

## **DSGE Macroeconomic Models: A Critique\***

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## 1. Introduction <sup>1/</sup>

The family of Dynamic Stochastic General Equilibrium (DSGE) macroeconomic models was widely developed in many countries and institutions in the period 1983-2008 <sup>2/</sup>. They emerged as a synthesis between the Chicago school of thought and the so called new neo-Keynesian approach. The new-neo-Keynesian approach is an unfortunate label, since it has little to do with the real Keynesian or post Keynesian thought. The economic context that explains such synthesis is the 1985-2007 “Great Moderation” period in the United States, during which the relative stability of the economy allowed for policy approaches that could only rely in the use of monetary policy – the rate of interest. Strange enough, the basic ideas of the DSGE models were disseminated and adopted in countries where no such stability occurred, pointing towards the fact that the propensity of macroeconomic researchers towards alienation was quite higher than in other sciences <sup>3/</sup>.

It is not possible to understand the econometric shortcomings of the DSGE models if it is not clear the number of analytical failures underlying them. Hence, this paper will present a summary of the analytical failures and theoretical shortcomings and then enter briefly the field of measurement and model estimation. Section 2 describes the origin of DSGE models. Section 3 summarizes the main analytical features of such models. Section 4 discusses some analytical shortcomings. Section 5 debates why several essential assumptions of the DSGE models have little to do with real life and how this fact explains the DSGE models failures. Section 6 deals with some problems in the estimation of DSGE models and section 7 presents the conclusions of this paper.

## 2. The origin.

Between 1983 and 2007 the macroeconomic debate in the USA was more focused on theories than on policies. The Great Moderation period is perhaps one explanation for this. However it also has to do with the fact that the Chicago led thought considered that all that was needed to face business cycles and/or recessive trends was an active monetary policy – although to be fair, some people from Chicago thought that not even that was needed since they believed that free market adjustment will always find the way out.

On the other hand, the so called new-neo-Keynesians believed that fiscal policy was not needed to deal with business cycle or recessive trends. Hence both schools converged in the idea that all that was needed to avert the risks of business cycles or recessive trends was a clever monetary policy guided by a monetary rule.

Professor Robert Lucas, from University of Chicago, had emphasized in the 1970’s the need to elaborate a macroeconomic model based on microeconomic foundations: the rational behavior of consumers and their choices, the profit maximization of

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<sup>1/</sup> Some of the arguments of this paper were included in Spanish language in García (2010)

<sup>2/</sup> Particularly in top level Universities and Central Banks of the USA, Europe, Asia and Latin America.

<sup>3/</sup> In 1985-2007 a large number of great shocks and recessions took place outside the United States, both in Europe, Asia and Latin America.

producers, rational expectations, the markets structures and the state of technology. Only through this approach one could be sure that the basic parameters will remain stable under changes in economic policy. The new-neo-Keynesians share with the Chicago thought the previous approach and the convenience of considering the previous micro-foundations for macro models. Although the approach of Professor Lucas is clearly unsustainable in a world where globalization shocks keep affecting every variable and reality changes by the hour, the fact is that Finn Kydland and Edward Prescott, who shared the 2004 Nobel Prize, gave an answer to Professor Lucas' worries – Kydland & Prescott (1982).

They emphasized that economic policy should be modeled as a result of a game where policy makers are part of it. They raised the issue that when the Government can not anticipate and commit itself in advance to a policy rule, the result in a world of rational expectations will be non optimal. This case was identified as discretionary policy making against what could have been achieved by an anticipated commitment to a policy rule or non discretionary policy making. Simultaneously, they argued in a sophisticated econometric approach that effective demand variations had nothing to do with economic fluctuations – which for them were explained by technological changes. In their view increases in unemployment were due to voluntary decisions of workers.

This was in short the theoretical origin of DSGE models that emphasized the use of a rule that could be anticipated – monetary policy rule – and rejected the use of discretionary policy – fiscal policy. However, as we shall see, DSGE models were better designed to gain insight about specific economic relationships following George Lucas suggestions than to describing and analyzing the economy.

### **3. Some analytical features of DSGE models.**

DSGE models are basically short run models. They introduced sticky wages and prices, in line with the assumption that the prevailing features are regulated labor markets and monopolistic product markets. However, they accept the idea that these phenomena will be overcome and the markets will finally clear in a matter of two or three quarters. They also introduce lags in the adjustments to shocks, due to the persistence of consumer habits and/or the inertial effects of the adjustment costs of private investment or the rate of unused capital stock.

Most of DSGE models assumed that independent variables are distributed following a stochastic function – and hence they are exposed to a stochastic adjustment under the influence of shocks. These models were normally accompanied by production functions that estimated the long run product potential and in many cases the DSGE estimates were presented as gaps calculated against the long term model results.

It is also a feature of these models the Lucas rational expectations hypothesis or at least a mix with other type of expectations – depending of the analyst views. They also recognized an institutional framework or rules of the game, in the way of a monetary authority with an explicit rule. It could be a Taylor rule or some other rule that the model builder thought more suitable. The monetary authority was able then to

establish an anticipated commitment to a monetary rule and have the possibility of inducing nominal shocks, following Kydland and Prescott principle of non discretionary policy.

However, the more important feature of the DSGE models was their absolute belief that the market adjustment will always tend to equilibrium. This belief was based in four principles: i) consumers always maximize their individual utility under a budget constraint; ii) producers always maximize their profits under a resource constraint; iii) markets may face here and there some bumps but in the end, after few quarters, they always clear and iv) the representative agent was guided by rational expectations. Hence, a shock could move away the economy from a “steady state growth” but after a dynamic adjustment process that could take a few quarters it will always be back to such state.

Hence, even assuming some lags due to sticky wages and prices, consumer habits and adjustment investment costs, as long as they assumed “rational” behaviors of consumers and producers, rational expectations and an inherent market ability to clear, shocks will always generate in DSGE models an inter-temporal trend towards equilibrium.

DSGE models were estimated through econometric methods or Bayesian statistics and computer calibration. Each approach had – as we shall see – shortcomings. But all of those shortcomings were quite less important than the ones introduced by their analytical framework.

#### **4. The analytical shortcomings.**

One of the main problems of the DSGE models is that they usually do not incorporate the financial sector. This is all the most surprising since they were used by Central Banks and advisers to policy makers in monetary policy. When a macro model does not incorporate the financial sector is because one or more of the following assumptions are made: i) the financial sector always tends to equilibrium - hence the model can focus only in the macroeconomic fundamentals; ii) there is unlimited confidence that the private leadership of the financial sector can always maintain under control the transitory disequilibria of the financial sector and led the sector to a market clearing; iii) it is assumed the existence of *complete* financial markets, were no defaults, insolvencies, illiquidity or other types of unbalances can ever happen. But in real life financial markets are intrinsically incomplete and exposed to uncertainty they constantly shift in ups and downs that affect the whole economy.

In fact DSGE models did not include the financial sector because the predominant macroeconomic thought in the USA when they were created believed that the financial market always cleared and no financial disequilibrium was possible – the so called efficient market hypothesis – Krugman (2009). If trends in market prices of financial assets always reflect the fundamentals, why we should worry modeling the financial sector? On the other hand, if trends in market prices of financial assets do not show the fundamentals and there is a risk of a financial unbalance, then the macro models

should incorporate the financial sector because financial disequilibria will rapidly affect macroeconomic real variables.

The idea of a macroeconomic model that is useful to Central Banks only when the financial sector keeps moving smoothly towards equilibrium is still surprising since Central Banks were created years ago to prevent, avoid and manage financial unbalances and maintain above all the private sector confidence in financial markets in such situations. They were not created assuming that such events will never happen. Tovar (2008) adds a second important dimension: DSGE models are not able to capture the full implications of international financial linkages in a world of large financial openness.

The second issue refers to their obsession on non discretionary policy: DSGE models have no room for fiscal policy and even less attention to fiscal policy alternatives. The idea is that monetary policy and particularly the monetary rule for the interest rate is all that is needed to maintain the economy in an equilibrium path. The 2007-09 global crisis and literally hundreds of financial crisis all over the world in many years before 2007 have demonstrated how naïve this approach is and the enormous risk involved in it.

The third problem is that DSGE models are built to deal with low intensity shocks. They can not easily absorb high intensity shocks or a sharp increase in uncertainty. For example a sudden increase in uncertainty that reduces private investment decisions which, if they are not neutralized, will push the economy towards a recessive trend. Market type economies are prone to such ups and downs, recessive trends do occur frequently and external shocks are common in a globalised economy. Hence DSGE models were built either assuming that no such high shocks ever occur or if they occur the free market adjustment process would be enough to pull the economy out of such situation. Since numerous Chicago contributions to economic thought emphasized the second reason – even during the 2007-09 global recession - one tends to believe that such second reason played a silent but decisive part in the previous explanation.

This issue is even more important for open emerging economies, sensitive to external financial shocks that usually provoke deep hardships. If policy makers do believe these models forecasts, they will always be handling a very well behaved economy that faces little problems because whatever the size of external shocks, it is only a matter of time for the market adjustment to pull the country out of the mess. But the real world shows that the case is just the opposite – as the people of many Central Banks learnt in 2008-09.

## **5. Three crucial assumptions.**

However the main failures of the DSGE models are explained by their emphasis on building macro models based on the neoclassical microeconomic assumptions of “rational behavior” of a representative agent that maximizes consumption under a budget constraint and maximizes profits in production with a resource constraint,

within a very well behaved market clearing process and guided by rational expectations.

### **5.1. Rational behavior?**

North (1993), the 1993 Nobel Prize winner for his contribution to institutional analysis demonstrated that under uncertainty it is not possible to assume the idea of a “rational behavior” defended by conventional neoclassical economics and it is more close to real life to accept that people learn and behaves by trial and error. Contemporary psychology dismisses the idea of a built in “homo economicus” that drives peoples behavior towards permanently maximizing their marginal utility or profits.

Danny Kahneman, 2002 Nobel Prize winner and a not frequent professional mix of well trained psychologist with large clinical experience and brilliant mathematician, demonstrated empirically with Amos Tversky in their “Prospect Theory”, that in decisions under uncertainty the empirical evidence did not point towards a “rational behavior of agents”<sup>4</sup>/. Under uncertainty tends to emerge an asymmetric pattern that is quite different from the neoclassical rational behavior and does not follow the probability theory: the risk aversion drive dominates behavior. People prefer much more not to loose 100 us. dollars than to win 100 us. dollars – even though probability theory does not subscribe such preference.

This asymmetrical behavior summarized in the idea that when uncertainty increases the driving force is risk aversion is frontally opposed to the neoclassical assumption that the representative model agent is always maximizing profits or utility. In some periods agents may be maximizing profits but as soon uncertainty increases they rapidly shift towards risk aversion. Hence, human behavior and thus economic decisions can not be assumed as constant or permanent along time *because they change* following the increase or decrease in uncertainty, confidence and expectations. Uncertainty is not a particular case. It is the frequent environment in today’s economies. The findings of Kahneman and Tversky (1979) are very much in line with John Maynard Keynes 1936 animal spirits proposition that the human behavior is moved by deep forces that can not be explained by probability theory – hence his emphasis on the variability of animal spirits and its consequence for investment decisions and macroeconomic performance.

We are left then with the evidence that risk aversion and the *changing behavior of agents along time*, following the ups and downs of uncertainty, is in fact a more reasonable assumption than the maximizing behavior of the representative agent. This is more than important because uncertainty rises with shocks affecting macroeconomic performance and these shocks are very frequent in today’s globalised world.

### **5.2. Market clear adjustment?**

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<sup>4</sup>/ Amos Tversky died before the 2002 Nobel Prize was awarded.

The same happens with the idea of very well behave markets that always move towards equilibrium. It is useful to illustrate this subject with some contemporary Nobel Laureate contributions. James Mirrlees, 1996 Nobel Prize, demonstrated that under incomplete information, a quite common fact in the real world, market adjustment does not clear and does not ensure full employment of resources – Mirrlees (1996). The findings of 2001 Nobel Prize winner Akerlof (1970) showed that markets do not optimize and in many circumstances do not even clear or exist. Another 2001 Nobel Prize winner, Stiglitz (2003), following a similar path to that of James Mirrlees but considering asymmetrical information reached a similar conclusion: there is no automatic market clear adjustment that warrants full employment. The 2001 Nobel Prize winner Michael Spence, working on the dynamics of information flows that allow for the development of labor markets, presents the same conclusion – Spence (1974). Krugman (1979), 2008 Nobel Prize winner for his contribution on the importance of international specialization and economic scales for international trade and growth concludes that larger scales and thus trends towards monopolistic markets do not point towards neoclassical optimal market adjustments. Oliver Williamson, 2009 Nobel Prize winner for his contribution to economic governance and his “transaction theory” underlines situations when it is not possible or too expensive to acquire information for each transaction - issue that generates frictions in market adjustments – Williamson (2002). Peter Diamond obtained the 2010 Nobel Prize for his search and friction analysis in labor markets. Thus, beside the previous contributions of a great number of top level economist to this subject, seven recent Nobel Laureates emphasized that the assumption of an automatic adjustment that clears the markets is far from been true due to quite a number of reasons.

Hence, there is plenty scientific evidence that a *permanent* trend towards market automatic adjustment in the sense of market clear with full employment does not exists. The fact that in 1985-2007 no trends towards recessions were verified in the USA can not be taken as hard evidence towards market efficient adjustment because in the same period: i) many episodes happened in USA showing that financial and other markets did not clear; ii) dozens of other market economies faced in 1985-2007 serious recessive trends and iii) before 1985-2007 hundreds of recessions took place in numerous market economies – Rogoff & Reinhart (2009). After this evidence the DSGE approach starts to sound as a general theory of a particular interpretation of a certain period of time in one country.

### **5.3. Rational expectations?**

What about rational expectations, the third main assumption of DSGE models? George Lucas theory of rational expectation, which was deduced like a mathematical theorem, defines a type of expectation that for the average agent tends to be equal to the best guess of future events using all the information available today. It is assumed that future events do not significantly differ from the outcome of the future market equilibrium. Hence, rational expectations do not significantly differ from the future market equilibrium outcomes. In mathematical terms is equivalent to give a variable today the value that it will obtain in the market equilibrium tomorrow.

There is a branch of contemporary psychology that has dealt with human expectations. Professor Albert Bandura, former president of the American Psychologist Association and former Director of the Psychology Department of the University of Stanford, led a school of thought on this subject and made lasting theoretical and empirical contributions. Bandura (1986) developed what is today known as the Social Cognitive Theory. This approach emphasizes that human behavior is a result of the dynamic interaction between personal factors, behavioral patterns and environment. Behavior, for this approach, is regulated by a previous cognitive process. A key issue is the human capacity to understand and retain symbols: images, mental portraits, paintings, and above all words and language. Symbols are essential in the mechanism of human thinking because they allow human beings to store information in their memory.

Such information is going to be used afterwards by human beings in order to assess future behavior. Symbols are then the input to engage in actions assessing the future. It is through symbols that human beings can think about the future consequences of a certain behavior. Hence, through the stored symbols, the previous individual experiences create the expectation that a certain outcome will be the consequence of a certain behavior. The process of elaborating and storing symbols associated with previous experiences allows human beings to represent in their minds future events in the present. It is in the essence of contemporary psychology expectations analysis that symbols allow the storage of information in human memory and this information will be afterward used in order to assess, anticipate and guide future behavior.

Hence the Social Cognitive Theory emphasizes that in order to develop certain expectations is previously needed the storage of symbolic information about previous individual experiences. It is that stored symbolic information the necessary input that will allow us to form expectations towards the future. For this branch of Psychology, causality runs from previous experiences stored symbolically in the human brain towards the creation of expectations for the future. But for rational expectations theory causality runs in the opposite direction: the capacity to foresee the future market equilibrium is what determines today's expectations towards the future. For the rational expectation theory, the symbolic information storage process in the human brain is not relevant. The agents behave as having perfect foresight which allows them to form expectations towards the future which are equal to future market equilibrium values <sup>5/</sup>.

The fact is that the rational expectation theory has no connection at all with the branch of contemporary psychology that studies human expectations. Once it is analyzed at the light of contemporary psychology it sounds more as a convenient

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<sup>5/</sup> The only and unique situation where the rational expectations hypothesis can be legitimated by contemporary psychology is when we store in our minds symbols representing previous market equilibriums that allow us to form expectations that in the future those market equilibriums will be repeated. Clearly in this case the rational expectation theory is correct only if the future is a repetition and identical copy of the past market equilibrium. But when the future is an identical copy of the past it is the same to use rational or adaptive expectations since the first ones obtain information from the future, the second ones from the past but in both cases is the same information.



intellectual craft that pays little attention to real human behavior than a scientific economic approach.

Moreover, Buiter (2009) suggests that the rational expectation approach emphasizing that today prices depend of price expectations for tomorrow, can be extended in time towards the future. This extension process allows us to say that tomorrow prices will depend on price expectations for the day after tomorrow. Since this process is continuous and doesn't have an end we can conclude that today prices depend of price expectations for the infinite remote future. And once we get the infinite within our reasoning, the equation becomes undetermined. In the same way, rational expectations operate when there is only one future market equilibrium. Once we allow for multiple possible future equilibriums or the possibility of a future disequilibrium the hypothesis becomes inoperative.

#### **5.4. Where do we stand?**

Hence, all the evidence of the previous sections draws attention to one important fact: there are no scientific reasons to believe that a dynamic inter-temporal model should always move towards a short run equilibrium path. Once the essential assumptions of a) microeconomic "rational behavior", b) permanent drive towards an equilibrium market adjustment and c) rational expectations are lifted, no DSGE model or any kind of macroeconomic model can permanently and automatically move towards a dynamic equilibrium path. If assumptions more close to real world are adopted, a bounded instability would probable replace the previous outcome and both soft or more intense shocks would tend to push the model path towards unbalances that would need policy interventions to be neutralized.

If a DSGE model always move towards equilibrium is because *it has been built to perform in such a way* and not because is a good interpretation of the real world. As a matter of fact, if it does is because it has been built in such a way that will *always* move towards equilibrium under all kind of circumstances – which raises of course many doubts and problems. This is more the case if such model is a stochastic model designed to received shocks that although soft could tend to push macroeconomic performance far from the equilibrium path if there are no automatic built in mechanisms ensuring convergence. The previous statement is both analytically important and useful to understand estimation problems, since it also explains many debates about the statistic and econometric estimates of DSGE models, the forecasting power of that models, the role of such models and to what extent the use of DSGE models can help policy makers or induce more confusion.

#### **5.5. A tale to remember.**

One example of the risks faced with such kind of models is found in a 2007 Federal Reserve Symposium. DeLong (2009) and Krugman (2009) reminds us that in September 2007, one year *after* the mortgage default started in the USA and several weeks *after* the symptoms of severe financial stress were felt - with the anxiety that one can imagine – Frederic Mishkin a distinguish and brilliant economist member of the FED,

presented a paper that gave tranquility and confidence to the participants of the Kansas City Federal Reserve Bank Symposium in Jackson Hole, Wyoming. Mishkin (2007) presented the results of simulations done with the model FRB/US of the FED. The FRB/US was not a DSGE model but it was using a similar approach: monetary policy is the only thing needed to ensure a quick market clearing trend. The empirical results indicated that when in the following two years the housing prices would decline in 20 percent, the GDP contraction would only amount to 0.25 percent and this would add only 0.10 percent to the unemployment rate. The reason why Frederic Mishkin arrived to these results was that he assumed that the FED would react very aggressively reducing in one point of percent the rate of interest on federal funds. The main conclusion of Mishkin presentation was that the FED had the tools to contain the damage within a manageable level. It goes without saying that the previous paragraph is not a critic to Frederic Mishkin, to whom we own numerous valuable contributions, but to the use of models that are intrinsically “charged” with assumptions that should be part of the analysis and not taken as given.

One of the more intriguing issues of the discussion following Frederic Mishkin presentation at Jackson Hole is that no serious collective attention was paid to the possible rebound of the mortgage crisis on a leveraged shadow banking system and vulnerable financial sector – and this happened just two and a half months before the financial crisis developed into a deep recession. One of the reasons for this omission was the widely spread belief that the financial sector was in good shape and firm hands and that it will tend to absorb shocks and move towards a market clearing equilibrium – the efficient market hypothesis.

From the date of that presentation onwards, the Federal Reserve reduced gradually the interest rate on federal funds in the following months in five points of percents reaching a rate of 0.25 percent in December 2008. Following the Kydland and Prescott approach fiscal policy was not activated during 2007-08 although it was obvious that in the fourth quarter of 2008 the U.S. economy had already entered a liquidity trap that made the interest rate policy ineffective. By that time, it was impossible to find any market moving towards equilibrium, the financial sector was suffering a melt down, the unemployment rate was heading towards a 10 percent record high and great imbalances spread all over the U.S. economy putting the whole world in the verge of a global collapse – and many financial economists close to a nervous break down.

## **6. The estimation problems.**

The application of DSGE models has generated some difficulties. Among them, we shall address: i) problems with the general equilibrium solution; ii) linearization; iii) using data for DSGE models; iv) econometric and bayesian estimation problems.

### **6.1. The general equilibrium solution.**

Professor Willen Buiter <sup>6/</sup> remember us that DSGE type models tend to confuse the solution for a general dynamic competitive equilibrium model, with the solution to a dynamic programming problem. This is evident when they confuse the market prices obtained from the data with the shadow prices of a dynamic programming model – attaching to the first ones the efficient market hypothesis. It is even more evident when they confuse the transversality conditions that are an integral part of the solution for optimizing problems within a dynamic programming problem, with the price expectations that are a feature of the market economies. But in a market economy there is no efficient mathematical programmer who supervises and take care of the fulfillment of the boundary conditions and limits of a dynamic programming model. The efficient market hypothesis included in general equilibrium models of the DSGE type implicitly assumes that at the end of the road there is always a great and friendly auctioneer that makes sure that nothing strange happens with price expectations or with the present value of the stock of assets or financial wealth. This is not a realistic representation of a market economy. It is just a dynamic programming approach for centrally planned economies – Buiter (2009).

## **6.2. Linearization.**

Even if we accept that a DSGE model could be used for economic policy purposes, it would be immediately clear that a relevant model for economic policy should be highly non linear. For instance, changes in policy decisions tend to generate non linear behaviors. Policy variable changes tend to interact among each other in a non linear fashion. Similarly, certain policies have no effect until a certain threshold is reached after which they induce rapid changes in behavior. Or reciprocally, they have effect until they reach a certain threshold after which they loose traction on agent's behavior – a good example is monetary policy when it reaches a liquidity trap. These frequent type of processes can not be captured by linear relations. Moreover the existence of economic fluctuations, which is the way through which market economies grow, produces a non linear interaction among variables.

Buiter (2009) points out that the interaction of this non linearity with uncertainty increases the non linearity and causes serious and complex mathematical problems that must be overcome in order to obtain a solution. In order to remove this obstacle, DSGE model builders stripped out the non linearity from the model and transformed the complex evolution of random variables into a linear system with additive stochastic disturbances that behaves very well indeed. But that procedure also meant that they threw out of the window processes that are essential for the understanding of how the economy and economic policy works. People that focused attention on endogenous uncertainty that emerge from the interaction among agents with a variable but bounded rationality were quite worried by the insistence of DSGE models that all uncertainty is exogenous and additive – Buiter (2009). Tovar (2008) made a similar

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<sup>6/</sup> Willen Buiter is Professor at the London School of Economics. He has been Chief Economist of the European Bank for Reconstruction and Development, top adviser of the Bank of England and a member of the Monetary Policy Committee. Since early 2010 he is Chief Economist of one of the largest US banks: Citigroup.

point although in a more short and diplomatic fashion: DSGE models are too stylized to describe truly the dynamics of the data.

Additionally, the DSGE models analysis was restricted even more when they only considered random variations that tend to be of low intensity with regard to a “steady state growth”. Hence, the effects of low probability events that have a large impact could not be captured - Tovar (2008).

But even that was not enough: DSGE models are driven by rational expectations that in the past and present anticipated the future. Buiter (2009) remember us that when this kind of anticipatory model is transformed into a linear system exposed to shocks with stochastic additive disturbances, an unfortunate by product is that it tends to generate two kind of results: i) the model behaves in a stable way converging very rapidly to equilibrium; or ii) it tends to move restlessly towards an explosive trajectory of increasing unbalances. There is no way to introduce in DSGE models a bounded instability. The model builders, seeing that the USA did not exploded in 1985-2007, choose to select the first results. What it was left is a model that when is hit by random exogenous shocks tends to return very quickly and wisely to the “steady state growth” in a few quarters. Within the DSGE models approach there is no other possibility.

### **6.3. Using Data**

Some problems arise concerning the use of data by the DSGE models. The first one has to do with filtered information. Many theoretical concepts have been captured not using filtered data. In some cases, DSGE models are fed by filtered information, using the Hodrik-Prescott filter that decomposes serial data in a trend component and a cyclical component. The DSGE models are fed with the cyclical component because the model is suppose to explain short run cycles. But filtering has implications: forecast of actual data is no longer possible and the dynamics obtained do not match the requirements of policy makers – Tovar (2008).

A second issue is associated to the fact that DSGE models use a small number of data series. But relying on a small number of data series is against the need of the analysis of large number of data series as is normally required by Central Banks and financial markets – Tovar (2008). It is also against common sense.

### **6.4. Econometric and Bayesian solutions and problems.**

The first and more important issue is that a good econometric or statistical fit is far from being equivalent to a good economic policy tool. Kocherlakota (2007) shows that a model that fits very well the available data may provide worse answers to policy questions than an alternative model with an imperfect fitting.

Macroeconomics and particularly DSGE models have evolved in the last 25 years into the dangerous prevailing view that confuses rigor in econometric or statistical testing with soundness in economic policy analysis. There are five key issues in modeling macroeconomic policy models – and not only a good fit. The first and more important

one is the analytical soundness of the model – its capacity for capturing the main stylized macroeconomic features of the economy. The second one is how much room it offers for policy analysis and how well it can perform in this field. The third one is the statistical or econometric fit or the capacity to replicate past, present and future events and policy decisions. The fourth one is how the model performs in forecasting and information for policy making - which is really tested after the policy measures are adopted. The fifth issue has to do with great sudden changes generated by high intensity shocks that can modified the features of the adjustment process of several (or many) important variables. In such case stable parameters obtained through a good fit would cease to maintain their values towards the future and their usefulness for policy purposes. This leads to several methods for exploring parametric variation.

Tovar (2008) points out that the use of Maximum Likelihood estimates have a number of weaknesses when dealing with DSGE models. First there is a stochastic singularity problem. Second, Maximum Likelihood methods are unlikely to be consistent if the model has some degree of misspecification.

The stochastic singularity problem arises because DSGE models solutions may determine identities among variables or combinations of them. If such identities are not identified in the data any attempt to fit the data will fail. Tovar (2008) points out two ways to deal with that problem:

i). Introducing structural shocks until the number of shocks equal the number of endogenous series employed – i.e. first order autoregressive process or a random walk. But shocks can be themselves a source of misspecification and additional shocks increases identification problems. Kocherlakota (2007) highlights that confidence in the models prediction can not be increased by simply adding shocks to models in order to fit the data better.

ii). Using measurement errors. Measurement errors allow the extraction of information from a larger set of variables to estimate the parameters of the model. However, measurement errors are not based on economic theory so some of the dynamics of the model may be caused by trends that are completely exogenous to the model and which have no clear economic interpretation.

DSGE Models present a trade-off between the theoretical coherence and the empirical fit, rising important misspecification issues. The DSGE models may match some of the data but its simplified structure implies that they are likely to fail in many dimensions for the rest of the data.

Measurement errors tend to emerge in the identification of parameters. Tovar (2008) argues that the identification of parameters is not easily achieved because: i). observational equivalence – Canova and Sala (2006) - arising when the mapping between structural parameters and reduced form statistics is not unique; ii) under-identification problems if a parameter disappears due to the log-linearization of the model and iii) limited information problems: a parameter remains unidentified if only

partial information is employed. This arises if certain shocks are missing from the model.

Another way to obtain a solution for DSGE models is to solve it through Bayesian analysis. Fernandez–Villaverde (2010) presents a clever approach to this subject and states plainly that the appeal of Bayesian methods is because they are easier to apply than Maximum Likelihood methods. In fact they are considered to perform better and avoid the Maximum Likelihood obstacles.

The likelihood of DSGE models is a highly dimensional object with a number of parameters that usually oscillates between a couple of dozen and more than one hundred. Any research of a high dimensional function faces numerous perils when maximum likelihood methods are used. Additionally, likelihood of DSGE models are full of local maxima and minima and of nearly flat surfaces – due to the sparse data set and to the propensity of the DSGE models in generating similar behavior with relatively different combination of parameter values – Fernandez-Villaverde (2010). But Bayesian Methods have also some weaknesses. They can generate biased estimates - Kocherlakota (2007). And because posterior estimates of the structural parameters rely on computationally intensive simulations, methods and replication of Bayesian results may not be straightforward – Tovar (2008).

Finally, Tovar (2008) emphasizes that statistical or econometric evaluation of DSGE models is often not enough for economic purposes. They don't tell us much about *why* the model fails to fit the data. An improved analytical soundness may help to answer this question.

## **7. Conclusions**

Hence the real problem seems to lie on one fact. DSGE policy type models are a sort of contradiction on its terms. Whatever shock hit the model the answer is an automatic and rapid move towards market equilibrium that pulls out the economy of any kind of difficult situations. Thus, they intrinsically emphasized that no policy intervention is needed. Once a monetary rule is established for the interest rate policy, then the economy is ran by an automatic pilot that adjusts the interest rate surfing from one market equilibrium to the next one and policy analysis has little to say. However, once the absence of such automatic trend is empirically recognized, having nothing to say is not precisely a good policy approach. The opposite approach is a model that recognizes a bounded instability that exposed to shocks tends to amplify their consequences and requires firm policy intervention to move back closer to equilibrium.

It seems fair to close this paper quoting an above all suspicion distinguish economist and Nobel Laureate, Professor Emeritus Robert Solow of MIT, in his presentation on DSGE models to the U.S. House of Representatives Committee on Science and Technology on July 20 2010.

..."Here we are still near the bottom of a deep and prolonged recession, with the immediate future uncertain, desperately short of jobs, and the approach to macroeconomics that dominate serious thinking, certainly in our elite universities and in many central banks and other influential policy circles, seems to have absolutely nothing to say about the problem. Not only does it offer no guidance or insight, it really seems to have nothing useful to say. My goal in the next few minutes is to try to explain why it has failed and is bound to fail" ...

..."Before I go on, there is something preliminary that I want to make clear. I am generally a quite traditional mainstream economist. I think that the body of economic analysis that we have piled up and teach to our students is pretty good; there is no need to overturn it in any wholesale way and I find non acceptable the suggestion for doing so. It goes without saying that there are important gaps in our understanding of the economy, and there are plenty of things we think we know that aren't true. That is almost inevitable. The national – not to mention the world – economy is unbelievably complicated, and its nature is usually changing underneath us. So there is no chance that anyone will ever get it quite right, once and for all. Economic theory is always and inevitably too simple; that can not be helped. But is all the more important to keep pointing out foolishness wherever it appears. Especially when it comes to matters as important as macroeconomics, a mainstream economist like me insists that every proposition must pass the smell test: does this really make sense? I do not think that the currently popular DSGE models pass the smell test. They take it for granted that the whole economy can be thought about as if it were a single, consistent person or a dynasty carrying out a rationally designed, long-term plan, occasionally disturbed by unexpected shocks, but adapting to them in a rational, consistent way. I do not think that this picture passes the smell test. The protagonists of this idea make a claim to respectability by asserting that it is founded on what we know about microeconomic behavior, but I think that this claim is generally phony. The advocates no doubt believe what they say, but they seem to have stopped sniffing or to have lost their sense of smell altogether" ....

..."This is hard to explain, but I will try. Most economists are willing to believe that most individual "agents" – consumers, investors, borrowers, lenders, workers, employers – make their decisions so as to do the best they can for themselves, given their possibilities and their information. Clearly they do not always behave in this rational way, and systematic deviations are well worth studying. But this is not a bad first approximation in many cases. The DSGE school postulates its simplified economy – remember that all economics is about simplified economies just as biology is about simplified cells – with exactly one single combination worker-owner-consumer-everything-else who plans ahead carefully and lives forever. One important consequence of this "representative agent" assumption is that there are no conflicts of interest, no incompatible expectations, no deceptions"...

..."This all purpose decision maker essentially runs the economy according to its own preferences. Not directly, of course: the economy has to operate through generally well behaved markets and prices. Under pressure from skeptics and from the need to deal with actual data, DSGE modelers have worked hard to allow for various market

frictions and imperfections like rigid prices and wages, asymmetries of information, time lags and so on. This is all to the good. But the basic story always treats the whole economy as if it were like a person, trying consciously and rationally to do the best it can on behalf of the representative agent, given its circumstances. This cannot be an adequate description of a national economy, which is pretty conspicuously not pursuing a consistent goal. A thoughtful person, faced with the thought that economic policy was being pursued on this basis, might reasonably wonder what planet he or she is on”...

...”An obvious example is that the DSGE story has no real room for unemployment of the kind we see most of the time, and specially now: unemployment that is pure waste. There are competent workers, willing to work at the prevailing wage or even a bit less, but the potential job is stymied by a market failure. The economy is unable to organize a win-win situation that is apparently there for the taking. This sort of outcome is incompatible with the notion that the economy is in rational pursuit of an intelligent goal. The only way that DSGE and related models can cope with unemployment is to make it somehow voluntary, a choice of current leisure or a desire to retain some kind of flexibility for the future or something like that. But this is exactly the sort of explanation that does not pass the smell test”...

...”The point I am making is that the DSGE models have nothing useful to say about anti-recession policy because they have built into its essentially implausible assumptions the “conclusion” that there is nothing for macroeconomic policy to do. I think we have just seen how untrue this is for an economy attached to a highly-leveraged, weakly-regulated financial system. But I think it was just as visibly false in earlier recessions (and in episodes of inflationary overheating) that followed quite different patterns. There are other traditions with better ways to do macro-economics”....

Hence what can economists do with DSGE models that are built in such a way that whatever happens they *always* move rapidly towards market equilibrium leaving no need for economic policy? The answer is straight forward: they are too dangerous to be used for forecasting purposes and even more dangerous for policy making. In today’s world, a stable and predictable scenario is highly improbable and uncertainty prevails. Policy makers have learned through experience that they should always be prepared for the unexpected – exactly the opposite philosophy of DSGE models.

There is of course no model for every kind of situation. But we can not hide behind the curious argument that DSGE models were not built to perceive disequilibrium trends and the problem was that the unbalances appeared – since unbalances have always been an important feature of market economies history. Economists are responsible to understand, prevent and face the problems of their societies whatever prevailing theories are in place. So model builders have a choice. They can remain within the cozy framework of models that flourish for more than twenty years, proved that were useful when the economy functioned very smoothly but contributed to a world wide catastrophe when the road got bumpy. Or they can abandon the set of naive and very dangerous assumptions and try to get closer to real life, validating empirical behavior



and paying attention to the real economic environment with all its frictions and uncertainties. Fortunately for the macroeconomic profession, young people is already moving in the second direction and we shall see in the years to come how a new breed of macroeconomic modeling leave aside the DSGE models as an historical intellectual curiosity.

It remains an open question for sociology of knowledge to explain why the macroeconomic profession took this almost thirty years detour that brought us to the present mess. Many hypotheses were raised on this subject and probably many more will be added in the future. However, after looking around us and seeing so much damage, it seems more useful to leave such question to historians and start right now in a new analytical track. But not before hanging a very visible reminder for all future economists: do not ever allow this to happen again.

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