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MASTER'S THESIS

MONETARY, FISCAL POLICY AND REAL ECONOMIC ACTIVITY IN GREECE

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CONTENT OF THE THESIS

Abstract

The goal of this work, which concerns my master's thesis, is to examine the effect of monetary and fiscal policy on real economic activity in Greece. Specifically, the indicators which will be used here to display the behavior of economic activity in Greece will be real output, consumption and stock prices.

Its specification is the analysis of monetary and fiscal policy effects on real economic activity in Greece within a framework of the rational expectations hypothesis (REH). In other words, this work examines the ***effects of anticipated and unanticipated monetary and fiscal policy on real economic activity in Greece.***

I. HISTORICAL BACKGROUND

The crucial question which has been arisen concerning the economic science is: "Can the government help to stabilize the economy through active, interventionist policies?"

The answer that the economists give to it is different for different economic schools of thoughts, but especially over the last 20 years the macroeconomic theory concerning this question has undergone a revolution. This revolution is performed by the economic school of thought known as *rational expectations*.

Almost 40 years before, listening Keynesian economists, such as Tobin and Modigliani, one could hear that the government can remedy economic pains. On the other side, monetarists, like Friedman and Brunner, while acknowledging some effect of governmental economic policies in the short run, deny any such influence in the long run. Furthermore, they attribute most economic pain to governmental meddling in economic affairs. While recently, new classical economists, like Lucas and Sargent, the rational expectations theorists, have extended the previous ideas in a more dramatic conclusion : the stabilization policies are impotent even in the short run.

Of course, for each new economic theory (school) there was an economic event which gave reason for growing it up. For giving a clear view how they appeared, let's go through a very brief economical history.

In the '60s, the world of economics witnessed the massive triumph of the Keynesian revolution and so the neo-Keynesian economists dominated the macroeconomic analysis. According to them, if political leaders would listen their advice, another Great Depression would never occur again. The optimism of the neo-Keynesians was founded on a confidence in their tools of analysis - the IS/LM framework and the Phillips curve. By simple examples let see how do they work.

The IS/LM framework illustrates the effectiveness of fiscal policy as follows: a tax cut or more government spending increases the income of individuals and hence induces more spending (IS_1 shifts to IS_2 - Figure 1). The increase in spending generates an additional need for transactions money, which pushes up the interest rate. As a consequence, the initial increase in spending (y_3 - y_1) is reduced, but the final impact of fiscal measure remains positive (y_2 - y_1).

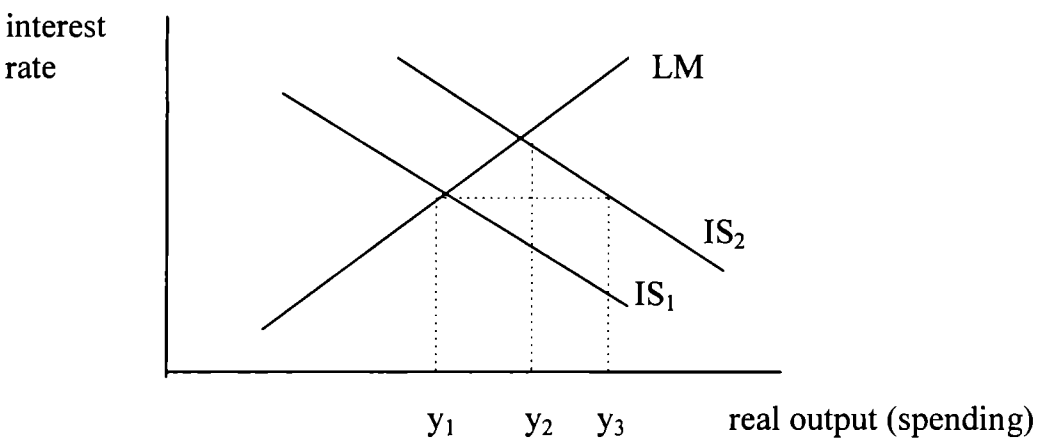

Figure 1

As far as the Phillips curve concerns, neo-Keynesians assumed that the relationship between unemployment and inflation is stable and that's why it is useful for government policy. Fiscal measures were considered effective to move the economy along the Phillips curve, setting it at a preferred combination of inflation and unemployment. A tax cut, for example, would induce more spending and a lower unemployment rate, as the IS/LM diagram indicates, but only at the expense of a higher inflation rate, as the Phillips curve predicts.

Based on these theoretical arguments, politicians began to believe to Keynesians. But in 1970, the confidence in Keynesians was shaken because of

the events of that time. The American economy was in its worst times. The economic demand of the Vietnam War propelled inflation rates. The breakdown of financial system happened when Nixon devaluated the dollar, which had functioned as a key currency and canceled its convertibility into gold. National economies faltered by bad harvests, disastrously low catches of anchovies off the coast of Peru and the OPEC oil shocks, all in 1973.

The result was an experience of high inflation rates and high unemployment rates throughout the 1970s. This experience seemed at odds with the Keynesians Phillips curve. Thus economists had to account for economic hardship. Some of them targeted the neo-Keynesian approach and advocated radically different answers to economic questions. Post-Keynesians, Marxists and monetarists economics were offered as alternatives and had to be reckoned with.

Above all the others, the monetarist critique turned out to be more effective despite the fact that during the 1950s and 1960s its influence was minimal. Therefore, the monetarists appeal to the classical belief in market forces, which had been rejected by Keynes, dominated the macroeconomic discourse in the early 1970s.

The distinction between the short and long run was the crucial element in the discussion between neo-Keynesians and monetarists. The former stressed the short run, adhering to Keynes's famous phrase "in the long - run we are all dead". Meanwhile, monetarists supported the *neutrality of money*. According to it, changes in money supply affect the price level and are neutral with respect to real output and employment. By contrast, for Keynesians money is non-neutral : an increase in the money supply (which causes a shift in the LM curve) brings down interest rates; lower interest rates induce more spending and real output increases. The monetarists contested this conclusion and claimed a neutral effect in the long run.

In 1968 Friedman added a significance dimension to the monetarist challenge concerning the Phillips curve. He asserted that the short - run Phillips

curve is highly unstable; if the government wishes to maintain a low unemployment rate, the inflation rate accelerates which causes an upward shift in the Phillips curve. Thus, the long - run tendency is toward a predetermined equilibrium rate of unemployment which was called by Friedman the *natural rate of unemployment*. The natural rate hypothesis asserted that there exists a fixed relation but not between economic aggregates and the rate of inflation. Instead, it is between these aggregates and the difference between the actual rate of inflation and expectations about the rate of inflation. In this way, if the actual aggregate output and employment are higher than their natural magnitudes, then the actual inflation rates are higher than the expected. Higher inflation rates than the expected tend to increase the inflationary expectations and so there will be steady increases in both the expected and the actual inflation rates. Exactly the opposite results (i.e., decreases in the actual and the expected inflation rates) will occur in the case where actual output and employment are below their natural rates.. Thus, according to natural rate hypothesis, there is no economic policy which can permanently keep output above and employment below their natural levels. The only service that economic policy can offer is to minimize the difference between the actual and expected inflation rates which will have as consequence the minimization of the difference between actual levels of output and unemployment and their natural levels.

The Friedman's argument of the above conclusion in more common explanation is like the following :

Suppose that the government attempts to reduce unemployment through an expansionary policy (more spending and/or more money). This results in more production and higher prices. Initially workers consider this increase in prices as temporary and do not adjust their price expectations, therefore they continue to work without being paid more than before. On the other hand, employers are getting higher prices without having to pay higher wages and

that is why they increase the demand for labour. The last one causes the unemployment to decrease.

But this situation isn't a permanent one because as the time goes by the workers understand that increases in prices aren't temporary. Therefore, they adapt their expectations and demand a higher wage which will decrease the demand for labour. Thus, fiscal policy has again only nominal effect.

From the abovementioned analysis it is clear that *adaptive expectations* and not rigid prices, as in the Keynesian story, are responsible for the occurrence of that disequilibrium; workers need time to adjust their expectations and hence are temporarily fooled.

Considering all those economical events and theoretical treatments, the monetarist challenge did not leave neo-Keynesian economists unaffected. For example, they had to acknowledge the significant role of money in the economy and could not deny the existence of a natural rate of unemployment in the long - run. On the other hand, neo-Keynesians questioned the length of the long - run and maintained that price rigidities bring about a short - run that is long enough to warrant government policies.

At about this point when the debate was blocked, the new-classical economists entered the debate with the assumption of *rational expectations*. With the appearance of rational expectations in a model the theoretical treatments of government's control would conclude in the stirring conclusion : there is no effective fiscal and monetary policy. This neutrality hypothesis, which was derived from these essential principles - market clearing, rational expectations, and only real variables matter - pointed out the new economic school : the neo - classical school.

Rational expectations and new classical economics are commonly taken as synonyms, but this interpretation is probably incorrect. It is so because a new classical economics necessarily beliefs in rational expectations, but a belief in RE by itself is not sufficient for one to be new classical. So, the principle of rational expectations can be employed by anyone who seeks a

convenient way of introducing endogenous expectations into an economic model. On the other hand, he can violate any of the tenets of the new - classical theory.

Since this work concerns the policy effectiveness under the rational expectation hypothesis, it would be appreciable the more detailed treatment of this hypothesis, which is presented in the following section.

II. THE RATIONAL EXPECTATIONS HYPOTHESIS : THEORETICAL CONSIDERATIONS

1. Rational expectations, its origin and evolution.

It is a well-known fact that all economic agents have expectations about the future events based on their information set. The question is that in which case these expectations should be considered as 'rational'.

In 1961 John Muth, who is recognized as the father of rational expectations, suggested that expectations of individuals in the context of a model are rational when they are identical with the predictions of that model. Rewriting his words 'Expectations ..... tend to be distributed, for the same information set, about the prediction of the theory (or the "objective" probability distribution of outcomes)'. In formal presentation it is

$$P_t^* = E_{t-1}(P_t/I_{t-1}) \qquad (1)$$

which says that the price levels P_t^* equals the optimal expectations of P_t at time t-1 (E_{t-1}) given all available information at time t-1 (I_{t-1}). Thus, the rational expectation of P_t formed at period t-1 is the mathematical expectation of P_t, conditional on the available information. Of course it is more natural to think that RE are formed about variables which are determined by recurring processes rather than variables which are unique or 'unusual' events, since the recurrent nature of the process is what allows it to be discerned. In this sense, RE are an equilibrium concept in which they are best seen as applying to processes which have recurred sufficiently often to have been discerned and they can help to define full equilibrium.

Within a common sense interpretation, one example would be: if people have the information that the money supply will increase and know that this will result in higher prices, then they will increase their price expectations and alter their behavior.

Muth claims that in rational expectations hypothesis three assertions are involved: first, information is scarce and economic system does not waste it; second, expectations are formed from the specific structure of the relevant system describing the economy; third, public predictions can have no substantial effects unless there is "inside" information, i.e., a (true) economic forecast does not give anyone a special opportunity to profit from it if it is known to everyone.

The Muth's idea about rational expectations took nearly 10 years before the economists began to use it. It was Lucas who unearthed it and gave a decisive impetus to a research of implications of rational expectations in macroeconomics.

This idea of rational expectations was used really wisely by Lucas and other new classical economists in their changes in thinking about the relation between government behavior and business cycles. So, in the case of *natural rate hypothesis*, variations in economic aggregates relative to their natural levels are associated with expectational errors involving differences between actual and expected rates of inflation.

The idea of rational expectations takes this line of thought one step further, which is a fundamental step. It is so because RE proposes a general theoretical approach to the study of expectations. The RE theoretical approach was based on the analysis of RE models. Being dependent on Muth's idea, the RE model is composed of 3 components :

The first component involves assumptions about the structure of the economy. These assumptions specify the relevance of expectations and perceptions for the market activities of private agents, the relation between the perceptions of government's monetary and fiscal actions and the interaction of the behavior of the private agents and the government to determine the aggregate variables - output, employment, unemployment - and the rate of inflation. One important assumption, for example, is that the information that is potentially relevant for private agents includes both knowledge of the

specification of the structure of the economy and knowledge of the past and current data of this structure.

The second component which is called also the 'rational expectations postulate', states that the private economic agents gather and use information efficiently. This efficiency means that the cost of resources used by private agents devoting gathering and using information is equal with the marginal benefit from the information.

The third component involves the specification of the availability and usability of information.

These models of RE, which were used mainly by new classical economists, were the great incentive for the revolution in economic thought. It is a revolution because the entrance of RE in a model pointed out a new view in macroeconomic policymaking - the human behavior. Before the revolution, the policymaking was viewed as an engineering problem. In 1960s, guiding the economy was similar to guiding a ship. Similar to an engineer's goal of keeping a ship on its course, a macroeconomic policymaker's goal was to keep the economy on a full employment, noninflationary path. The policy maker had the policy tools control, such as tax rates or base money similar to the engineer's levers and dials. This engineering paradigm required that the relationships which determine how the economy moves over time be invariant to changes in policy rules. That is, in order for an economic model to indicate how outcomes for goal variables, such as real growth and inflation, depend on the rules for setting the policy variables, the model's relationships can not change whenever the rule changes. In the early 1970s, Lucas flawed the engineering paradigm with the famous article "Expectations and the Neutrality of Money". His paper indicated that economic relationships in the macroeconometric models would be expected *to change* when relevant policy rules changed. Thus, economic models that were attempting to represent *human behavior* were fundamentally different from engineering models that were attempting to capture the movement of inanimate objects. But which would be the implication of RE

models on the policymaking decisions? This question will be in line of the discussion in the following section.

2. Rational Expectations, Neutrality and Non-Neutrality Hypothesis

The application of the RE models in theoretical treatments of new classical economists concluded in two propositions about the government behavior and the business cycles : the neutrality hypothesis and the non-neutrality hypothesis. In the following analysis it will be clear that the distinction between these two hypothesis is based mainly on the third component of RE models, i.e., the availability and usability of information.

The neutrality hypothesis, originated in Sargent and Wallace (1975, 1976), claims that the time pattern of differences between actual and natural levels of aggregate output and employment, which forms the main component of business cycles, is independent of monetary and fiscal actions that involve systematic responses to business cycle development. According to this proposition, systematic monetary actions affect only nominal variables.

The non-neutrality hypothesis, which is supported by Lucas (1972, 1975b, 1977) and Barro (1976), claims that the pattern of business cycles depends in a significant way on an important subset of monetary and fiscal actions.

The precise nature of neutrality hypothesis should be clarified. This hypothesis does not say that systematic government behavior in general cannot affect aggregate output and employment, instead, it affects economic aggregates only to the extent that it alters the microeconomic structure of the economy and changes the natural levels of these aggregates. For example, if these natural levels are largely independent of monetary phenomena, systematic monetary actions can have little effect on the actual levels of these

aggregates. Sargent and Wallace (1975, 1976) and Lucas (1976) found that the analytical exercise of calculating the optimal feed-back control for monetary policy rules is not efficacious.

It is very important to stress that *the neutrality and non-neutrality hypothesis are not contradictory*. It is so because neutrality hypothesis *does not* say that historically monetary and fiscal policies *have not been* important factors in generating real macroeconomic fluctuations. Instead, it implies only that the *systematic* part of monetary actions has not been consequential in this respect.

Both neutral hypothesis and non-neutral hypothesis are not following directly from the natural rate hypothesis and the rational expectations postulate alone. Instead, the set of additional assumptions about information is very crucial for them.

So, the *neutrality hypothesis* ***is derived by*** *the natural rate hypothesis and the three main following assumptions* :

first : private agents know enough about the structure of the economy to foresee correctly on average the effects of monetary and fiscal actions, if they either perceive or predict these policies accurately.

second : private agents adjust their behavior in according with these perceptions or expectations.

These two assumptions mean that given the natural rate hypothesis, being perceivable or predictable, on average monetary and fiscal policy do not affect the time pattern of differences between actual and natural levels of output and unemployment.

third : if monetary and fiscal policies involve systematic responses to business cycle developments, which would include the case of a feedback control rule, even if the government doesn't announce its behavior, private agents will figure it out. In other words, this assumption means that the systematic monetary and fiscal policies are accurately predictable.

The *non-neutral hypothesis* ***is derived by*** *the natural rate hypothesis and the assumption of incomplete information* which states that :

monetary and fiscal policies which are neither predictable, i.e., systematic, nor perceivable, generate a private behavior that is based on incomplete information and possibly incorrect expectations about the rate of inflation. In order to show the aforementioned hypothesis, let us relax the classical perfect information assumption (i.e., at incomplete information). Suppose that economic agents have limited information and they do not know all the relative prices of the various goods they are interested in. Then, although individuals are making the best possible forecasts of all the relative prices they care about, errors are unavoidable. Thus a general increase in all absolute prices, caused by the unanticipated component of money growth, is taken by the agents as an increase in the relative price of the good they are selling, leading them to increase their output more than they had planned. This increase of output will occur whenever the actual price level exceeds agents' expectations and vice versa, concluding that only the unanticipated component of money growth affects real economic variables.

There is also another important assumption which extends the RE theory beyond the neutrality and non-neutrality hypothesis in the *variance hypothesis*. This assumption is that the degree of inaccuracy in beliefs about the state of the economy that results from a given unpredictable monetary or fiscal action, depends *inversely* on the variance of monetary or fiscal policies.

From all we have cited so far, it is obvious that the content of the information set is very crucial to the results of the rational expectations theory.

An elaboration of the non-neutrality hypothesis is the ***variance hypothesis***, analyzed by Lucas (1973) and Barro (1976), which states that the larger the variance of monetary and fiscal behavior, the smaller the effects of given unpredictable and unperceivable monetary and fiscal actions on aggregate output and unemployment.

In the framework of the variance hypothesis, the larger the variance of monetary and fiscal behavior, the more likely are private agents to misinterpret other economic disturbances and to fail to make the adjustment in resource allocation that these other disturbances would otherwise call for.

Expressing in few words the main conclusion concerning the application of RE in economic analysis, we could say that monetary and fiscal policies may not be able to produce systematic expectational errors, and this implies that the ability of government to improve the aggregate performance of the economy is even more limited that that one inferred from the natural rate hypothesis. Specifically, *the idea that RE suggests is that it may not be feasible to design monetary and fiscal policies that can actively stabilize aggregate output and unemployment relative to their natural levels.*

3. The Activist Policy Theory under Rational Expectations. The Policy Effectiveness Proposition.

There are some economists who have developed models incorporating rational expectations hypothesis and concluded in exactly the opposite results of the aforementioned. Their conclusion, that activist monetary policy can affect the behavior of real output, is based on the Keynesian assumption that prices are rigid, at least in short run, for one reason or another. Some of the models which lead to such conclusion are those by Fischer (1977), Phelps and Taylor (1977), among others. Referring mainly to these two mentioned models, let us mention their main characteristics.

Both Fischer's and Phelps-Taylor's models are not supply - oriented. Fischer has assumed that demand determines the level of employment, while Phelps - Taylor have supposed that the aggregate demand determines the expected value of output in the current period. Another important characteristic of these models is that the effectiveness of the monetary policy is based on the

assumption that the economy is subjected to random disturbances that affect output and the price level in each period.

Seeing that Phelps and Taylor's paper (1977) has the same principal theme as the Fischer's and more or less the same result, i.e., that monetary policy is effective, in the following only the Fischer's paper will be analyzed.

In his paper in 1977, Fischer used a short run "wage stickiness" by assuming that all labour contracts have been made for two periods. In everything else, the model was similar to the simple rational expectations model of Sargent and Wallace (1975). Moreover, if the model would include only *one-period* labour contracts, then the Sargent and Wallace results would be confirmed. In this case, i.e., one-period contract, Fischer states that there is irrelevance of the monetary rule for the behavior of output. He explains it through the neutrality of money and the proper knowledge of the individuals each period of the money supply in the next period. So, the individuals set their nominal wage as to maintain constancy in their real wage.

The results are entirely different when the *two-period* wage contract enters the model. By assuming that the contracts which have drawn up at the end of period t specify nominal wages for period (t+1) and (t+2), Fischer concluded that monetary policy can affect the real output. The explanation that he offered for this conclusion was that by having two -period labour contracts, the monetary authorities can react, during the second period of the contract, to new information about recent economic disturbances. Furthermore, as in the second period the nominal wage has already been negotiated, the monetary authorities can affect the real wage of that period and thus output.

There are also other studies which support the activist policy, but one of the most important is that one by Howit (1981). It is quite different from the previous one in the structure of the model. Howit takes into account that there are positive costs of gathering and processing information and there is uncertainty concerning the structure of the economic system. The difference with the previous papers is that in this model the economic agents formulate

their demands so as to maximize their utility function subject to their budget constraint. Then a monitoring cost has been entered the model. This cost indicates the expenses that economic agents should spend in monitoring a monetary policy indicator. In this case an economic agent is monitoring only if his additional expected utility of monitoring equals at least the monitoring cost. According to Howit, the activist monetary policy will dominate the neutrality policy if (i) the monetary policy indicator is reliable enough, effective demand is unstable enough, or marginal cost rises fast enough that social gain to monitoring exceeds the cost of administering an activist policy and (ii) the cost of processing the information contained in the indicator of monetary policy is large enough that the quotient of these abovementioned magnitudes at least equals the social gain to monitoring.

Among the aforementioned hypothesis and propositions, within the rational expectations framework, the conclusions differ from each other. For this reason, economists have found the empirical test of this hypothesis as a sign of their validity. Studies by Barro (1977) for the United States, Attfield, Demery, and Duck (1981) for the United Kingdom, among others, have provided empirical verification of the REH that only the unanticipated component of money growth affects real variables.

In contrast, studies by Mishkin (1982a) for the United States, Darrat (1985), Mohabbat and Al-Saji (1990), and Amer K. Al-Saji (1991) for Italy, Beladi and Samanta (1988) for United Kingdom, among others, have found that the anticipated component of the money growth has a significant effect on real variables. This means that the rational expectations hypothesis should be rejected.

Based on the empirical investigations nobody could conclude that rational expectations hypothesis is definitively supported by economic data. Therefore, it certainly comes in mind the question about its validity and consequently, the critique on it is showed up. This work will attempt to infer one more evidence about the validity of the rational expectations hypothesis:

does the behavior of the Greek economy support or reject the REH? But before proceeding to the empirical analysis of this work, the rational expectations' critique will be presented in the following section.

4. The Rational Expectations Critique

As it was mentioned above, the rational expectations application in macroeconomics was considered as a revolution in the economic theory. It was so mainly because of the fact that animate agents were included into macroeconomic models and therefore it presented a breakthrough in the methodology of macroeconomics. More specifically, the rational expectations hypothesis (REH) attempted to establish a relationship between agent's expectations and actual outcomes of the economic system. On the other side, the rational expectations hypothesis shook the confidence on the fact that the government could remedy the economic problems. Therefore, after some time had passed by, the rational expectation and new -classical theory became subject to the critique. Critics of this new macroeconomics fall into two groups : **(1)** those who reject RE as a plausible model of actual behavior and **(2)** those who find the hypothesis attractive but nevertheless are troubled by the results that it generates when it is applied into the market clearing natural rate models. Beginning to present the first group of critique, it is necessary to make once again a very brief summary of the RE hypothesis. The reason of presenting it is because the critique is referred to the RE model specification.

Thus, the RE can be stated simply : (1) if economic and social relations are deterministic[(1)]; (2) if all aspects of these determinate relations are known; (3) if economic agents form their prediction of the future upon this complete knowledge; then (4) the prediction (expectations) formed in this manner will on

[1] The REH is a deterministic theory by the definition of physical sciences. According to the famous physics Max Born it is that :"Determinism postulates that events at different times are connected by laws in such a way that predictions of unknown situations (past or future) can be made"

average be correct and any divergence between anticipated and actual outcomes will be the result of purely random influences.

According to Weeks (1989), at this outset there are three serious difficulties with the REH. *The first* one is that : "it presupposes a strict dichotomy between systematic and random influences ....". In essence, REH asserts that what is known represents the total sum of systematic influences and *all* other influences are by definition random events. This would raise a question about the preciseness of the identification upon theoretical analysis.

Could the models be identified so exactly? According to Weeks (1989), "only if the theory has *completely and correctly* specified *all* relevant behavioral relationships and estimated them correctly with unbiased data, can the unexplained residual considered purely random".

If one could assert that what is stated above is possible, even in principle, this would show a considerable faith - better an arrogance (as Weeks states) - in somebody's human affairs.

The second astonishing thing is the REH' assertion that there exists full and complete knowledge how the economy works. As Show (1984) has interpreted it, there exists "the economic agent who fully understands how economy actually operates", having obtained this knowledge from the discoveries of economic science. In other words, it claims that economics has revealed the *proper* and *complete* operation of capitalist economy.

But even physical science or any other social science has not claimed for such exact knowledge of the phenomenon. It is so because new discoveries continuously challenge the existed accepted truth. On the other hand, even in the case when assuming that economic science has reached to correctly and completely model the capitalist economy, the economists among themselves do not agree upon what the correct and complete model might be. For illustrating it can be mentioned that Hahn (1980), for example, at the contrary with what is previously accepted as correct, writes : ".... it is by no means the case that

economists are agreed that the IS - LM cross is a generally accepted theory of economy".

Thus, based on scientific methods and controversies among economists, it is not credible to preassume that a correct and complete model of the capitalist economy exists for economic agents.

The third strange point related with RE hypothesis concerns the "as if ..." statement. This kind of expression was used by neoclassicals seeking to establish credibility. Thus, in the case of consumer theory, they argued that it is not necessary for people to know their utility function and to act for maximizing it, subject to a budget constraint, but people should behave "as if they did". Similarly this argument was used by neoclassicals in the case of firm's cost - minimizing problem.

This "as if they did" treatment has been applied to RE hypothesis too. For illustrating it serves the following paragraph by Shaw (1984) : "Nor is it necessary for economic agents to know the true model of the economy. All that is required is for them to form their expectations in the aggregate *as if* they did know it". But how can operate an economic agent without knowing exactly his final target : e.g., maximization of utility or minimization of cost? The answer remains in vague.

Therefore, based mainly on these three unclear assertions, Weeks (1989) concluded that since RE models contain dark areas, the conclusions inferred by their applications related with policy effectiveness problems, are not conceivable any more. In Weeks' words : "The policy implications of the RE hypothesis, particularly those reached by the new - classical economists, almost invariably follow from extremely simple and sometime flawed false dichotomy models".

The critique on RE hypothesis described above was, in general lines, considering simply the content of the definition. As a more concrete case, in the following is presented the critique concerning the implementation of the RE hypothesis in the wage bargaining story. The natural rate hypothesis, which is

certainly included here, has also been subject of critique. This new hypothesis (the natural rate hypothesis), for Weeks (1989) was nothing more that *the full employment equilibrium*. In order to support this idea, he brings a lot of arguments [J. Weeks (1989) "A Critique of Neoclassical Macroconomists"] but it is out of this work's scope to deal with them. What deals with RE hypothesis implementation in wage bargaining is presented in the following.

Assuming that the correct and complete model of the economy is known by both capital and labour, the wage bargaining - RE hypothesis, according to Begg (1982) goes like following: "The equilibrium expected real wage at the date of the nominal wage bargain is made is assumed to be set in the expectation of clearing the labour market.... . Thus I assume that nominal wages are set each period to produce an expected real wage which is expected to generate unemployment at the natural rate ...".

Referring to the above postulate of Begg, Weeks (1989) states that the situation which is described there has no resemblance with what occurs in any actual economy. It is so because of these reasons : *First :* there are very few capitalist economies where an aggregate wage bargain takes place. Moreover, in most western capitalist countries, the majority of wage takers are not even organized into trade unions. *Second :* there is the assumption that the parties to the wage bargain seek a nominal wage which will clear labour market. According to Weeks (1989), this is completely an arbitrary assumption and a particularly strange one to be made by neoclassical economists. It is so because for decades neoclassical economists have argued that trade union leaders tend to be most influenced by their direct consistuency and in this way showing little concern for the non-union employed and much less for the unemployed people. Therefore, the assumption that nominal wage clears labour market is flawed.

Third : In the Begg's paragraph it is implicitly made the assumption that there is no conflict between capital and labour since both parties to bargain seek the wage which will clear the labour market. But since by the RE hypothesis both capital and labour know with certainty the true model of the economy and

simultaneously they both seek to establish the full - employment real wage, why should they waste the time to meet together? The trade union leaders would leave confidently the wage - setting process to the capitalists (or vice - versa) since both parties have the same information and look for the same result. Thus, it is quite clear that it is completely ignored that the wage bargain in part involves a struggle on the distribution between wages and profits.

These three reasons which create a distance between the REH - wage bargaining story (model) and the actual economy, provides the conclusion that this type of model is not close to the reality. Moreover, according to Weeks (1989) ".... this story is not merely an exercise in abstract model building, but has pretensions to explain actual events".

Until here, the critique on REH presented is asserted by the first group of critics i.e., those one who do not support RE as a plausible model of actual behavior. The second group of critiques is composed by those who find the hypothesis attractive but are upset by the results that this hypothesis generates. The neutrality hypothesis is surely disturbing those people who view the government as an economic doctor, attempting to use stabilization policy to treat a periodically ailing private economy. If the government will be declared unable to remedy the economic problems, who else can undertake and carry out this responsibility?!

Therefore, the RE hypothesis can not be hailed from this group of economists. The goal of monetary and fiscal policies is to stabilize the economy, i.e., each economic variable to move around its equilibrium level. Since RE hypothesis imposes the impossibility of getting this target, it could not be supported as a proper economic hypothesis.

Anyway, keeping into consideration all the above treatments, the empirical analysis of this work will give one more evidence in support or not of the validity of the rational expoectations hypothesis.

III. THE RATIONAL EXPECTATIONS HYPOTHESIS AND THE GREEK EXPERIENCE

In the case of Greek economy, there have been undertaken some empirical studies aiming to show the validity of RE hypothesis. In general, the results which have been found support the rejection of the RE hypothesis. They are presented in more details in the proceeding section, beginning from the recent studies to the oldest one.

In 1992 J. Paleologos and S. Georgantelis incorporated the rational expectations (RE) approach to the life - cycle permanent income hypothesis (LCH-PIH) model and examined its empirical validity for Greece during 1953 - 1988.

Recalling the LCH-PIH theory, it claims that consumption depends upon the present discounted value of the expected future stream of income. In order to explain how the expected future stream of income was formed, Paleologos and Georgantelis implemented the RE theory. Briefly the procedure is presented beneath.

It is known that consumption C_t is given as a function of non-human wealth A_t and present value of future labour income H_t like in equation 2

$$C_t = k(A_t + H_t) \tag{2}$$

where k - represents a constant number.

Being that H_t is not directly observable (because it is depended on the expected future value of labour income), the value of H_t mathematically can be expressed:

$$H_t = \sum_{i=0}^{\infty} \frac{Y^e_{t+i}}{(1+r)^i} \tag{3}$$

where it is assumed that consumer lives for ever. By implementing the rational expectations theory, the expected income Y^e_{t+i} is expressed as :

$$Y^e_{t+i} = E_t Y_{t+i} \quad (4)$$

Using equations 2, 3, 4 and considering the previous works by Attfield *et al.* (1985) and Hall (1978), the final equation which was used by Paleologos and Georgantelis to test RE-LCH hypothesis was:

$$C_t = \alpha + \beta C_{t-1} + \lambda (Y_t - E_{t-1} Y_t) + \phi E_{t-1} Y_t + w_t \quad (5)$$

where $(Y_t - E_{t-1} Y_t)$ - represents the unanticipated values of income and

$E_{t-1} Y_t$. represents the anticipated values of income

Including in equation (5) some other macro-variables which were thought to affect consumption, the final form of equation (5) was :

$$\Delta C_t = \alpha + \beta_1 Uy_t + \beta_2 \Delta P_t^* + \beta_3 \Delta M_t + \beta_4 E_{t-1} y_t \quad (6)$$

where Uy_t - unanticipated change in real income $(\Delta y_t - \Delta \hat{y}_t)$

P_t^* - expected inflation

M_t - money supply as a proxy for liquid assets

C_t- real consumption

Estimating equation (6), Paleologos and Georgantelis found that both β_1 and β_2 were statistically significant. By exerting significant influence on consumption, Uy_t allowed for a provisional acceptance of RE-LCH. By the other side, the anticipated income values appeared to affect consumption as well (the statistical level of β_4 was significant). Because both these findings do not match, the conclusion which should be inferred is that RE-LCH hypothesis is rejected in the Greek case.

Nevertheless, Paleologos and Georgantelis considered some reservations about this conclusion. One could be the "simplicity" of modelling the income series by an ARIMA model. It was used in order to decompose income into its anticipated and unanticipated parts. Other reasons could be regarding the nature of consumer's expenditure (includes durables), the measurement of labour

income by personal disposable income and the possibility of a changing structure regarding the length of the sample size.

In 1986 J. Paleologos developed and estimated a small new classical model of the Greek Economy, using annual data from 1954 to 1980. These types of models are based on the theories of 'new classical macroeconomics' which emphasize the role of the unanticipated changes in policy instruments as one of the most important determinants of the macroeconomic fluctuactions. There has been previous studies by Sargent (1973), Barro (1977), Attfield, Demery and Duck (1981a, 1981b) which have tested and proved empirically the validity of rational expectations hypothesis. In contrast to these works, Liederman (1980), Driscoll, Frod, Mullinex and Sen (1983) showed that it is better to test the joint hypothesis of structural neutrality (SN) and rational expectations (RE). In this joint hypothesis (RESN), the rational expectations (RE) restrictions can not be imposed independently of structural neutrality (SN) hypothesis. Therefore, the validity of SN can be evaluated only given the acceptance of RE and any test of SN must involve a test of the joint hypothesis of RESN. So the rejection of RE implies that the joint hypothesis RESN is also likely to be rejected.

Based on this experience, the two structural equations incorporated in the model by Paleologos are:

$$Y_t = \alpha_o + \alpha_1(P_t - EP_t) + \alpha_2 Z_t + \alpha_3 Y_{t-1} + u_{1t} \quad (7)$$

$$(M - P)_t = \beta_o + \beta_1 Y_t + \beta_2 (M - P)_{t-1} + u_{2t} \quad (8)$$

where Y_t - log of real GDP

P_t - log of the price levels

M_t - log of nominal money balances

Z - a set of variables affecting the 'capacity' level of output

u_{1t}, u_{2t} - error terms with zero means, constant variances and no autocorrelations.

Solving the model for the two endogenous variables Y_t and P_t, and imposing the RE hypothesis for EP_t/I_{t-1}, it yielded the following reduced form :

$$Y_t = \phi_o + \phi_1(M_t - EM_t) + \phi_2(Z_t - EZ_t) + \phi_3 Z_t + \phi_4 Y_{t-1} + \varepsilon_{1t} \quad (9)$$

$$P_t = \pi_o + \pi_1 M_t + \pi_2(M_t - EM_t) + \pi_3 Z_t + \pi_4(Z_t - EZ_t) + \pi_5(M - P)_{t-1} + \pi_6 Y_{t-1} + \varepsilon_{2t} \quad (10)$$

Equation 9 states that the level of output will deviate from its natural level only if the monetary policy is unanticipated, whereas the price levels in equation 10 is influenced by both actual and unanticipated changes in money supply. The interpretation of equation 9 is consistent with the natural rate hypothesis which states that output (or employment) is a unique monotonic function of errors in expectations.

The unanticipated values of monetary policy were inferred by the following money equation :

$$\Delta M_t = \gamma_o + \gamma_1 \Delta M_{t-1} + \delta K_t + \theta_1 L_{t-1} + \theta_2 UL_{t-1} + \rho X_t \quad (11)$$

where K_t - the proportionate rate of foreign exchange reserves of present to previous year.

L_{t-1} - the ratio of reserves to money supply of the previous year

UL_{t-1} - the log of the lagged deficit of general government

X_t - the ratio of interest rate charged by banks for working capital to the rediscount rate of the central bank.

Estimating equations 9 and 10 it was found that RE, which states that systematic policy would be fully anticipated and, therefore, ineffective in changing the level of output, is rejected. It is so because the estimation of equation 10 indicated that the actual money growth affects the price level. Also,

the estimation of equation 9 lead to the rejection of the hypothesis that only the unanticipated part of money growth is relevant to output.

These findings provided an evidence against new-classical explanation of output and price level fluctuation, for the Greek economy. According to these findings, actual and anticipated government policies may have a significant stabilization role to play in the short - run. Therefore, it is supported the idea that economy does not always operate in general equilibrium, and so macroeconomic policy is required to stabilize the economy at its general equilibrium levels.

Concerning rational expectations, some other works are performed for Greek case by Alogoskoufis (1981), Baltas and Apostolou (1988), among others. The reason why they are not presented here is because there is just the implementation of rational expectations and not testing its validity.

Through this thesis an attempt will be made to provide a further evidence about the RE validity in the Greek economy.

IV. THE EMPIRICAL ANALYSIS

As it was mentioned in the previous section, the RE hypothesis for the Greek case has been tested by various economists. What is new in this work has to do with the simultaneous impact of monetary and fiscal policies. The sample period runs from 1975 to 1995, while the previous works have the upper limit the year 1988.

As far as the fiscal policy concerns, the reason why it is incorporated in the model has to do with its important impact on economic activity. Without being restricted within the RE hypothesis' framework, it is analyzed and accepted that fiscal policy affects considerably the economic activity of a country. But the mechanism *how* it influences one certain economic variable is not the same for different economic schools. Let us mention for instance the case of the fiscal policy impact on inflation which is named as "accommodation hypothesis". Keynesian economists pretend that there is a positive relation between them. Their explanation is grounded on the fact that budget deficits stimulate aggregate demand and this induces inflation to increase. In contrast, monetarists explain this positive relation by the fact that budget deficits lead to higher money growth rates as result of either the direct monetization or following the attempts of central bank to prevent increases in interest rates.

Concerning this positive relationship between budget deficits and inflation, there have been undertaken a lot of empirical work which have been supportive to the theoretical arguments [Niskanen (1978), Hamburger and Zwick (1981), and Grier and Neiman (1987), among others] or against it [Dwyer (1982), King and Plosser (1985) and Jonies (1985), among others].

Nevertheless. what is of special interest in this work concerns instead of inflation - fiscal policy relationship, the relationship between fiscal policy and real economic variables in Greece: output, stock prices and consumption.

As far as the relationship fiscal policy - real output concerns, economists have agreed unanimously for the impact of the former on the latter. Moreover, they have asserted that in certain cases, the close relationship between the real side of the economy and budget deficits, turn to be negative. Government deficits have been blamed for the slowdown in real growth of economy. The argument here is that the increase of government's borrowing requirements reduces investments and retards output growth.

There is an astonishing problem concerning the relationship between fiscal policy and stock prices. It has to do with the question: " does there exist any relationship between them?"

Much of the update literature has provided that there exists a strong relationship between money supply and stock prices, in the meaning that the former is the leading indicator for the latter. Furthermore, the empirical evidence has been in favor of Stock Market Efficiency (SME) hypothesis which states that stock prices reflect all available information of monetary policy movements.

By contrast, the considerations related to the possibility of changes in stock prices as result of fiscal policy changes were very reserved and limited. How can be explained this neglect of fiscal policy in stock price determination? According to Barro (1990), the possible answer can be that researchers in the macro-finance area may have implicitly taken for granted the validity of the "Ricardian equivalence proposition". Under this proposition, government bonds do not represent any part of private wealth because the asset holders will completely discount the future tax liabilities implied in the deficits. Therefore, government deficits are preassumed irrelevant for portfolio decisions, and perhaps for almost everything else in the economy. Empirically, this idea is supported by studies of Kormendi (1983), Evans (1985, 1987) and Hafer and Hein (1988).

But according to Barro (1990), this neutrality impact of fiscal policy on stock prices theoretically and empirically - as he found it - should not hold. In

order to argue that, Barro refers to the general equilibrium approach by Tobin (1969) and generalizes the theoretical portfolio approach by Brunner (1961) and Cagan (1972). Based on those approaches, it is stated as following : "Given that government bonds represent - at least to some extend - a component of private wealth, any change in federal debt (fiscal policy) would disturb the equilibrium position of government bonds relative to other assets in the investitor's portfolio" [Barro (1990)]. Thus, an asset holder will attempt to return to portfolio equilibrium, which should require substitutions between government bonds and other assets, including common stocks. Therefore, theoretically changes in fiscal policy could influence stock prices.

Mathematically, stock prices can be presented like :

$$PV_0 = \sum_{t=0}^{\infty} \frac{E_t^e}{(1+i_t+r_t)_t} \tag{12}$$

where PV_0 - current price of an equity

E^e_t - expected earnings in time t

i_t - riskless rate of interest

r_t - risk premium

As a second argument supporting the fiscal policy impact on stock prices are the empirical findings by Makin (1983) and Hoelscher (1986). They found that the budget deficit is a very important determinant of the interest rate, which is the second component of stock prices. Implicitly stock prices are influenced as well.

Risk premium, which is known as component of stock prices, was found as the third channel for the possible influence of fiscal policy on equity prices. These findings by Evans (1984) and Strongin (1987) provided that budget deficits may induce general economic uncertainty.

The other real economic variable under examination was consumption. The relationship between it and fiscal policy was stated by economists as a

neutral one. More or less, the most researchers concluded that fiscal policy can not influence private consumption. The argument for this conclusion is the same with one of the arguments in the case of stock prices - the Ricardian equivalence theorem.

In the consumption context, the Ricardian equivalence theorem states that it is inconsequential whether a government budget deficit is financed by debt issue or by tax increases, since under certain conditions, the impact of government purchases on aggregate demand is impervious to the mode of financing fiscal deficits. Such an 'equivalence' arises because economic agents, being fully aware of the path of future fiscal policies, consider today's deficit financing as tomorrow's tax liabilities.

For this reason, based on the abovementioned comments, Barro (1974, 1978) claimed that if a) capital markets are perfect and consumers do not face any borrowing constraints; b) both private and public sectors have the same planning horizons; and c) taxes are non-distortionary, then the Ricardian equivalence theorem is valid.

But the empirical evidence particularly of developing countries has not always substantiated the Ricardian equivalence theorem. This means that in the case of financing the raised deficit by issuing bonds instead of taxation, the private consumption will tend to be increased ought to the wealth effect.

The reason why all these arguments were mentioned here, was to show briefly the significance of fiscal policy on economic activity and therefore to justify its incorporation into RE hypothesis test. Moreover, monetary and budget policies cannot stand independently of each other. For instance, it may not be possible to run high budget deficits in order to stimulate the economy in a certain period while maintaining low money growth to control inflation. Therefore, previous studies which have included only monetary variables or only the fiscal variables may suffer from the problem of omitted variables which may have provided biased or nonconsistent estimated coefficients.

In the framework of RE, the impact of *only* fiscal policy was studied empirically by Laumas and McMillin (1984) and McElhattan (1982). They found that not only unanticipated policy actions, but also the anticipated ones can affect real variables in the short - run.

Whereas, the test of rational expectations hypothesis on *both* monetary and fiscal policies simultaneously, was performed by Laumas (1991). The result of this innovative work (it is 'innovative' because he firstly estimated jointly the effects of monetary and fiscal policies on real output) was against the RE hypothesis and policy ineffectiveness proposition.

Based on the methodology applied by Laumas (1991), the procedure which will be followed in this work is almost similar. The objective function, the macro welfare function, in our case will be defined over these macroeconomic variables: output, inflation and consumption. The goal of monetary and fiscal policy is to maximize the welfare of the economy. The less the abovementioned macrovariables fluctuate from their equilibrium level, the more the welfare goes toward its maximum. Do the monetary and fiscal policies carry out this duty? The answer will be given based on empirical results for the Greek case.

1. Data

The main source of the data that are used for the purpose of empirical analysis is the Monthly Bulletin of Greece. Quarterly data were obtained over the period 1980 - 1995 from the following time series:

B - base money

M1- money supply

Y - industrial production

C - aggregate consumption

SP - stock prices

By contrast, M4 - money supply, will be used for the period 1988 - 1995 only. Real consumption and real stock prices were obtained by disinflating consumption and stock prices by the consumer's price index.

2. *Methodological issues*

1) In the first step the money growth equation as well as the deficit equation must be determined. It is necessary to estimate them because from these equations the actual money/deficit growth will be decomposed into its anticipated and unanticipated components. The procedure of model determination will be the same for both the money and fiscal equations.

In this work, the money and deficit growth equations will be defined by using an autoregressive integrated moving average (ARIMA) model. The reason of using it is because an ARIMA model is a very advanced method of prediction for many macro-variables, and on occasions it is even better that the structural econometric method (Box & Jenkins, 1970). The identification of the proper ARIMA model will be in two ways : 1) by examining the plot of the series and their autocorrelation and partial autocorrelation samples and 2) by using the Q - Box-Pierce statistic test. The reason of using both of these ways is to make a comparison between them and to get the most appropriate model.

Let us begin to describe the procedure and the results found using the first way. The money growth equation will be examined first and then the deficit growth equation.

a) As a *first step* we plot the time series data of money supply M1. Through the careful examination of the plot, we can get the idea if the series contains the nonstationary and non-normal phenomena like trend, seasonality, outliers, non-constant variances etc. In our case, the money growth series exhibited trend and seasonality phenomena (Figure 2). In order to eliminate the seasonality, the adjustment procedure was performed (Figure 2a). While for the

trend elimination, the differencing procedure is necessary. In the framework of this method, in order to be sure about the trend existence, the examination of the ACF (autocorrelation function) and PACF (partial autocorrelation function) samples is performed in the second step.

b) In the *second step*, the plot of ACF, which dies very slowly and the plot of PACF, which cuts off after lag 1(Figure 3), insures us that the money growth equation is not stationary and therefore the differencing procedure is needed.

c) In the *third step*, after removing the stationarity we plot again the ACF and PACF of the stationary series and examine them for defining the orders of p and q of the ARIMA model. The plot (Figure 4) suggests that the proper ARIMA model for money supply equation is (2,1,2).

The same procedure is done for the other money supply series ; base money (B), and M4 and for the deficit growth equation F as well (see their ACF and PACF sample plots depicted in the Figures 5, 6, 7, 8, and 9. The result founded is that their ARIMA models are described by the following processes:

Money supply M1	- ARIMA =	(2,1,2)
B	- ARIMA =	(4,1,3)
M4	- ARIMA =	(5,1,5)
F	- ARIMA =	(2,0,3)

Thus, according to the 'observing the plots' method, both the money supply equations and deficit growth equation were determined.

Let us see the other way, using the Q-statistic test. According to this method, first of all we have to define if the series are stationary or not. For this reason the ADF (augmented Dickey-Fuller) test is carried out. The results for money and deficit growth are presented in the following Tables.

Table 1. UNIT ROOT TEST FOR VARIABLE M1

	T- statistic	T* - critical value
DF test	0.1224	-3.4696
ADF test	0.397	-3.4704

Since the statistical values found are smaller (in absolute values) than the critical values, it means that there is unit root, i.e., the series is not stationary and therefore the differencing procedure must be applied. The results of the Dickey-Fuller test for the differenced series are presented in Table 2.

Table 2. UNIT ROOT TEST FOR VARIABLE DM1

	T- statistic	T* - critical value
DF test	-9.7510	-3.4704
ADF test	-8.2846	-3.4713

The results show that there is no unit root in first differences since the statistical values are greater (in absolute values) than their critical values. So the money supply growth follows a stationary process. Next, the Q - statistic test is performed. According to it, for levels of significance greater than 0.05, the smallest chi-square value for the money supply M1 corresponds to the proper ARIMA model. In this case, for the P - level 0.88 > 0.05, the smallest X^2 value was 12.91, which corresponds to the ARIMA model (2,1,2). Exactly the same procedure is followed for the remaining series. The results of the analysis are presented in the following Tables:

Table 3. UNIT ROOT TEST FOR VARIABLE F

	T- statistic	T* - critical value
DF test	-11.6618	-2.9001
ADF test	-11.8712	-3.4696

The statistical results show that the deficit equation follows a stationary process since its statistical values are smaller (in absolute values) than the critical values. Therefore, the proceeding Q - statistic test is made and its result is that the smallest X^2 value founded in the P -value 0.66 > 0.05, is 15.809. It corresponds to the ARIMA model (2,0,3).

Table 4. UNIT ROOT TEST FOR VARIABLE B

	T- statistic	T* - critical value
DF test	-1.3901	-3.4696
ADF test	-1.1695	-3.4704

It is clear that the differencing procedure once again is necessary. Therefore, the second test is made for the differenced series DB and its results are showed in Table 5.

Table 5. UNIT ROOT TEST FOR VARIABLE DB

	T- statistic	T* - critical value
DF test	- 10.0451	-3.4704
ADF test	-8.9598	-3.4713

This stationary series will be under the examination of the Q - statistic test. It is shown that the proper ARIMA model for which the X^2 has the smallest value is (4,1,3). In this case the X^2 value is 15.14 with the P - value equal with 0.58.

For the other measure of money supply, the results of the same procedure are like beneath:

Table 6. UNIT ROOT TEST FOR VARIABLE M4

	T- statistic	T* - critical value
DF test	2.1486	-3.4696
ADF test	0.89638	-3.4730

The unit root test for the differenced series gives the following results :

Table 7. UNIT ROOT TEST FOR VARIABLE DM4

	T- statistic	T* - critical value
DF test	- 14.8156	-3.4704
ADF test	-5.2295	-3.4713

The Q - statistic test is performed for this stationary series and the results showed that the proper ARIMA model is (5,1,5). In the case the X^2 value is 22.17 for the P - value equal with 0.07.

Finally, once the identification procedure has finished, the equations of the money and deficit growth equations can be expressed mathematically as follows :

$$DM1_t = \alpha_1 DM1_{t-1} + \alpha_2 DM1_{t-2} + \rho_1 \varepsilon_{t-1} + \rho_2 \varepsilon_{t-2} \quad (13)$$

$$F_t = \beta_1 F_{t-1} + \beta_2 F_{t-2} + \theta_1 v_{t-1} + \theta_2 v_{t-2} + \theta_3 v_{t-3} \quad (14)$$

$$DM4_t = \gamma_1 DM4_{t-1} + \gamma_2 DM4_{t-2} + \gamma_3 DM4_{t-3} + \gamma_4 DM4_{t-4} + \gamma_5 DM4_{t-5} + \varphi_1 w_{t-1} + \varphi_2 w_{t-2} + \varphi_3 w_{t-3} + \varphi_4 w_{t-4} + \varphi_5 w_{t-5} \quad (15)$$

$$DB_t = \delta_1 DB_{t-1} + \delta_2 DB_{t-2} + \delta_3 DB_{t-3} + \delta_4 DB_{t-4} + \psi_1 z_{t-1} + \psi_2 z_{t-2} + \psi_3 z_{t-3} \quad (16)$$

The purpose of the mathematical presentation is to infer the anticipated and unanticipated estimates of monetary and fiscal policy. Therefore, they will be estimated and the fitted values of the money growth/ deficit equations will

represent respectively the anticipated values of the money/deficit growth, while the residuals will represent the unanticipated components of them.

2) In the second step the decomposition of money growth and deficit growth into their anticipated and unanticipated parts is performed. To this purpose, the above equations are estimated and then the fitted values as well as residuals are obtained. The estimated equations look like the following:

$$DM1_t = \underset{(-2.050)}{-0.1951}\, DM1_{t-1} + \underset{(7.3939)}{0.1024}\, DM1_{t-2} \qquad \textbf{(17)}$$

[values in brackets denote t - statistic values.]

Diagnostic tests :

R - squared	0.29
S.E. of regression	0.071

$$F_t = \underset{(-2.016)}{-0.3436}F_{t-1} - \underset{(-1.7483)}{0.298}\, F_{t-2} \qquad \textbf{(18)}$$

R - squared	0.7
S.E. of regression	0.015

$$DB_t = \underset{(3.1201)}{0.1068}DB_{t-1} + \underset{(2.6434)}{0.1122}DB_{t-2} + \underset{(2.6188)}{0.1146}DB_{t-3} + \underset{(4.1378)}{0.1244}DB_{t-4} \qquad \textbf{(19)}$$

R -squared	0.21
S.E. of regression	0.011

$$DM4_t = \underset{(0.4994)}{0.0623}DM4_{t-1} + \underset{(2.8092)}{0.1164}DM4_{t-2} - \underset{(-2.1952)}{0.0128}DM4_{t-3} + \underset{(14.5175)}{0.9935}DM4_{t-4}$$

$$- \underset{(-2.5649)}{0.0793}DM4_{t-5} \qquad \textbf{(20)}$$

R - squared	0.87
S.E. of regression	0.013

Having estimated the anticipated and unanticipated values of monetary and fiscal policies, we are ready to move on to the next step of the empirical analysis.

3) In the third step, the examination of the impact of anticipated and unanticipated parts of monetary and fiscal policies on real economic activity in Greece will be carried out. This concerns the final goal of this thesis.

As it is mentioned above, the macroeconomic variables which will be considered to represent the economic activity in this case will be : real output, real consumption and real stock prices. The way they are influenced by monetary and fiscal policies will be estimated through equation (21) as it appears below. In this case only the real output and monetary/fiscal policy relation is presented, but in the similar way will be determined the relation of monetary/fiscal policy with other economic variables.

$$RY_t = d_0 + \sum_{i=0}^{n} d_{1,i}AF_{t-i} + \sum_{i=0}^{n} d_{2,i}UF_{t-i} + \sum_{i=0}^{n} d_{3,i}AM_{t-i} + \sum_{i=0}^{n} d_{4,i}UM_{t-i} + e_t \qquad \textbf{(21)}$$

where RY_t - rate of growth in real output

AF - anticipated fiscal actions

UF - unanticipated fiscal actions

AM - anticipated money growth

UM - unanticipated money growth

e_t - error term

In a more general form, equation (21) could be presented as

$$RV_t = d_0 + \sum_{i=0}^{n} d_{1,i}AF_{t-i} + \sum_{i=0}^{n} d_{2,i}UF_{t-i} + \sum_{i=0}^{n} d_{3,i}AM_{t-i} + \sum_{i=0}^{n} d_{4,i}UM_{t-i} + e_t \qquad \textbf{(22)}$$

where RV_t represents each real economic variable : real output, stock prices and consumption. Each of these variables will be examined separately from the others.

Starting with real output Y, before considering the Y series into regression of equation (22) [or equation (21)], here it is presented its ADF stationary test:

Table 8. UNIT ROOT TEST FOR VARIABLE Y

	T- statistic	T* - critical value
ADF(1) test	2.7712	2.9006
ADF (2)test	2.7271	2.9012

Table 9. UNIT ROOT TEST FOR VARIABLE DY

	T- statistic	T* - critical value
ADF(1) test	10.5673	2.9012
ADF(2) test	8.335	2.9017

The stationary series DY is used for the estimation of the equation 21. The ordinary least squares estimators (OLS) provided the following results:

$$DY_t = \underset{(2.699)}{1.34} - \underset{(-3.6753)}{0.0534\, AM_{t-1}} - \underset{(-1.561)}{0.011 UM_t} - \underset{(-3.249)}{8.709E\text{-}05 AF_t} +$$

$$\underset{(3.891)}{5.576E\text{-}02 AF_{t-1}} - \underset{(-4.961)}{7.918E\text{-}05 AF_{t-2}} + \underset{(6.688)}{2.103E\text{-}02 UF_t} - \underset{(-3.939)}{4.069E\text{-}02\, UF_{t-1}} \quad \textbf{(23)}$$

R - squared 0.55
S.E. of regression 0.038
Durbin - Watson 2.18

The values into the brackets in equation 23 and the other equations in the following will always represent the t - statistical values of the respective variable.

Overall, the statistical parameters of equation 23 are acceptable. The conclusion that we can infer from it is that the anticipated values of monetary and fiscal policy influence significantly real output. They are only the lagged values of anticipated monetary policies which enter the equation, whereas, the anticipated values of fiscal policy affect real output by present and lagged values too. It can be observed from the estimated parameters that the anticipated parts of monetary/deficit growth models are statistically significant. Meanwhile, the unanticipated components of fiscal policy also influence real output whereas the unanticipated part of monetary policy does not seem to convince us for its significance on real output. It is so because of its level of significance which is not big enough as it must be ($|-1.561| < 2$). Conclusively, we could argue that this statistical interpretation in the abovementioned case implies that the rational expectations hypothesis does not hold.

As it is mentioned above, money supply will not be confined only with M1, but instead base money B and money supply M4 will be involved in the estimation too. As it is mentioned above, the money supply M4 will be included only for the period 1988 - 1995. The reason for this specification is explained by Apergis (1996). The explanation goes as following :

At the end of eighties, the Greek monetary system was characterized by the presence of direct controls on credits and interest rates which lead to inefficiencies and resource misallocations; therefore it was urgent for policy makers to go ahead and reform the monetary and credit system. At the beginning of 1988, a new system of monetary reforms, utilizing more indirect or market based instruments to achieve macroeconomic objectives, was put into operation. Under these reforms, the role of interest rates was enhanced and an effort was made to improve the performance of monetary policy, the efficiency

of the monetary system, the lending process, and competitive conditions in the banking system (Apergis, 1996). Therefore, as a better indicator of these reforms serves the money supply M4.

Let us see how these kinds of money supply, together with budget deficit influence on real output in Greece. The same procedure like above with M1 will be repeated for B and M4. The estimated equations are like the following :

For base money **B**

$$DY_t = \underset{(2.735)}{1.64} - \underset{(-1.971)}{2.134E\text{-}05AM_t} - \underset{(-3.588)}{4.189E\text{-}05AM_{t-1}} - \underset{(-2.750)}{2.233E\text{-}02UM_t} -$$

$$- \underset{(-1.524)}{4.122E\text{-}05AF_t} + \underset{(2.866)}{4.500E\text{-}05AF_{t-1}} - \underset{(-3.617)}{6.349E\text{-}05AF_{t-2}} + \underset{(3.942)}{1.411E\text{-}03UF_t} -$$

$$\underset{(-2.261)}{-0.2507UF_{t-1}} \qquad \textbf{(24)}$$

R - squared	0.533
S.E. of regression	0.039
Durbin - Watson	2.12

For money supply **M4 :**

$$DY_t = \underset{(2.795)}{9.79} - \underset{(-3.06)}{1.099E\text{-}05AM_t} - \underset{(-2.41)}{9.156E\text{-}05AM_{t-1}} - \underset{(-3.157)}{2.581E\text{-}02UM_t} -$$

$$+ \underset{(2.4)}{5.784E\text{-}02AF_{t-1}} - \underset{(-3.478)}{7.482E\text{-}05AF_{t-2}} + \underset{(-2.604)}{1.366E\text{-}03UF_t} \qquad \textbf{(25)}$$

R - squared	0.68
S.E. of regression	0.058
Durbin - Watson	2.17

The statistical parameters of the estimated equations 24 and 25 show very clearly that the anticipated parts of monetary and fiscal policies are as much significant as the unanticipated ones. Furthermore, the diagnostic test parameters are acceptable, which means that both equations 24 and 25 are well specified. Seeing that the anticipated parts of monetary and fiscal policies influence real output, this means that there is a place for policymakers to design an improving policy for the economy. Therefore, the neutrality hypothesis of the rational expectations does not work. Nevertheless, the value of the unanticipated part is proved to be more substantial than its anticipated counterpart, thus, reducing the potency of active economic policy to influence real economic activity.

Throughout equations (23), (24) and (25) it can be inferred the conclusion that using various types of money supply, the jointly estimation of each of them with deficit growth did not supported the idea that real output in Greece is influenced only by the unanticipated parts of monetary and fiscal policies . The anticipated part of monetary as well as fiscal policy influence the stabilization or destabilization of the economic equilibrium of a certain country. It is the case to claim that the rational expectations hypothesis is rejected by the Greek data.

In the same way like real output, the other economic variables will be estimated. Let us proceed with real stock prices SP. Before entering the equation of the form 22, the stationarity test for real stock prices series is performed. The results are presented beneath:

Table 10. UNIT ROOT TEST FOR VARIABLE SP

	T- statistic	T* - critical value
DF test	- 1.6468	-3.4696
ADF test	-1.8737	-3.4704

Table 11. UNIT ROOT TEST FOR VARIABLE DSP

	T- statistic	T* - critical value
DF test	- 7.3729	-3.4704
ADF test	-6.2777	-3.4713

The t -statistical values presented in Table 10 convinces us for the existence of the unit root in the real stock prices series. The results of the Augmented Dickey-Fuller test in that table suggest that this series needs the differencing procedure Meanwhile, Table 11 convinces us that the proper stationary series is the differenced real stock prices series of order 1 (one) - DSP. Therefore, it is the DSP series which will enter the equation 22.

Through the estimations of equation 22 for **stock prices**, let us see what alternatives do they offer concerning the validity of neutrality hypothesis.

For money supply **M1** :

$$DSP_t = \underset{(1.39)}{12.588} - \underset{(-2.362)}{0.60005AM_{t-2}} + \underset{(1.474)}{0.03AF_t} - \underset{(-1.385)}{0.03AF_{t-1}} \qquad \textbf{(26)}$$

R - squared 0.11
S.E. of regression 0.069
Durbin - Watson 1.6

In the case of money supply M1, the statistical parameters suggest that only the anticipated part of monetary/fiscal policy enter the equation. Moreover, these statistical parameters are not as good as they should be (the levels of significance, except that one of AM_{t-2}, are not big enough and the diagnostic test are not at the required level). Being in such situation, equation 26 not only denies the RE hypothesis but also raises a question on the influence of fiscal policy on real stock prices at all.

For base money **B:**

$$DSP_t = 24.07 - 0.00079AM_t - 0.0004AM_{t-1} - 0.00071AM_{t-2} +$$
$$(2.038) \quad (-2.488) \quad (-2.101) \quad (-2.724)$$

$$0.027UM_{t-1} - 0.039AF_{t-1} - 0.015UF_t \qquad \textbf{(27)}$$
$$(1.634) \quad (-1.727) \quad (-2.474)$$

R - squared	0.16
S.E. of regression	0.069
Durbin - Watson	1.4

Findings from equation 27 follow the same line as previous equations concerning the RE hypothesis. Furthermore, equation 27 states that there is a negative impact of monetary and fiscal policies on real stock prices. It is certified by the negative sign of the coefficients in front of these variables.

As far as equation 28 concerns, the implementation of M4 for the period 1988 - 1995 into regression points out that referring the monetary policy alone, it is its unanticipated part which influences real stock prices. Thus, if one could analyze separately into two parts equation 28, - the monetary part and the fiscal part - it could be stated that concerning the monetary impact on real stock prices, the rational expectations hypothesis does hold. On the other side, fiscal policy do influence real stock prices by both its components. But the most correct conclusion must be inferred considering both these parts simultaneously. In this case, the conclusion should be similar with the previous one concerning real output, i.e., the rational expectations hypothesis is rejected again.

For money supply **M4:**

$$DSP_t = -0.031UM_{t-1} - 0.00084AF_t - 0.055UF_{t-1} \qquad \textbf{(28)}$$
$$(-2.754) \quad (-1.623) \quad (-2.523)$$

R - squared	0.31

S.E. of regression 0.088
Durbin - Watson 1.76

None of the estimated equations which refer the relationship between real stock prices and monetary/fiscal policy was supportive for the rational expectations hypothesis. The last variable which will be tested is real consumption C. As in the previous procedure, the real consumption series is examined for its stationarity and the results are presented in the Tables 12 and 13. The integrated series C of order one I(1), DC will be entered in the estimation of equation 22. The results of the ordinary least square estimation for various kinds of money supply are presented in the following equations 29, 30 and 31.

Table 12. UNIT ROOT TEST FOR VARIABLE C

	T- statistic	T* - critical value
DF test	- 0.3074	-3.4696
ADF test	- 0.7083	-3.4704

Table 13. UNIT ROOT TEST FOR VARIABLE DC

	T- statistic	T* - critical value
DF test	- 10.3535	-3.4704
ADF test	-8.5576	-3.4713

<u>For money supply **M1**</u> :

$$DC_t = \underset{(2.213)}{8.2309} + \underset{(2.265)}{0.2191AM_t} + \underset{(2.368)}{0.1392UM_t} - \underset{(-3.323)}{0.2325AF_{t-1}} \qquad \textbf{(29)}$$

R - squared 0.22
S.E. of regression 0.024
Durbin - Watson 2.15

For base money **B:**

$$DC_t = \underset{(1.81)}{5.6915} + \underset{(4.968)}{0.283AM_{t-1}} + \underset{(3.257)}{0.1877AM_{t-2}} + \underset{(3.27)}{0.1279UM_{t-1}} - \underset{(-2.816)}{0.181AF_{t-1}} \quad \textbf{(30)}$$

R - squared	0.41
S.E. of regression	0.022
Durbin - Watson	2.15

For money supply **M4:**

$$DC_t = \underset{(-3.119)}{-0.419AM_t} + \underset{(6.346)}{0.527AM_{t-1}} + \underset{(3.749)}{0.541AM_{t-2}} + \underset{(1.45)}{0.1096AF_{t-2}} \quad \textbf{(31)}$$

R - squared	0.63
S.E. of regression	0.022
Durbin - Watson	1.36

Equations 29 and 30 do not show us anything new referring to the previous findings. It is so because like in the previous equations, both anticipated and unanticipated parts of monetary and fiscal policy enter there significantly . What is more interesting is presented in equation 31 which is completely in the contrary with the RE hypothesis. Instead of the unanticipated parts of the respective policies, as the RE hypothesis claims, they are the anticipated ones which influence real consumption.

V. CONCLUSIONS

The emergence of Rational Expectations - Natural Rate (RENR) hypothesis has been a provocative development in modern macroeconomic analysis. This hypothesis implies that systematic, and hence anticipated, short-run stabilization policies do not influence real economic activity in a economy whose agents form their expectations rationally. Under such conditions, real economic variables become dependent only on non - policy variables, i.e., on shock variables. Consequently, authorities abandon attempts for stabilizing real variables and instead focus on price stability.

Therefore, certainly this 'policy ineffectiveness proposition' has come under severe attacks because it conflicts with the view of many macro theorists and policymakers and moreover, it became subject of empirical analysis for proving its validity.

Thus, the empirical studies which supported the rational expectations hypothesis were those ones by Barro (1977) for the United States, Attfield, Demery, and Duck (1981) for the United Kingdom, among others.

In contrast, studies by Mishkin (1982a) for the United States, Darrat (1985), Mohabbat and Al-Saji (1990), and Amer K. Al-Saji(1991) for Italy, Beladi and Samanta (1988) for United Kingdom, Paleologos (1986) for Greece, among others, have found that the anticipated component of the money growth has significant effect on real variables. This means that the rational expectations hypothesis should be rejected.

This work intended to empirically investigate for Greece the RENR hypothesis that only unanticipated monetary and fiscal policies matter to real economic variables. To my knowledge, there has been no study that examines the evidence for Greece of the simultaneous impact of monetary and fiscal policy within the rational expectations framework. The real economic variables

that were examined in this work were real output, real stock prices and real consumption. Whereas, the measures of fiscal and monetary policies are respectively the budget deficits and money supply M1, base money (B) and money supply M4. The equations to forecast monetary and fiscal actions are specified through the ARIMA model, and the anticipated and unanticipated parts of those policies were generated by the OLS estimation of the respective ARIMA models. Next, the anticipated and unanticipated parts of both policy actions entered the equations of determining real variables : real output, real stock prices and real consumption. The equations of each of them were determined as a function of present and lagged values of anticipated and unanticipated monetary and fiscal parts alone.

Through the ordinary least square estimation, the deviations of real output from its trend as result of monetary and fiscal policy influence, was examined first. For all types of money supply : M1, B, M4; and budget growth F, it was found that real output is influenced not only from the unanticipated parts of monetary and fiscal policies but from the anticipated parts as well. The latter one, were as much significant as the former ones were. This finding is of course in conflict with the rational expectations - natural rate hypothesis.

As far as the real stock prices concern, the OLS estimation provided that when money supply M1 and deficit growth entered simultaneously the estimation procedure, the results found there were not at all in accordance with the RE hypothesis. In contrary, they claim that it is only the anticipated part of policy actions which influence real stock prices. Whereas in the case when the base money was used as money supply, the statistical parameters showed that both anticipated and unanticipated parts of monetary and fiscal policies entered significantly the real stock prices equation. The implementation of M4 as money supply inferred the idea that only unanticipated parts of money supply disturbs real stock prices, which seems in accordance with RE hypothesis. But being jointly estimated with fiscal policy, the final results do not support any

more the RE hypothesis because the anticipated and unanticipated parts of fiscal policy enter statistically significant real stock prices equation.

The estimation results for the real consumption' fluctuations are like beneath:

The implementation of money supply M1 and base money did not bring something new relative to the previous findings. In both cases, the predicted movements of policy actions showed up to be deterministic for real private consumption. Therefore, the RE hypothesis is rejected. In the case of implementation of M4 as money supply, the results are much more disappointed for the RE supporters. It is so because instead of unanticipated parts of the above policies, they are the anticipated parts of them which significantly influence real consumption.

Overall, these findings in no case support the rational expectations - natural rate hypothesis that unanticipated monetary and fiscal policies have significant impact on real economic variables. These conclusions are the same with those ones found by Laumas (1991). Therefore, here is the case to claim that for the Greek case, the RE hypothesis is rejected. In such situation, the conclusion that can be inferred from this work is that the Greek government has the possibilities to help the stabilization of real variables through the interference of the proper economic tools.

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Figure 2. Money supply growth M1

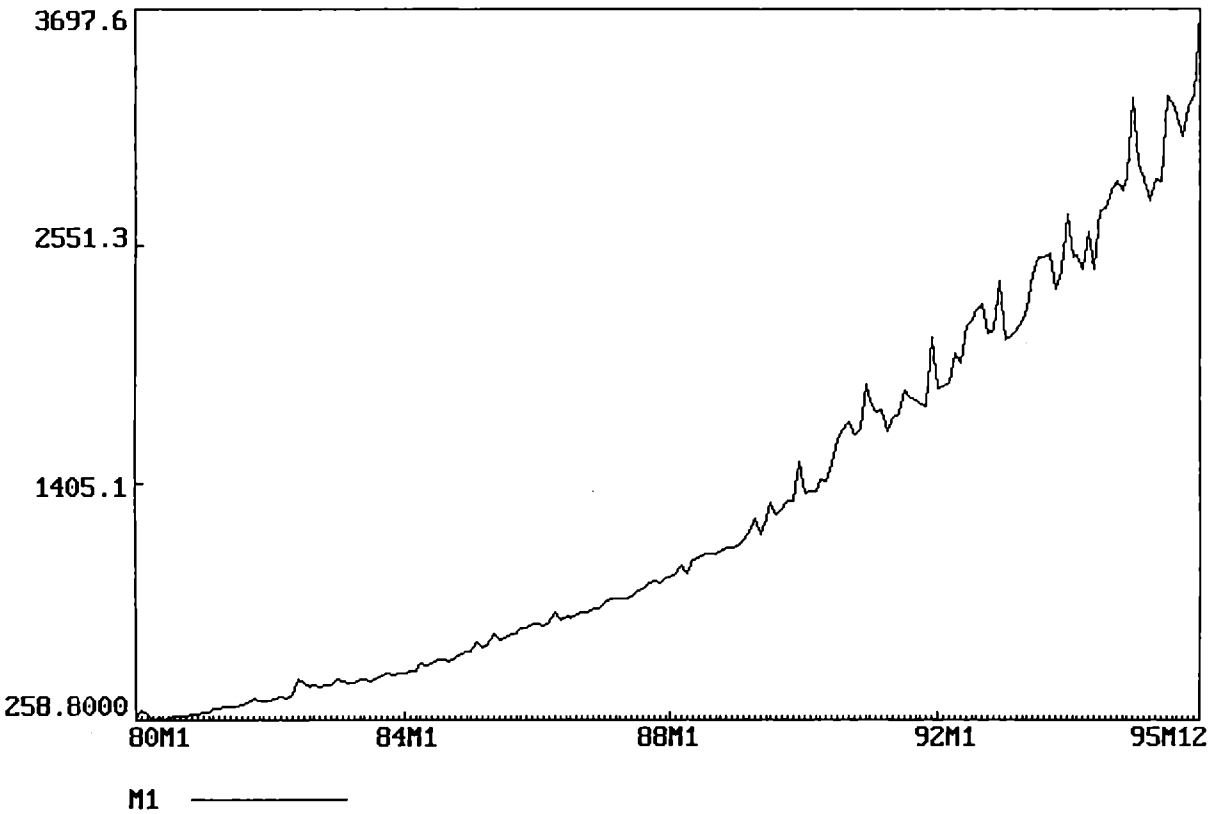

Figure 2a. Money supply growth seasonally adjusted M1

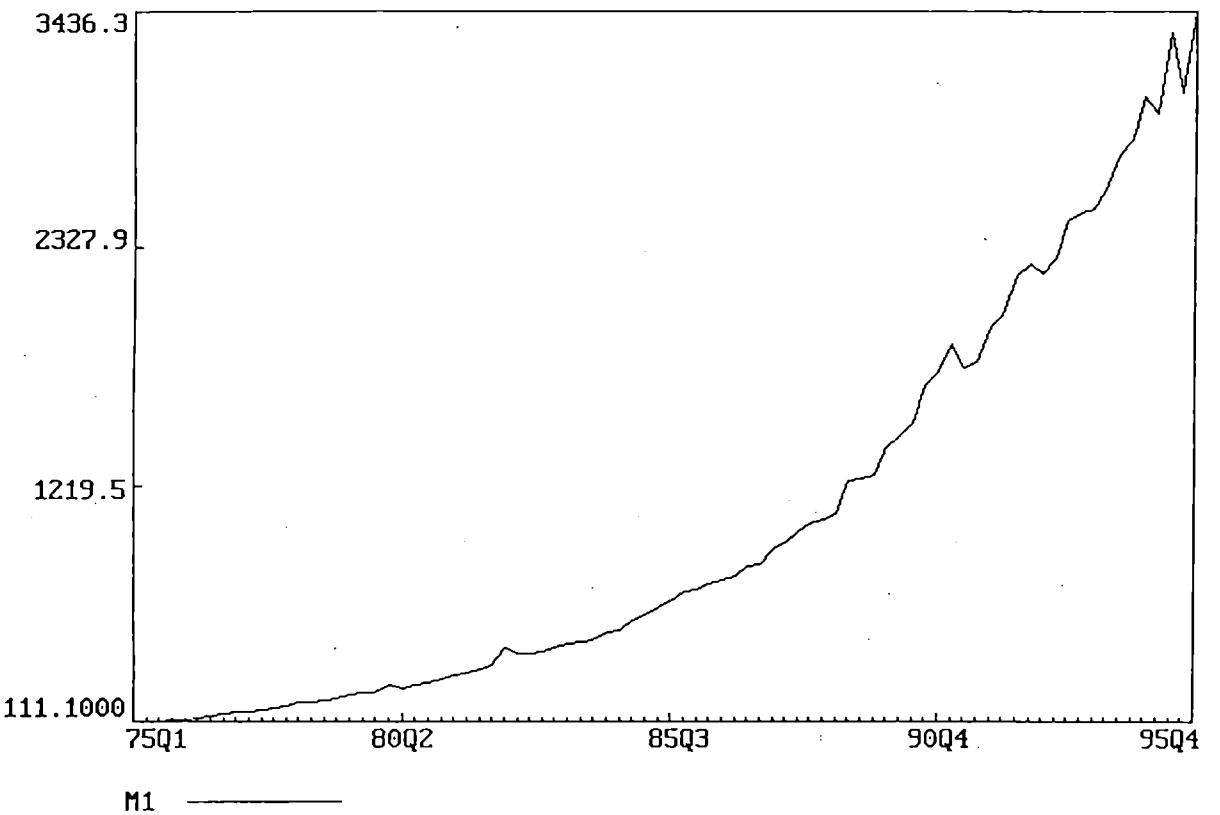

Figure 3. The plots of autocorrelation functions (ACF) and partial autocorrelation functions (PACF) of the money supply series M1

```
        Autocorrelations          Partial Autocorrelations          ac     pac
|            .   |************|            .   |************|  1  0.949  0.949
|            .   |************|            .   |**.         |  2  0.913  0.119
|            .   |***********|            .**|   .         |  3  0.863 -0.146
|            .   |***********|            .   |* .         |  4  0.824  0.060
|            .   |**********|            . *|   .         |  5  0.779 -0.043
|            .   |**********|            .   |   .         |  6  0.739 -0.014
|            .   |*********|            .   |   .         |  7  0.698 -0.000
|            .   |*********|            .   |   .         |  8  0.660  0.000
|            .   |********|            .   |   .         |  9  0.624 -0.007
|            .   |********|            . *|   .         | 10  0.586 -0.039
|            .   |*******|            .   |   .         | 11  0.547 -0.038
|            .   |*******|            .   |   .         | 12  0.511  0.011
|            .   |******|            .   |   .         | 13  0.476 -0.009
|            .   |******|            . *|   .         | 14  0.438 -0.055
|            .   |*****|            . *|   .         | 15  0.399 -0.039
|            .   |*****|            .   |   .         | 16  0.365  0.026
|            .   |****|            .   |   .         | 17  0.332 -0.011
|            .   |****|            .   |   .         | 18  0.301 -0.009
|            .   |****|            .   |   .         | 19  0.271 -0.004
|            .   |***|            . *|   .         | 20  0.234 -0.092
Q-Statistic (20 lags)  635.561                  S.E. of Correlations  0.109
```

Figure 4. The plots of autocorrelation functions (ACF) and partial autocorrelation functions (PACF) of the stationary money supply series DM1

```
        Autocorrelations          Partial Autocorrelations          ac      pac
 |        *****|   .          |        *****|   .          |  1 -0.422 -0.422
 |           .  |*****       |           .  |****        |  2  0.416  Q.290
 |           . *|   .        |           .  |***         |  3 -0.071  0.234
 |           .  |***         |           .  |**.         |  4  0.201  0.174
 |           .  |* .         |           .  |***         |  5  0.103  0.225
 |           .  |**.         |           .  |***         |  6  0.161  0.246
 |           .  |* .         |           .  |**.         |  7  0.090  0.160
 |           .  |**.         |           .  |* .         |  8  0.121  0.091
 |           .  |   .        |           . *|   .        |  9  0.020 -0.070
 |           .  |**.         |           . *|   .        | 10  0.141 -0.058
 |           .  |**.         |           .  |* .         | 11  0.130  0.102
 |           .  |* .         |           .  |* .         | 12  0.064  0.044
 |           .  |   .        |          ***|   .        | 13 -0.019 -0.218
 |           .  |***         |           .  |   .        | 14  0.196  0.011
 |           .  |   .        |           .  |**.         | 15  0.011  0.132
 |           .  |   .        |          .**|   .        | 16  0.022 -0.150
 |           .  |***         |           .  |**.         | 17  0.237  0.155
 |          .**|   .        |           .  |* .         | 18 -0.118  0.047
 |           .  |**.         |          .**|   .        | 19  0.143 -0.124
 |           .  |   .        |           .  |   .        | 20 -0.009  0.002
Q-Statistic (20 lags)   52.029                S.E. of Correlations  0.110
```

Figure 5. The plots of autocorrelation functions (ACF) and partial autocorrelation functions (PACF) of the money supply series B

```
        Autocorrelations          Partial Autocorrelations          ac     pac
|          .  |************|  |          .  |************|  1  0.955  0.955
|          .  |************|  |          .**|   .        |  2  0.897 -0.165
|          .  |***********  |  |          .  |   .        |  3  0.837 -0.032
|          .  |**********   |  |          .  |   .        |  4  0.780 -0.000
|          .  |**********   |  |          .  |*  .        |  5  0.734  0.080
|          .  |*********    |  |          .  |*  .        |  6  0.701  0.106
|          .  |*********    |  |          .  |   .        |  7  0.674  0.010
|          .  |********     |  |          . *|   .        |  8  0.643 -0.087
|          .  |********     |  |          .  |   .        |  9  0.612  0.014
|          .  |********     |  |          .  |   .        | 10  0.582  0.023
|          .  |*******      |  |          .  |   .        | 11  0.555  0.026
|          .  |*******      |  |          . *|   .        | 12  0.520 -0.115
|          .  |******       |  |          . *|   .        | 13  0.480 -0.073
|          .  |******       |  |          .  |*  .        | 14  0.444  0.046
|          .  |*****        |  |          .  |*  .        | 15  0.416  0.079
|          .  |*****        |  |          . *|   .        | 16  0.384 -0.103
|          .  |*****        |  |          .  |   .        | 17  0.354 -0.022
|          .  |****         |  |          . *|   .        | 18  0.324 -0.044
|          .  |****         |  |          .  |   .        | 19  0.293  0.020
|          .  |***          |  |          .  |   .        | 20  0.260 -0.029
Q-Statistic (20 lags)  609.848                   S.E. of Correlations  0.110
```

Figure 6. The plots of autocorrelation functions (ACF) and partial autocorrelation functions (PACF) of the stationary money supply series DB.

```
        Autocorrelations          Partial Autocorrelations          ac     pac
|          .  |***          |  |          .  |***          |  1  0.197  0.197
|        ***  |   .         |  |        ***  |   .         |  2 -0.205 -0.254
|       ****  |   .         |  |        ***  |   .         |  3 -0.328 -0.253
|          .  |**.          |  |          .  |****         |  4  0.186  0.305
|          .  |   .         |  |       ****  |   .         |  5 -0.006 -0.290
|          . *|   .         |  |          . *|   .         |  6 -0.097 -0.046
|          .**|   .         |  |          .  |   .         |  7 -0.187 -0.020
|          .  |***          |  |          .  |**.          |  8  0.207  0.122
|          .  |* .          |  |          . *|   .         |  9  0.079 -0.082
|          .  |* .          |  |          .  |* .          | 10  0.040  0.077
|          .  |   .         |  |          .  |**.          | 11 -0.030  0.153
|          .  |***          |  |          .  |* .          | 12  0.208  0.092
|          . *|   .         |  |          .**|   .         | 13 -0.062 -0.142
|          . *|   .         |  |          .  |* .          | 14 -0.100  0.073
|          . *|   .         |  |          .  |* .          | 15 -0.107  0.051
|          .  |***          |  |          .  |* .          | 16  0.208  0.056
|          .  |* .          |  |          .  |* .          | 17  0.100  0.094
|          . *|   .         |  |          . *|   .         | 18 -0.067 -0.082
|          . *|   .         |  |          .  |***          | 19 -0.051  0.197
|          .  |* .          |  |          .**|   .         | 20  0.089 -0.135
Q-Statistic (20 lags)   37.439                   S.E. of Correlations  0.110
```

Figure 7. The plots of autocorrelation functions (ACF) and partial autocorrelation functions (PACF) of the money supply series M4

```
Autocorrelations          Partial Autocorrelations          ac     pac
     .  |************|          .  |************|   1  0.944  0.944
     .  |************|          .  |   .        |   2  0.894  0.033
     .  |***********|           . *|   .        |   3  0.843 -0.039
     .  |**********|            .  |   .        |   4  0.796  0.009
     .  |**********|            . *|   .        |   5  0.742 -0.084
     .  |*********|             .  |   .        |   6  0.693  0.012
     .  |********|              .  |   .        |   7  0.644 -0.035
     .  |********|              .  |   .        |   8  0.600  0.020
     .  |*******|               . *|   .        |   9  0.551 -0.062
     .  |*******|               .  |   .        |  10  0.510  0.030
     .  |******|                .  |   .        |  11  0.470 -0.007
     .  |******|                .  |   .        |  12  0.432 -0.012
     .  |*****|                 . *|   .        |  13  0.390 -0.050
     .  |*****|                 .  |   .        |  14  0.353 -0.002
     .  |****|                  .  |   .        |  15  0.317 -0.003
     .  |****|                  .  |   .        |  16  0.284 -0.016
     .  |***|                   . *|   .        |  17  0.247 -0.039
     .  |***|                   .  |   .        |  18  0.215  0.001
     .  |**.|                    .  |   .        |  19  0.183 -0.017
     .  |**.|                    .  |   .        |  20  0.153 -0.009
```

Figure 8. The plots of autocorrelation functions (ACF) and partial autocorrelation functions (PACF) of the stationary money supply series DM4

```
Autocorrelations          Partial Autocorrelations          ac     pac
     .  |* .|                  .  |* .|        |   1  0.077  0.077
     .  |********|              .  |********|   |   2  0.637  0.635
     .  |   .|                  . *|   .        |   3  0.036 -0.051
     .  |***********|           .  |*********|  |   4  0.810  0.686
     .  |* .|                   .  |   .        |   5  0.075 -0.009
     .  |*******|               ***|   .        |   6  0.524 -0.252
     .  |* .|                   .  |***         |   7  0.080  0.249
     .  |*********|             .  |* .         |   8  0.661  0.067
     .  |* .|                   .**|   .        |   9  0.082 -0.167
     .  |*****|                 ***|   .        |  10  0.360 -0.202
     .  |   .|                  .**|   .        |  11  0.032 -0.125
     .  |******|                .  |* .         |  12  0.497  0.060
     .  |* .|                   . *|   .        |  13  0.051 -0.060
     .  |****|                  .  |* .         |  14  0.282  0.072
     .  |   .|                  .  |   .        |  15 -0.005 -0.009
     .  |*****|                 .  |   .        |  16  0.393 -0.008
     .  |   .|                  .  |* .         |  17  0.001  0.041
     .  |***|                   .  |   .        |  18  0.199 -0.022
     . *|   .|                  .  |   .        |  19 -0.049  0.013
     .  |****|                  .**|   .        |  20  0.273 -0.137
Q-Statistic (20 lags)  189.714                S.E. of Correlations  0.115
```

Figure 9. The plots of autocorrelation functions (ACF) and partial autocorrelation functions (PACF) of the deficit growth series F.

```
        Autocorrelations          Partial Autocorrelations          ac     pac
|          .**|   .            |          .**|   .            | 1 -0.124 -0.124
|          . *|   .            |          . *|   .            | 2 -0.096 -0.113
|          .  |***            |          .  |**.            | 3  0.207  0.185
|          ***|   .            |          .**|   .            | 4 -0.204 -0.176
|          .  |   .            |          . *|   .            | 5 -0.036 -0.042
|          . *|   .            |          .**|   .            | 6 -0.086 -0.181
|          . *|   .            |          . *|   .            | 7 -0.075 -0.042
|          .  |***            |          .  |***            | 8  0.250  0.216
|          ***|   .            |          .**|   .            | 9 -0.210 -0.173
|          .  |   .            |          . *|   .            |10 -0.033 -0.060
|          .  |* .            |          . *|   .            |11  0.070 -0.111
|          .  |   .            |          .  |**.            |12  0.017  0.173
|          .**|   .            |          ***|   .            |13 -0.180 -0.256
|          .  |* .            |          .  |* .            |14  0.049  0.075
|          .  |* .            |          .  |   .            |15  0.104 -0.011
|          .**|   .            |          .**|   .            |16 -0.155 -0.136
|          .  |   .            |          .  |   .            |17 -0.021 -0.024
|          .  |   .            |          . *|   .            |18  0.038 -0.073
|          . *|   .            |          .  |   .            |19 -0.051  0.012
|          .  |**.            |          .  |   .            |20  0.135  0.020
Q-Statistic (20 lags)   24.984                S.E. of Correlations  0.115
```