
[14] " To achieve a solid recovery, we need a easier monetary policy combined with a tighter fiscal policy. (Tobin, 1982).
[15] An episode of fiscal consolidation is identified as starting when CAPB increases of 1% of GDP in no more than two years. Short term interest rates are used as a proxy for monetary stance (Ahrend et al., 2006).
[16] Marvin King, Governor of the Bank of England is completely aware of the relevance on fiscal stance on Central Banker behaviour. See King (2005 and 2007)

authorities: exchange rate appreciation and increased interest rate can frustrate fiscal Keynesian policy: "The fiscal authority attempts to lower unemployment by rising the deficit; this is countered as monetary authority raises interest rates to fight inflation; and so forth. At the end of this struggle, because the two parties pursue different objectives, the surplus is the big loser" (Nordhaus, 1996).
The key variable to produce asymmetries in the central banks reaction functions, and particularly for European Central Bank is given by the central role that inflation and inflation expectations play in determining monetary authority setting interest rates. Fiscal policies consistent with a downgrading of inflation expectations determine a co-operative stance by Central Bank, an increase of public deficit perceived as inconsistent with the stability of inflation expectations is worried and potentially fought by monetary authorities. Starting from such evaluation we will present, in the next section, a simplified model of income determination, taking into account NKV discussed assumptions on "super-Barro effects" of public retrenchment on consumption function, the relevance of monetary policy decisions on interest and exchange rates, variables affected by an peculiar reaction function, asymmetrically influenced by assumed consequences of public deficit movements on inflation expectations (Surico, 2003).

5. A Naïve Representation.

It is possible now to introduce a simple model of income determination, moving from theoretical evaluations carried on by NKV, augmented with inclusions we consider crucial: changes of fiscal stance proceed necessarily with interest rate variations produced, through its reaction function, by effects that monetary authorities think public deficit will cause on market inflation expectations.
Our model, therefore, is built up according some key assumptions: the NKV theory of relation between fiscal policy, permanent income and consumption; the supposed effect of public deficit on inflation expectations; the existence of a monetary policy reaction function careful to inflation expectations alterations.
We show intentionally a simple exercise of comparative statics, aimed at stressing main structural equations of model, coming back "to the Neolithic Age of Structural Model" (Nordhaus, 1996)[17].

$$Y = C + I + D_1 + D_2 + NX \qquad (4.1)$$

$$C = \theta c_0 Y + (1-\theta) c_1 Y_P \qquad (4.2)$$

$$I = -\alpha R \qquad (4.3)$$

$$Y_P = B + -\gamma D_2 \qquad (4.4)$$

$$NX = n_0 E - n_1 Y \qquad (4.5)$$

$$R = \beta \pi^e + \delta Y \qquad (4.6)$$

$$\pi^e = \nu A + D_1^n + D_2^n \qquad (4.7)$$

$$E = -\xi R \qquad (4.8)$$

Equilibrium income is represented in equation (4.1); the only exception respect to manual treatment is given by division of public deficit in two different components: D_1, a transitory component that is not thought as a component of fiscal stance and D_2, perceived as a permanent value of fiscal stance. Consumption function, in equation (4.2), embodies alternative scenarios: a traditional Keynesian element, $c_0 Y$, whereby consumption depends on current income and NKV, $c_1 Y_P$,

[17] Dynamic complication (and/or functions smoothing) should not modify main results.

whereby consumption depends on permanent income. Value of θ determines social behaviour regards private consumption: if $\theta = 1$, a strict Keynesian approach holds; with $\theta = 0$, consumption depends, at all, on permanent income and, therefore, a NKV scenario rule; if $0 \prec \theta \prec 1$, then private consumers decide, in the very short run, both on disposable and permanent income. Investment depends, as in equation (4.3), on interest rate, while equation (4.4) considers the flow of permanent income given by usual factors of "life-cycle" hypothesis , B, and the "super-Barro" component derived from expected permanent reduction in fiscal stance, D_2. The wealth variation is a condition determined through a subjective parameter, γ. Net exports depends, as in equation (4.5), from exchange rate and disposable income[18]. Equations (4.6)-(4.7)-(4.8) have to be analyzed together: Both components of public deficit, D_1 and D_2, affect, in addition to an exogenous element A, inflation expectations, π^e, according to Eq. 7. The general form of influence of D_1 and D_2, is included through generic exponents value, n, that, in case of odd values allow us to suppose a non-linear influence of public deficit on inflation expectations. Inflation expectations, along with a proxy of output gap, impact on interest rate, through central bank reaction function[19](hereafter cbrf), that, in the very short run, is the key variable for assessing exchange rate, as we assume in eq.8. The non-linearity assumption between deficit and inflation expectations, and, thus, between deficit and cbrf will result crucial in discussing NKV.

Resolving for Eq.(4.1), the value of equilibrium income is:

$$Y = \frac{1}{k}\left(1 - \beta\alpha D_1^{n-1} - n_0 \xi D_1^{n-1}\right) D_1 + \frac{1}{k}\left[1 - \beta\alpha D_2^{n-1} - n_0 \xi D_2^{n-1} + c_1 \gamma\left(\vartheta - 1\right)\right] D_2 + \\ + \frac{1}{k}\left[B c_1 \left(1 - \vartheta\right)\right] - \frac{1}{k}\left[A \beta \nu \left(\alpha + \xi n_0\right)\right] \qquad (4.9)$$

where $\frac{1}{k}$ is the usual multiplier of autonomous aggregate demand:

$$\frac{1}{\mathrm{k}} = \frac{1}{1 - \vartheta c_0 + n_1 + \delta(\alpha + n_0 \xi)} \qquad (4.10)$$

Let us consider k deeply.

First components, $1 - \vartheta c_0 + n_1$, compare as well as in the Keynesian fashion, keeping in mind the significance of ϑ. A new, different role is played by CBRF, included in $\delta(\alpha + n_0 \xi)$: if income raises there is a balancing effect of interest rate reaction function of the central bank on investment expenditure ($\alpha\delta$) and through the exchange rate ($n_0 \xi \delta$). From an analytical point of view the term $(\alpha + n_0 \xi)\delta$ could be thought as a "negative accelerator" of the Central Bank.

As a first step, we can discuss the effects of fiscal policy with assumptions of NKV and without the working of CBRF. It means the assumption of a fixed interest rate, $R = \bar{R}$.

Now equilibrium income is:

$$Y = \frac{1}{1 - \vartheta c_0 + n_1}\left[(1 - \vartheta) c_1 (B - \gamma D_2) - (\alpha + n_0 \xi) R + D_1 + D_2\right] \qquad (4.11)$$

Further, if all public deficit is judged as long-lasting and consumption depends completely on permanent income, that is if:

$D_1 = 0 ; \vartheta = 0$

income value is:

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[18] It should be necessary, from a strictly theoretical point of view, to include flow of permanent income, Y_P, as an independent variable affecting NX, in addition to Y. Bur results should remain unchanged.

[19] Appendix I derives a Central Bank Reaction Function consistent with a structural Loss Function of monetary authority.

$$Y = \frac{1}{1+n_1}\left[c_1 B + (1 - c_1\gamma)D_2 - (\alpha + n_0\xi)R\right] \qquad (4.12)$$

From Eq.(4.12) counter-intuitive non-keynesian effects will have to be satisfied by the following inequality:

$$\frac{dY}{dD_2} = \frac{1 - c_1\gamma}{1 + n_1} < 0 \qquad (4.13)$$

or if:

$$\gamma > \frac{1}{c_1} \qquad (4.14)$$

We remind that γ is a parameter that links permanent public deficit to permanent income. If $c_1 = 1$, inequality holds if $\gamma > 1$, that is if a permanent income variation involves a belief of a *greater* permanent income variation. If $c_1 < 1$, inequality becomes much more doubtful.

Including CBRF equilibrium income is equal to:

$$Y = \frac{1}{k}\left(1 - \beta\alpha D_1^{n-1} - n_0\xi D_1^{n-1}\right)D_1 + \frac{1}{k}\left[1 - \beta\alpha D_2^{n-1} - n_0\xi D_2^{n-1} + c_1\gamma\left(\vartheta - 1\right)\right]D_2 + \\ + \frac{1}{k}\left[Bc_1\left(1 - \vartheta\right)\right] - \frac{1}{k}\left[A\beta\nu\left(\alpha + \xi n_0\right)\right] \qquad (4.15)$$

A detailed list of fiscal multipliers with different significant assumptions on parameters value is included in Appendix II. Now, deriving Eq.(4.15) for D_1 and D_2, we obtain the total effect on income of public deficit, D_1 and D_2:

$$\frac{dY}{dD_1} + \frac{dY}{dD_2} = \frac{1 - n\beta(\alpha + n_0\xi)D_1^{n-1}}{k} + \frac{1 - n\beta(\alpha + n_0\xi)D_2^{n-1}}{k} + \frac{c_1\gamma(\theta - 1)}{k} \qquad (4.16)$$

If consumption is completely dependent on permanent income, that is if $\vartheta = 0$, the total effect is equal to:

$$\frac{dY}{dD_1} + \frac{dY}{dD_2} = \frac{1 - n\beta(\alpha + n_0\xi)D_1^{n-1}}{k'} + \frac{1 - n\beta(\alpha + n_0\xi)D_2^{n-1}}{k'} - \frac{c_1\gamma}{k'} \qquad (4.17)$$

where:

$$\frac{1}{k'} = \frac{1}{1 + n_1 + \alpha\delta + n_0\xi\delta} \qquad (4.18)$$

is a smaller multiplier of Eq.(4.10), due to the absence of c_0.

If we assume a simple linear relation between public deficit and inflation expectations, with exponent of D_1^n and D_2^n equal to unity, the effect of deficit spending on income becomes

$$\frac{dY}{dD_1} + \frac{dY}{dD_2} = \frac{1 - \beta(\alpha + n_0\xi)}{k} + \frac{1 - \beta(\alpha + n_0\xi)}{k} + \frac{c_1\gamma(\theta - 1)}{k} \qquad (4.19)$$

Hence:

$$\frac{dY}{dD_1} + \frac{dY}{dD_2} < 0 \qquad (4.20)$$

if

$$\left\{2\left[1 - \beta(\alpha + n_0\xi)\right] - (1-\theta)c_1\gamma\right\} \prec 0$$

or if

$$|2| \prec |2\beta(\alpha + n_0\xi) + (1-\theta)c_1\gamma| \qquad (4.21)$$

Finally, inequality (4.21) holds greater the CBRF of monetary market, β, and exchange ξ market, the non Keynesian component of consumption, $c_1(1-\vartheta)$, the "super-Ricardian" effect, γ.
If we relax previous assumption of linearity between public deficit and inflation expectations, and we suppose non-linearity and asymmetry in effects of public deficit on inflation expectations, public deficit will switch in cubic functions, D_1^3 and D_2^3.
Now:

$$\frac{dY}{dD_1} + \frac{dY}{dD_2} = \frac{1 - 3\beta(\alpha + n_0\xi)D_1^2}{k} + \frac{1 - 3\beta(\alpha + n_0\xi)D_2^2}{k} + \frac{c_1\gamma(\theta - 1)}{k} \qquad (4.22)$$

Reminding the key role of CBRF, and naming:

$$\beta(\alpha + n_0\xi) = RF$$

$$\frac{dY}{dD_1} + \frac{dY}{dD_2} < 0 \qquad (4.23)$$

if

$$1 - 3\beta(RF)D_1^2 + 1 - 3\beta(RF)D_2^2 - (1-\theta)c_1\gamma < 0$$

or if:

$$|2| \prec \left|2\left[(3\beta(RF)(D_1^2 + D_2^2)\right]\right| + |(1-\theta)c_1\gamma| \qquad (4.24)$$

Asymmetrical effects of public deficit on inflation expectations increases, in comparison with the case of consolidation , probability of success of fiscal but it is worth mentioning that in such a case non linearity increases inequality probability because fiscal retrenchment is helped by an easing monetary policy that increases investment and net export. but this is not a case of pure fiscal policy.

6. An Empirical Analysis

In this section we check out the existence of a relationship between interest rate setting and a set of explanatory variables like inflation expectations, deficits, output gap, and other macroeconomic

factors that could affect monetary policy decisions. Our approach to modelling inflation expectations and monetary policy follows the idea, introduced by Ball (2000), of the so called "nearly rational" approach. It assumes that, in forming expectations (of any variables), economic agents optimally use all information in the past values of such a variable. That is, we assume that expectations are based on optimal univariate forecasts. This "near rational" approach to expectations can explain why inflation appears so sluggish in past two decades.
First, we consider the basic relationship between interest rate setting and inflation expectations with a standard OLS methodology. Second, we use a Kalman filter approach in order to observe how the coefficients of each variable of the model have changed over time. Finally we move our analysis to the study of linear-nonlinear relationships of an augmented Taylor rule where we test the assumptions made in the theoretical model of nonlinear reactions of the Central Bank to Deficit. Using monetary policy reaction functions, this section examines whether monetary policy responds to deficit in two central banks, namely, ECB and FED.

6.1 Data Analysis

The choice of the sample 1999-2006 for ECB and FED, using monthly observations, was essentially based on the need of analysing the behaviour of both monetary authorities after that the launch of the Euro currency took place. We describe, in appendix III, the variables that will be used in our empirical analysis.

6.2 Preliminary Evidences

A first step of the analysis requires to test the relationship between a CBRF to inflation expectations. The assumption underlying this relationship is using HCS (Harmonised Consumer Survey) and MSCI (Michigan Consumer Sentiment Index) variables as indicators of inflation expectations. We postulate that they are positively correlated with the interest rate settled by central banks. We think there is a strong influence of inflation expectations on interest rate setting. Therefore, inflation expectations dynamic is crucial in determining monetary authority co-operative behaviour in case of fiscal consolidation. We use, for the ECB and FED, respectively Repurchase Rate and the Federal Funds Rate.
Figures 1 and 2 present the patterns of the most representative economic variables and their trends in order to explain the different behaviours of the two Central Banks.
Figures 1 and 2 give a preliminary evidence that there is a relation between interest rate and inflation expectations. Moreover they evidence that it seems to be a relation between deficit and inflation expectations for the ECB, while for the FED it does not seem to exist. Thus, this raw data analysis suggests a deeper investigation in the relationships between interest rate and inflation expectations and its determinants.

Figure 1 EU Macroeconomic Variables and their Trends

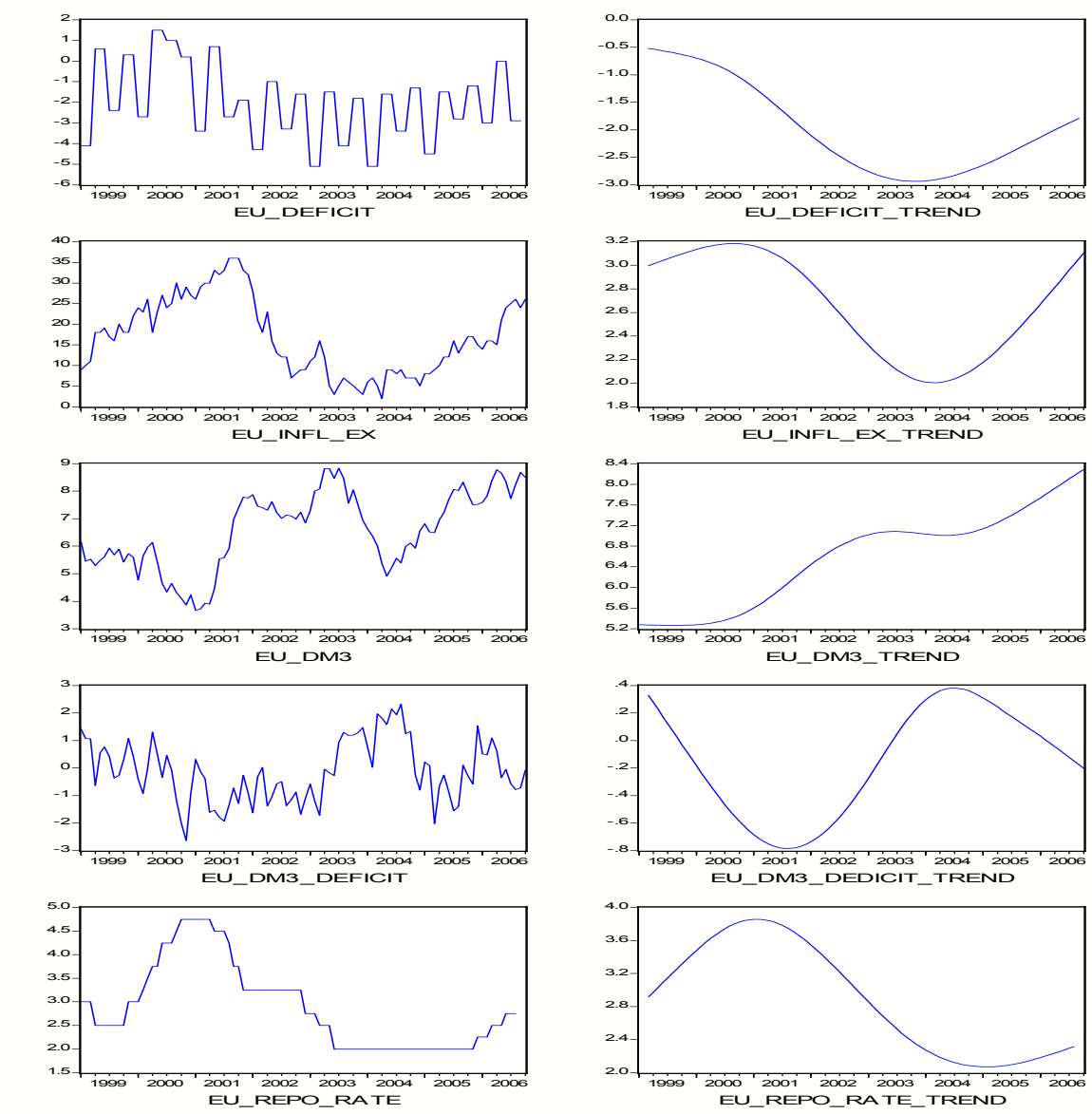
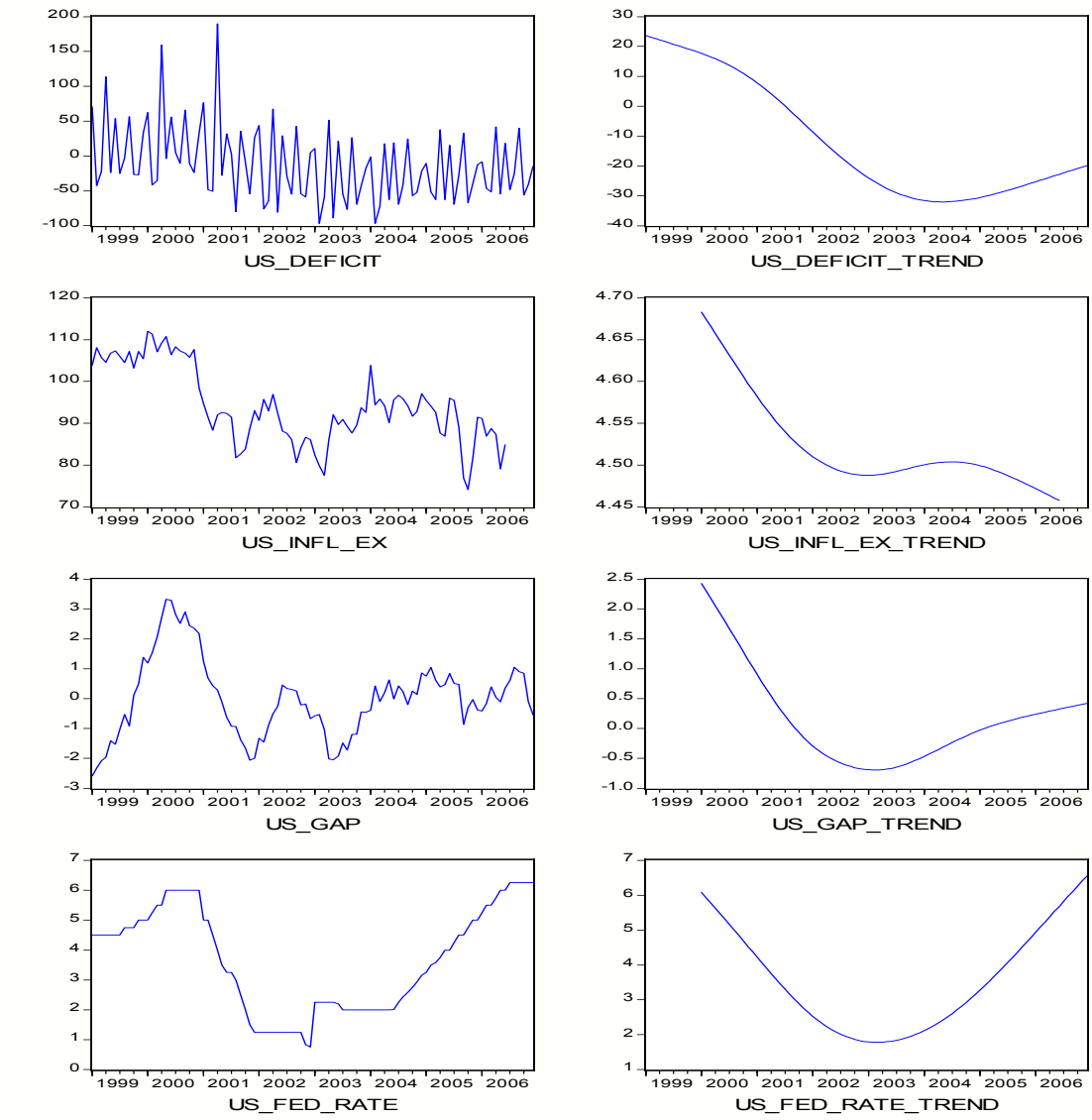


Figure 2 US Macroeconomic Variables and their Trends



Therefore, we start our empirical analysis applying an OLS estimation with several lags of the dependent variable. However, it is well established in the literature that, because of the correlation of the lagged dependent variable to the transformed error term, standard fixed effects estimators of models with lagged dependent variables result in biased and inconsistent estimates unless the number of time periods are large (see Ridder & Wansbeek 1990, and Kiviet 1993). In this model, T = 92, hence the bias is negligible.

We assume that central bank cooperation will depend on inflation expectations dynamics in the following way:

$$R_t = \alpha + \sum_{i=1}^{n} \beta_{j,i} \pi^e_{t-n} + \varepsilon_t \qquad (6.2.1a)$$

or

$$R_t = \alpha + \sum_{i=1}^{n} \beta_{j,i} \left(\pi^e - \pi\right)_{t-n} + \varepsilon_t \qquad (6.2.1b)$$

The results of the estimations of equations (6.2.1a) and (6.2.1b) for ECB and FED are presented in tables 1 and 2. The best measure is given by the relation between overnight rate and inflation gap, a quarter lagged.

Tab. 1 EUROPEAN CENTRAL BANK INTEREST RATE REACTION TO INFLATION EXPECTATIONS.

	REPURCHASE RATE		**OVERNIGHT RATE**	
		R_squared		**R_squared**
π_t^e	0.078 (11.939)	0.618	0.077 (12.293)	0.61
π_{t-1}^e	0.079 (12.208)	0.629	0.078 (11.59)	0.61
$\left(\pi^e - \pi\right)_t$	1.103 (7.715)	0.403	1.092 (7.473)	0.383
$\left(\pi^e - \pi\right)_{t-4}$	1.347 (8.549)	0.601	1.347 (10.825)	0.577
Source: ECB and European Commission				

Tab. 2 FED INTEREST RATE REACTION TO INFLATION EXPECTATIONS.

	FED DISCOUNT RATE		**FED FUND RATE**	
		R_squared		**R_squared**
π_t^e	0.078 (4.554)	0.20	0.11 (6.492)	0.30
π_{t-1}^e	0.081 (4.509)	0.20	0.118 (6.545)	0.32
$\left(\pi^e - \pi\right)_t$	2.53 (7.164)	0.30	1.782 (4.396)	0.11
$\left(\pi^e - \pi\right)_{t-4}$	2.49 (6.808)	0.25	1.826 (4.541)	0.11
Source: FED and University of Michigan				

6.3 The Kalman Filter Methodology

Then, we proceed to the identification of the coefficient of inflation expectations in eq. (6.2.1a) and (6.2.1b) in a more sophisticate way. In order to recover the parameter dynamics overtime, we estimate eq. (6.2.1) employing the Kalman filter algorithm. Our second step refers to the selection of the best lagged variables using the time varying coefficients methodology. Generally, the choice of explanatory variables depends on their statistical significance in the model.
The Kalman Filter is a popular method which can be used to estimate unobserved variables, provided they appear as explanatory variables in a model that can be written in a "state space form". Hence, the system must be written in a state space form with a measurement equation in a matrix format:

$$y_t = Z.X_t + \gamma_t \quad \text{with} \quad \gamma_t \sim N(0, H) \qquad (6.3.1a)$$

where y_t is the value of output gap, while X_t is a matrix of dimension *(Txk)* which includes all the explanatory variables plus a constant; the state vector *Z*, a (*kx1*) vector that contains all the slope coefficients, which are now varying through time and γ_t represents residuals with variance/covariance matrix H.. The transition equation in a matrix format:

$$Z_t = T.Z_{t-1} + v_t \qquad (6.3.1b)$$

where *vt ~ N (0,Q),* and T is a vector of parameters. Such a model may be estimated by means of a Kalman filter.

In principle, with this method all the parameters of the model may be estimated. In practice, there might be a trade-off between the number of parameters being estimated and the convergence of the likelihood function. More specifically, a key variable to the estimation of such models is the relative smoothness of the unobserved variable, which is governed by the relative size of the error variances in (6.3.1a) and (6.3.1b). The higher the ratio of the variance of the transition to the measurement equation residuals, referred to as the "signal-to-noise ratio" (Q/H), the more explanatory power is given to the unobserved variable, and the better the fit of the measurement equation. In the limit, for very large values of Q, the unobserved variable may soak up all the residual variation in the measurement equation. Alternatively if Q is zero, then it will be estimated as a constant.

In practice, most studies fix the signal-to-noise ratio so that the estimated unobserved variable is relatively smooth, with fluctuations which are judged to be reasonable from one period to another, which Gordon (1997) qualifies as "the [unobserved variable] can move around as much as it likes, subject to the qualification that sharp quarter-to-quarter zigzags are ruled out"[20].

The Time Varying Methodology allows us to recover an unobservable factor that could affect the repo rate.

We then apply a time varying parameters model as follows:

$$R_{it} = \alpha_{it} + b_{1it}\pi_{it-1} + b_{2it}\pi_{it-2} + ... + b_{n,it-n}\pi_{it-n} + \gamma_{it} \qquad (6.3.2)$$

where *i* is the country, γ_{it} is an independent white noise and the coefficients are assumed to be random walks. This can be written in state space form where the observation equation is given by (3) above and the state equations are given by:

$$\begin{bmatrix} \alpha_t \\ b_{1it} \\ b_{2it} \\ \dots \\ b_{nit} \end{bmatrix} = \begin{bmatrix} 1 & 0 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 \\ \dots & \dots & \dots & \dots & \dots \\ 0 & 0 & 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} \alpha_{t-1},\dots\alpha_{t-n} \\ b_{1t-1},\dots b_{1t-n} \\ b_{2t-1},\dots b_{2t-n} \\ \dots., \quad \dots.. \\ b_{nt-1},\dots b_{nt-n} \end{bmatrix} + \begin{bmatrix} v_{it} \\ v_{1it} \\ v_{2it} \\ \dots \\ v_{nit} \end{bmatrix} \qquad (6.3.3)$$

The model in equations (6.3.2) and (6.3.3) was initially estimated by maximum likelihood and the estimated variances are presented in table 3. Since we consider the time variation in parameters very important and its implication in defining a more reliable monetary policy, we need to test five hypotheses regarding the constancies of all or part of the parameters in Eq. (6.3.3). Accordingly, we test five hypotheses:

1. $H_0^1 : \sigma_v^2 = \sigma_{v1}^2 = \sigma_{v2}^2 = \sigma_{v3}^2 = 0$ which implies that all parameters in eq. 3 are constant;

20 See Bank of England (1998) for a survey. Some exceptions are Apel and Jansson (1998, 1999) for Sweden, Kichian (1999) for Canada. These are countries specific studies, using quite sophisticated models.

2. $H_0^2 : \sigma_\nu^2 = 0$ which implies a constant intercept but time variation in the persistence parameters;
3. $H_0^3 : \sigma_{\nu 1}^2 = 0$ which implies a time-varying intercept but a constant inflation expectations parameter with one lag.
4. $H_0^4 : \sigma_{\nu 2}^2 = 0$ which implies a time-varying intercept but a constant inflation expectations parameter with two lags.
5. $H_0^5 : \sigma_{\nu n}^2 = 0$ which implies a time-varying intercept but a constant inflation expectations parameter with "n" lags.

In order to test these hypotheses, we estimate the restricted versions of the model.
The maximum number of lags used is n=5; the hypotheses in 1), 2), 3), 4) and 5) can be tested using likelihood ratio test (LR test). This test statistics follow a χ^2 distribution with R degrees of freedom under the null hypothesis[21]. The results from these five tests are given in table 4.

Table 4 Variance of the parameters from Kalman filter of equations (3) and (4).

Variance	USA	EUM
σ^2_{ν}	3.958×10^{-7}	6.875×10^{-6}
$\sigma^2_{\nu 1}$	3.857×10^{-6}	4.269×10^{-7}
$\sigma^2_{\nu 2}$	3.098×10^{-6}	7.546×10^{-6}
$\sigma^2_{\nu 3}$	8.153×10^{-6}	6.172×10^{-7}
$\sigma^2_{\nu 4}$	4.589×10^{-7}	5.771×10^{-7}
σ^2_{μ}	3.547×10^{-5}	5.334×10^{-6}

Tab. 4 Likelihood Ratio Test (LR test)

		USA	EUM
$H_0^1 : \sigma_\nu^2 = \sigma_{\nu 1}^2 = \sigma_{\nu 2}^2 = \sigma_{\nu 3}^2 = 0$	$\chi^2_{LR}(4)$ ♦	524.65**	451.77**
$H_0^2 : \sigma_\nu^2 = 0$	$\chi^2_{LR}(1)$	623.69**	479.54**
$H_0^3 : \sigma_{\nu 1}^2 = 0$	$\chi^2_{LR}(1)$	598.71**	396.98**
$H_0^4 : \sigma_{\nu 2}^2 = 0$	$\chi^2_{LR}(1)$	608.26**	413.36**
$H_0^5 : \sigma_{\nu 3}^2 = 0$	$\chi^2_{LR}(1)$	588.45**	389.58**
$H_0^6 : \sigma_{\nu 4}^2 = 0$	$\chi^2_{LR}(1)$	651.94**	405.86**
Sample		1999:01/2006:10	1999:01/2006:10

[21] A likelihood ratio test is calculated as the ratio of the likelihood of the sample data at the hypothesised value of β to the maximum of the likelihood function (i.e. evaluated at the MLE). Hence we calculate (for H_0: $\beta = \beta_0$ vs $\neq 0$)
$LR = \lambda = L(\beta_0)/L(\beta_{ML})$ with $\lambda < 1$. If it is near to 1 we accept H_0, if not we reject. We now need the distribution of λ. In some simple problems this can be worked out, but usually not. Fortunately it can be shown that $-2 \ln \lambda \sim \chi^2$ in large samples, with *q* degrees of freedom where *q* is the number of restrictions in H_0. Now, large values of the test statistic (minus twice the log-likelihood ratio) reject H_0.

♦ $\chi^2_{LR}(R)$ **are the test statistics from the likelihood ratio tests of whether the variances in the equations for the parameters of the model are zero. ** significant at the 1% level;**

First, it can be noted that $H_0^1 : \sigma_v^2 = \sigma_{v1}^2 = \sigma_{v2}^2 = \sigma_{v3}^2 = 0$ is forcefully rejected for all countries and we conclude that some kinds of time-variation in coefficients seem to be important. The tests support also that the constant intercepts for all countries are time-varying. Rejecting $H_0^3 : 0, H_0^4 : 0, H_0^5 : 0$ and $H_0^6 : 0$ it connotes that the π^e_{t-1}, π^e_{t-2}, π^e_{t-3} and π^e_{t-4} are not constant.

In conclusion, null hypotheses are rejected for both countries and for all tests. Based on the above results, we conclude that the unrestricted models in equations (6.3.2) and (6.3.3) are preferred and we do not need to impose any restriction on them.

Once estimated the dynamic coefficients of the unrestricted model in Eq. (6.3.3), we see the contribution of each inflation expectations (*n)* at time *t* in our interest rate setting as presented in table 5 and in figures 8-9 .

In equation (6.3.2), the coefficient 'b', estimated using Kalman Filter approach against interest rates (EU Repurchase rate and US FED Fund rate), permits to evaluate the evolution of the ECB and FED responsiveness to inflation expectations. The empirical results are summarized in table 5.

Tab. 5 , The Kalman Transition Equation 1999-2006

ECB	Constant	INFLEX (-4)
Coefficient	-0.215	1.0971**
z-Statistict	*(-0.4562)*	*(5.212)*
FED	Constant	INFLEX (-1)
Coefficient	-4.981**	0.7128**
z-Statistic	*(-4.863)*	*(4.304)*

* significant at the 0.05 level; ** significant at the 0.01 level

The maximum likelihood estimates show that the parameters of the time varying coefficients "b" are positive, as predicted by the model, and highly significant for both countries. Figure 3 shows the behaviour of the coefficient 'b_t', for the sample, February 1999 to December 2006.

More precisely, as suggested by the analysis, the evolution of the ECB and FED responsiveness to inflation expectations reflects the behaviour postulated in the theoretical model and shown in figure 4.

Observing ECB behaviour, it increased steadily at the beginning of the sample and remain high till the end of 2004 when it inverted the trend, implying a tight monetary policy (high interest rate responses to high inflation expectations). The Federal Reserve increased its instrumental variable till the end of 2001 when noticeably inverted its trend, implying a monetary policy more "output oriented" (low interest rate responses to high inflation expectations).

Fig. 3 Kalman Filter's Coefficients and Trends

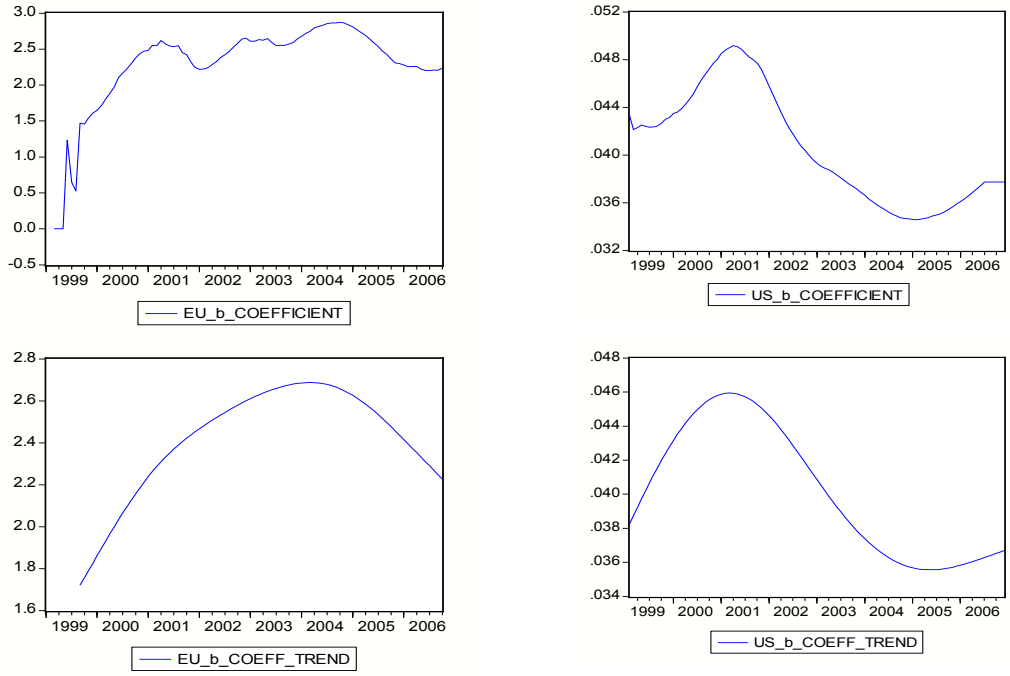


Fig. 4 EURO RED PARR and US Deficit and "b" Trends

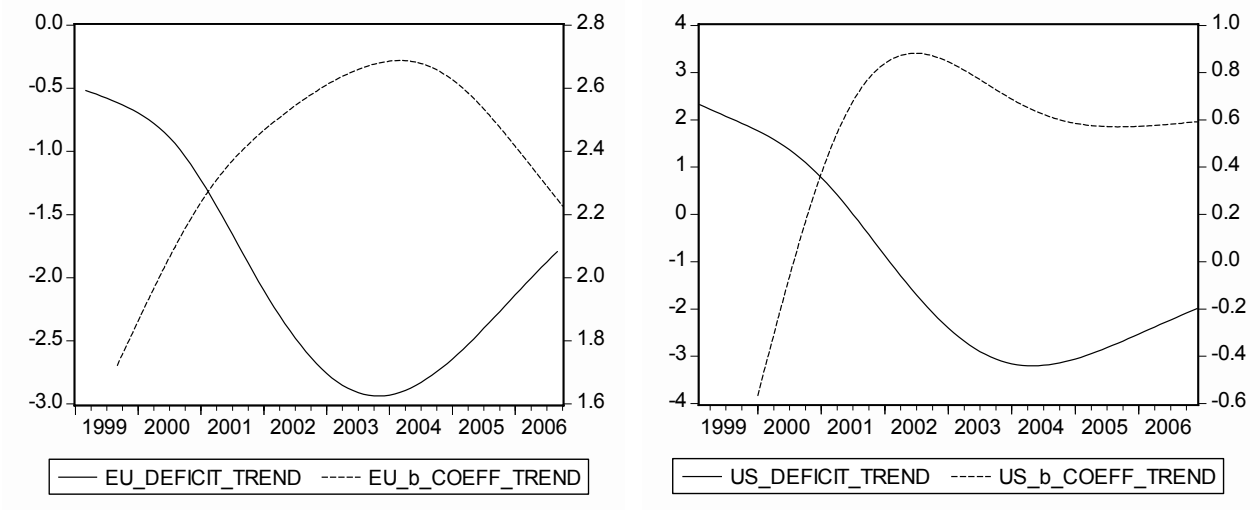


Figure 4 suggests that our model intuition of non-linear relationship between inflation expectations and deficit could be indirectly confirmed by the Kalman Filter analysis. Thus, it seems that a non-linear test for this relation and its analysis is needed.

6.4 Non-linear Analysis

The Smooth Transition Regression Model

In order to explain and analyze the non-linear policy behaviour of a central bank, a non-linear time series model is required. In this work we apply the smooth transition regression (STR) model. Despite the Markov-switching model, this methodology allows the regression coefficients to change smoothly from one regime to another. Moreover, in the STR model, the switching from one regime to another is endogenous, and gives opportunity for an economic explanation of the non-linear behaviour.

The STR model is defined as follows

$$r_t = \phi' z_t + \theta' z_t G(\gamma, c, s_t) + u_t \qquad (6.4.1)$$

and

$$G(\gamma, c, s_t) = (1 + \exp\{-\gamma(s_t - c)\})^{-1} \qquad (6.4.2)$$

Zt is a vector of explanatory variables. *G(γ,c,st)* is the transition function. *G(γ,c,st)* $\in$ [0;1], and it is continuous in the threshold/transition variable *st* . *st* is not necessary contained in *Zt*. *c* is the threshold around which the regimes are defined. γ is the slope parameter that determines the smoothness of the transition between regimes.
It is possible to assume that nonlinearities in the Taylor rule equation can be described adequately by a Logistic or an Exponential Smooth Transition model (LSTR and ESTR respectively)[22].
However, in this paper we define *G(γ,c,st)* as a logistic function of first order so that the STR model becomes a logistic smooth transition model (LSTR).
Defining *st* as the deficit (*dt*), the LSTR specification implies that the coefficient on deficit would take different values depending on whether deficit is below or above the threshold value "*c"*. This would mean that whenever deficit is beyond a particular level, the reaction of the monetary authority becomes more aggressive, leading to a larger response of interest rates when the deficit increases. On the other hand, when deficit is below the threshold "*c"*, the monetary authority reaction is milder.
In the case of the ESTR model, the coefficient changes depending on whether deficit is close or far away from the threshold "*c"*, regardless of whether this difference is positive or negative. In this case we would have that the reaction of the monetary authority is equally aggressive for negative or positive deviations from the threshold.
Given the above two specifications, we decide to apply the LSTR methodology because it fits well with the idea that a reasonable asymmetric reaction of central bank should take into account the sign of the deviation from the threshold value. Hence, the more the deficit is above the threshold, the stronger the central bank reaction should be. On the contrary, the more the deficit is below the threshold, the less aggressive the monetary authority reaction should be.
The equations (6.4.1) and (6.4.2) can be rewritten as a linear regression model with time varying coefficients. Hence, rewriting equation (6.4.1) as

[22] See Granger and Terasvirta, 1993.

$$r_t = \delta' z_t + u_t \qquad (6.4.3)$$

where

$$\delta_j = \phi_j + \theta_j G(\gamma, c, s_t) \qquad (6.4.4)$$

Thus, $\delta_j \in \left[\phi_j, \phi_j + \theta_j\right]$ and it changes monotonically with the deficit. When $\gamma = 0$ the logistic function is equal to 0.5 and the model is linear, when $\gamma \to \infty$ the LSTR approaches to a threshold model with two regimes.

Linearity Test

In order to test for linearity it should be tested the hypothesis that $\gamma = 0$ in the non-linear model. Unfortunately our model is not defined under the null. This problem can be avoided approximating the transition function with a Taylor-series expansion of the third order around the null hypothesis $\gamma = 0$, see Tarasvirta (1998). After the approximation, using the deficit as the threshold variable, the following auxiliary regression is obtained

$$r_t = \alpha_{00} + \alpha_{01} d_t + \alpha_{02} y_t + \sum_{j=1}^{3} (\alpha_{j1} d_t + \alpha_{j2} y_t) d_t^j + u_t^* \qquad (6.4.5)$$

Hence, the linearity test can be carried out with

$$Ho: \alpha_{11} = \alpha_{12} = \alpha_{21} = \alpha_{22} = \alpha_{31} = \alpha_{32} = 0$$

The results of linearity test on equation for the FED and the ECB are reported in table 5.

Tab. 5 P-VALUES FOR THE LINEARITY TEST.

	ECB	FED
H0: Linearity Model	0.0260	0.1151

Hence, an important result that can be drawn from this preliminary linearity test is that a linear model could be used to describe the FED behaviour while, a nonlinear model, should be the most appropriate one for the ECB in the observed period (1999-2006).

The LSTR Model Estimation

The LSTR model has been used to estimate the Taylor rule, as specified in the previous sections. In order to do it, the deficit is chosen as the threshold variable. Thus, the LSTR model takes the following form

$$r_t = \phi_0 + \phi_1 d_t + \phi_2 y_t + (\theta_0 + \theta_1 d_t + \theta_2 y_t) G(\gamma, c, d_t) + u_t \qquad (6.4.6)$$

and

$$G(\gamma, c, d_t) = (1 + \exp\{-\gamma(d_t - c)\})^{-1} \qquad (6.4.7)$$

where *rt* is the interest rate, *dt* is the deficit and *yt* is the output gap.
Table 6 shows that the γ parameter of the FED is close to zero, evidencing a very smooth transition. The deficit threshold for a reaction is estimated to be 4.76895. These conclusions are consistent with the results found in the linearity test (Table 5). In fact, in table 7 we calculate several levels of G corresponding to different levels of deficit. The calculated FED response shows that the reaction is extremely smooth since it ranges from 2.6 to 2.7.

Tab. 6 LSTR MODEL FOR THE FEDERAL RESERVE.

PARAMETER	ϕ_0	ϕ_2	θ_1	Γ	C
Estimate	6.0524	5.09716	4.3359	0.01019	4.76895
Standard error	7.8015	0.82455	0.05213	0.00481	2.73345
Palue	0.44	0.000	0.000	0.037	0.084
Sample period 1999-2006 R^2 0.52 Error Variance^(1/2) = 1.17352					

Table 7 THE FEDERAL RESERVE'S RESPONSE TO DEFICIT.

DEFICIT	4.5	4.6	4.7	4.8	4.9	5.0	5.1	5.2
G(γ,c,dt)	0,499315	0,49957	0,499824	0,500079	0,500334	0,500589	0,500843	0,501098
Fed response	2,164979	2,166084	2,167188	2,168293	2,169398	2,170502	2,171607	2,172711
The Federal Reserve's response: 4.3359*G								

Tab. 8 LSTR MODEL FOR THE EUROPEAN CENTRAL BANK.

PARAMETER	ϕ_0	ϕ_2	θ_1	Γ	C
Estimate	2.29556	0.77323	2.40118	15.2458	3.60975
Standard error	0.2955	0.19855	0.19853	0.11575	1.04585
P-value	0.002	0.001	0.001	0.000	0.005
Sample period 1999-2006 R^2 0.67 Error Variance^(1/2)= 1.18688					

Tab. 9 THE EUROPEAN CENTRAL BANK'S RESPONSE TO DEFICIT.

DEFICIT	3.3	3.4	3.5	3.6	3.7	3.8	3.9	4.0
G(γ,c,dt)	0,008816	0,039248	0,157994	0,462907	0,798337	0,947872	0,988169	0,9974
ECB response	0,021168	0,094242	0,379373	1,111522	1,916951	2,276011	2,372771	2,394937
The European Central Bank's response: 2.40118 *G								

Tables 8 and 9 illustrate the results for the ECB using the same methodology. The γ parameter is higher, thus the transition for the European Central Bank is less smooth around the threshold value.

It is worth noting that a) the threshold for the reaction is 3.60975; b) the ECB reaction thresholds is very close to the value fixed by the stability pact (3.00); c) these results are consistent with the linearity test output presented above (table 5) since the reaction of the ECB shows an asymmetric response. Moreover, we can asses that the ECB reaction is more asymmetric than the FED one; and d) the ECB reaction increases sharply when the deficit is above the threshold value.

7. Conclusions

NKV success in mainstream economics can be, initially ascribed to the climate of progressive criticism that, in the early 90's, regarded expansionary fiscal policies as a tool for achieving full employment. Those criticisms founded their rationales in the tide of massive disbelief in Keynesian tools, as crowding-out debate, trigger of financial instability due to growing stocks of public debts, Ricardian equivalence approach to policy making testify.
NKV deepened scepticism for fine-tuning target of public deficit as a last addendum to a decade of attacks to the Keynesian theory, trying to prove opposite, negative of "pure fiscal policy" on equilibrium income.
The intent to build an alternative point of view was considered so appealing to make them blind on the true causes of the success of some isolated experience of expansionary fiscal retrenchments: success was due to a policy mix that Keynesian experience, particularly in United States in the early 80's, had already widely examined, arguing the advantages of a mix of restrictive fiscal policies and easing monetary policies. Therefore, NKV success is much more the result of "consolidated results" of co-operative economic policies rather than an "unconventional wisdom".
The intent of our paper was to analytically prove that increase (decrease) in consumption and decrease (increase) of inflation expectations cannot result from pure fiscal retrenchments (expansions): in a few words, to deny the existence of a "super-Barro" effect and underline the crucial role of monetary stance in accompanying fiscal policy. It seems, in our opinion, a too weak manifesto for a revolution in the theory and policy making. Nothing new has happened but an over-stress of "Barro Effect" on consumption.
European Central bank, much more than Federal Reserve, was immediately prone to accept NKV theoretical background De Grauwe (2002), because it seemed a good theoretical underpinning for fiscal retrenchments and public sector shrinking. The label these constrained policies as Stability and growth Pact is the most evident belief in "Keynesian effects of non-Keynesian fiscal policies". This could help understand why NKV, despite its unequivocal limits, became the new conventional wisdom in Europe. It should be wise to day, not only, to see their shortcomings, but be aware that "new" policies come from far and their outcomes depend on many surrounding and exogenous conditions.

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APPENDIX I

CBRF is micro-founded through the CB LOSS FUNCTION

Money market equilibrium can be expressed in the following form:

$$m = ky - hR + \pi$$

where m is the demand of bank reserves - (M_3) expressed in terms of growth rate – which is a positive function of income growth ky and inflation π and a negative function of the rate of interest hR.

The loss function of the Central Bank is obviously linked to the growth rate of money:

$$L = L(m)$$

Or

$$L = L(y, R, \pi)$$

Writing the loss-function in an explicit and very simple form we have:

$$\sum L_i = \frac{1}{2}\left(ky_i + \pi_i - hR_i\right)^2$$

The Central Bank looks for the rate of interest - the instrument – which minimize the loss-function or the m rate of growth. Because m depends on y and π, it is a maximization problem subject to the vinculum:

$$sub \begin{cases} y_i = -\rho(R - \pi^e{}_i) \\ \pi_i = \sigma y_i + \pi^e{}_i \end{cases}$$

Where the first equation is a IS curve and the second one is a supply curve AS.

Substituting the IS constraint in the AS one we have:

$$\pi_i = -\sigma\rho R + (1 + \sigma\rho)\pi^e{}_i$$

Considering - for the sake of simplicity - just one period of time and substituting the vinculum in the loss-function we have the following Taylor rule:

$$R = \frac{h(1+\sigma) + \sigma\rho(\sigma\rho + 1)}{h^2 + \sigma^2\rho^2 + 2h\sigma\rho}\pi^e{}_t + \frac{k(\sigma\rho + h)}{h^2 + \sigma^2\rho^2 + 2h\sigma\rho}y_t$$

Which is the monetary policy rule curve (MP curve) which allows to find the aggregate demand. In turn the aggregate demand curve combined with the AS curve determines the equilibrium income.

Finally, indicating:

$$\beta = \frac{h(1+\sigma) + \sigma\rho(\sigma\rho + 1)}{h^2 + \sigma^2\rho^2 + 2h\sigma\rho}$$

and

$$\partial = \frac{k(\sigma\rho + h)}{h^2 + \sigma^2\rho^2 + 2h\sigma\rho}$$

The Taylor rule, then, becomes :

$$R = \beta\pi^e{}_t + \delta y_t$$

Appendix II.

Taxonomy of deficit increase effects

	$\Delta Y/\Delta D_1$	$\Delta Y/\Delta D_2$
No restrictive assumptions	$\frac{1-n\beta(\alpha+n_0\xi)D_1^{n-1}}{1-\vartheta c_0+n_1+\delta(\alpha+n_0\xi)}$	$\frac{1-n\beta(\alpha+n_0\xi)D_2^{n-1}}{1-\vartheta c_0+n_1+\delta(\alpha+n_0\xi)}+\frac{c_1\gamma(\theta-1)}{1-\vartheta c_0+n_1+\delta(\alpha+n_0\xi)}$
NX =0	$\frac{1-n\beta\alpha D_1^{n-1}}{1-\vartheta c_0}$	$\frac{1-n\beta\alpha D_2^{n-1}}{1-\vartheta c_0}+\frac{c_1\gamma(\theta-1)}{1-\vartheta c_0}$
$\theta=0$	$\frac{1-n\beta(\alpha+n_0\xi)D_1^{n-1}}{1+n_1+\delta(\alpha+n_0\xi)}$	$\frac{1-n\beta(\alpha+n_0\xi)D_2^{n-1}}{1-\vartheta c_0+n_1+\delta(\alpha+n_0\xi)}-\frac{c_1\gamma}{1+n_1+\delta(\alpha+n_0\xi)}$
$\delta=0$	$\frac{1-n\beta(\alpha+n_0\xi)D_1^{n-1}}{1-\vartheta c_0+n_1}$	$\frac{1-n\beta(\alpha+n_0\xi)D_2^{n-1}}{1-\vartheta c_0+n_1}+\frac{c_1\gamma(\theta-1)}{1-\vartheta c_0+n_1}$
$\theta=0$ $\delta=0$	$\frac{1-n\beta(\alpha+n_0\xi)D_1^{n-1}}{1+n_1}$	$\frac{1-n\beta(\alpha+n_0\xi)D_2^{n-1}}{1+n_1}-\frac{c_1\gamma}{1+n_1}$
$\theta=1$	$\frac{1-n\beta(\alpha+n_0\xi)D_1^{n-1}}{1-c_0+n_1+\delta(\alpha+n_0\xi)}$	$\frac{1-n\beta(\alpha+n_0\xi)D_2^{n-1}}{1-c_0+n_1+\delta(\alpha+n_0\xi)}$
$\beta=0$	$\frac{1}{1-\vartheta c_0+n_1+\delta(\alpha+n_0\xi)}$	$\frac{1}{1-\vartheta c_0+n_1+\delta(\alpha+n_0\xi)}+\frac{c_1\gamma(\theta-1)}{1-\vartheta c_0+n_1+\delta(\alpha+n_0\xi)}$
$\gamma=0$	$\frac{1-n\beta(\alpha+n_0\xi)D_1^{n-1}}{1-\vartheta c_0+n_1+\delta(\alpha+n_0\xi)}$	$\frac{1-n\beta(\alpha+n_0\xi)D_2^{n-1}}{1-\vartheta c_0+n_1+\delta(\alpha+n_0\xi)}$
$\theta=1$ $\beta=0$ $\gamma=0$	$\frac{1}{1-c_0+n_1+\delta(\alpha+n_0\xi)}$	$\frac{1}{1-c_0+n_1+\delta(\alpha+n_0\xi)}$

APPENDIX III
Data Description

For the estimation of the equations used in this work, the variables considered were[23]:

a) Repo rate: it is the central bank interest rates also called official interest rates. It is the main instrument of the monetary policy that aims to achieve its primary objective of maintaining price stability. The Federal Reserve Discount Rate is the rate at which member banks may borrow short term funds directly from a Federal Reserve Bank. The discount rate is one of the two interest rates set by the Fed, the other being the Federal funds rate;
b) Overnight rate: it is defined as the rate that constitutes the very starting point of the yield curve and is normally perceived as being within the control of the central bank, for, it is thus also important to understand its dynamics. For the ECB it is called EONIA and it is an average, calculated on a daily basis, of the (lending) turnover in the unsecured overnight market of the 49 panel banks. For the FED the federal funds rate (FEDON hereafter) is the interest rate at which depository institutions lend balances (federal funds) at the Federal Reserve to other depository institutions overnight. These variables are from the European Central Bank and Federal Bank of St. Louis.
c) Harmonised Consumer Survey (HCS): it is the proxy of inflation expectations used for Europe. The European Commission's monthly HCS is conducted every month across the European Union as part of the joint harmonised EU program of business and consumer surveys. The consumer survey was initiated in May 1972, and is now carried out in all 25 current members of the EU. The survey is conducted on behalf of the European Commission by various national survey organizations. The sample size in each of the fifteen countries that were members of the EU prior to the most recent expansion ranges between 1,000 and 3,300 consumers. The survey asks a standard set of questions in all countries, and the results are reported each month by the European Commission, and used as inputs to the monthly economic and consumer sentiment indexes (M. A. Wynne, 2005). The proxy of the inflation expectations used for United States is the MCSI, conducted by the University of Michigan, which is a valuable guide to changes in consumer attitudes that may influence spending behaviour. The preliminary data is released on the tenth (except on weekends) of each month. A final report for the prior month is released on the first of the month.
d) Industrial production: due to the need of using monthly observation, it is taken as proxy of GDP. The Index of Industrial Production shows the movement of the volume of output of the Industrial Sector. It is one of the most important industrial short-term indicators which aim at measuring, on a monthly basis, the ups and downs of the volume of industrial output with a special focus on detecting, as early as possible, the turning points of the business cycle. This enables planners, decision makers and the business community at large to be aware of any sign of change in the progress of the economy in order to take appropriate and timely policy measures. Both indexes are from the IMF- Financial statistics.
a) Output gap ***(y_t)*:** it is the percentage deviation of monthly industrial production from the long run trend computed with the Hodrick-Prescott filter;
b) The Consumer Price Index (CPI) is used to calculate effective inflation (π_t), that is π_t is equal to *100*[ln(CPIt/CPIt-12)]*;
c) US Deficit: it is general government deficit (-) or surplus (+), expressed as percentage points, series(t)/GDP(t). The EU Deficit is defined similarly as Euro area 12 (fixed composition), General government Deficit (change in aggregated debt), expressed as percentage points, series(t)/GDP(t);
d) Finally, the variable DM3 is the contribution to the M3 annual growth rate by central governments[24] borrowing to Monetary and Financial Institutions (MFIs). "The relationship between MFI credit to general government and M3 can be illustrated in the context of the consolidated MFI balance sheet. An increase in the credit extended to general government by MFIs (either in the form of loans or as purchases of government debt securities) will expand the asset side of the MFI balance sheet. All other things being equal, the accounting identity underlying the balance sheet implies that either another item on the asset

[23] Data source: IMF - Financial Statistics, Federal Reserve Bank, European Central Bank, University of Michigan and European Commissiom.
[24] Balance Sheet Items; Frequency: Monthly; Reference area: Euro area (changing composition); Adjustment indicator: Working day and seasonally adjusted; BS reference sector breakdown: Monetary and Financial Institutions (MFIs); type: Contribution to the annual growth rate of M3; Counterpart area: Euro area (changing composition); BS counterpart sector: Central Government deficit.

side must shrink or the liabilities side of the MFI balance sheet must also expand, for instance, through an increase in M3 (which represents the largest component of MFI liabilities)"[25].

[25] ECB Monthly Bulletin, April 2004, page 45.