The First Keynesian Reactions to Lucas's Macroeconomics of Equilibrium

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1. Introduction

This paper describes the first Keynesian reactions to Lucas's macroeconomic models in the early 1970's. The referred Lucas's models are equilibrium models in which the rational expectations hypothesis plays a central role in the prediction of expected values, in such a way that agents can make optimal intertemporal decisions given the set of information available to them. These models also imply a complete rejection of what Lucas considered to be the standard macroeconometric models at the time, in which some kind of adaptive expectations was typically used. I will show that the first Keynesian reaction to Lucas's models was a criticism of the adoption of the rational expectations hypothesis, based on the argument that the hypothesis was not reasonable. This criticism reveals the fundamental methodological difference between Lucas and his first critics, since Lucas's defense of the rational expectations hypothesis was based on its operationality, not on its reasonability. I will also show that Lucas's complete rejection of what he then called the standard macroeconometric models was firstly considered by the Keynesians an extreme and unnecessary attitude, and that some of the Keynesians actually wanted to incorporate Lucas's criticism into their own models - when appropriate - instead of just discarding them. Finally, I will show that new keynesians promptly incorporated the rational expectations hypothesis into their models in the mid-1970's while the old keynesians did not, and this was the result of a move of new keynesians towards the operationality of assumptions and away from the reasonability of assumptions in their models.

2. Lucas's macro equilibrium models in the early 1970's

Lucas's first macroeconomic equilibrium model with rational expectations was presented in his "Expectations and the Neutrality of Money" (Lucas, 1972a), published in the April of 1972 issue of the Journal of Economic Theory. Lucas (1972a) builds an overlapping generations model from which emerges a positive correlation between nominal prices and real output, what he calls "a variant of the well-known Phillips curve". Monetary shocks have real effects in the short run just because young agents have information problems; they cannot distinguish whether the price change of their products is relative or absolute. A monetary expansion induces a rise in demand for all goods by the part of old agents, who receives the new money. Young agents raise the production of the goods they produce since they do not know if the rise in demand is real or nominal. Therefore, real output increases as every agent perceives expansionary periods as good periods. If not for the incomplete information problem, agents would correctly predict future prices, since they have rational expectations, and the monetary expansion would not have real effects in the economy at all.

Lucas (1972a) does not engage in a deep discussion about the reasonability of the rational expectations hypothesis and, more than this, does not make too much effort to justify its adoption. Nevertheless, Lucas (1972a: 104) explains why he is using the rational expectations hypothesis instead of some kind of adaptive expectations when talking about the concept of equilibrium used in the paper, which implies the rational expectations hypothesis for the determination of equilibrium prices:

> In this paper, equilibrium prices and quantities will be characterized as finite dimensional vectors. This characterization permits a treatment of the relation of information to expectations which is in some ways much more satisfactory than is possible with conventional adaptive expectations hypothesis.

So Lucas's (1972a) explanation for the use of the rational expectations hypothesis is based on its operationality; in relating information to price expectations in a way to reach equilibrium in every point in time, differently from what would happen with

adaptive expectations. Lucas (1972a: 110, n. 7) presents the rational expectations hypothesis as if agents knew the correct distribution of future prices, and attributing this idea to Muth (1961). In Lucas (1972a), current and future prices are the same functions of random variables, what implies that current and future prices are random variables with the same distribution.

Despite being the first macroeconomic equilibrium model with rational expectations elaborated by Lucas, the one introduced in "Expectations and the Neutrality of Money" (Lucas, 1972a) was not the first model of this type to be presented by Lucas to a large audience.[1] During the summer of 1970, few months after writing "Expectations and the Neutrality of Money" (Lucas, 1972a), Lucas prepared a paper in which he exposed the implications of rational expectations to the modeling and testing of the natural rate of unemployment hypothesis. The paper was written for a conference that Lucas was invited to participate as an advocate of the natural rate hypothesis. It was the first time Lucas wrote a paper especially for a conference and it was his first deliberate effort in establishing his macroeconomics of equilibrium in the economics profession. The paper was called "Econometric Testing of the Natural Rate Hypothesis" (Lucas, 1972b) and was presented at the Federal Reserve Board conference "The Econometrics of Price Determination", in Washington, D.C., in October of 1970.

One decade later, Lucas (1984) said in an interview that he knew that James Tobin would be present at the conference and, so, he imposed himself the task of explaining to him the implications of rational expectations to the modeling and testing of the natural rate hypothesis in a way that he could comprehend. He also wanted to explain to Tobin, as a consequence, why standard tests of the natural rate of unemployment that did not adopt rational expectations were misleading. Lucas's choice of Tobin as his interlocutor was not random. Despite being responsible for summarizing the papers of the conference, Tobin was considered a leading macroeconomist and an "honest" person by Lucas (1984); someone that he could actually discuss his ideas with. In another occasion, when writing about his recollections of that period, Lucas (2004: 290) said that the paper was written with the intention of reaching a broad audience, which was not necessarily familiar with

[1] There is a draft version of "Expectations and the Neutrality of Money" dated from January of 1970, which was presented as a working paper at Carnegie-Mellon University and can be found at Lucas's Papers at Duke University (Robert E. Lucas Jr. Papers, 1960-2004 and undated. Rare Book, Manuscript, and Special Collections Library, Duke University, Durham, North Carolina, USA.). Unfortunately, there is no register of possible reactions to the paper, which is comprehensible, since it was an internal presentation.

his theoretical and more complicated paper "Expectations and the Neutrality of Money" (Lucas, 1972a).

Therefore, the presentation of "Econometric Testing of the Natural Rate Hypothesis" (Lucas, 1972b) at the Federal Reserve Board conference can be considered the first occasion in which a Lucas's macro equilibrium model with rational expectations was exposed to and criticized by Keynesian economists. Among the critics present at the conference, besides James Tobin, there were two professors of economics from MIT, Paul. W. MacAvoy and Franklin M. Fisher, who also had their critical comments published in the volume of the conference (Eckstein, 1972). I will show, then, that the content of the criticisms were mostly about the reasonability of the rational expectations hypothesis and of the macro equilibrium model in general, but that Lucas's defensive argument was based on the operationality of the rational expectations hypothesis, not on its reasonability, revealing the fundamental methodological difference between him and his first Keynesian critics.

It is important to note, though, that the Federal Reserve Board conference in October of 1970 was not the first time in which the reasonability of the rational expectations hypothesis was subject to criticism. It had been done before, not to a Lucas's macro equilibrium model, but to Lucas and Prescott's (1971) investment model. "Investment under Uncertainty" (Lucas and Prescott, 1971), of Econometrica, from September of 1971, was the first published paper in which Lucas – with Prescott – used, indeed, the rational expectations hypothesis in a model. In the paper, the authors determine the behavior, through time, of investment, output and prices at the firm level and, simultaneously, at the competitive industry level when facing a stochastic demand, following Lucas's (1966, 1967) research agenda on investment by firms. However, differently from Lucas (1966, 1967), the rational expectations hypothesis used in Lucas and Prescott (1971) implies that actual prices at the industry level and prices forecasted by firms are random variables – not deterministic variables -, having not only the same mean value, as in Muth (1961), but the same probability distribution as a whole.

In a letter addressed to Lucas, dated from August 22nd, 1968, Prescott refers to "Investment under Uncertainty", saying that the paper was overall well received at the 1968 Meeting of the Econometric Society, in Boulder, Colorado, but the rational expectations hypothesis had been source of conflict among the participants.[2] Some of

[2] Lucas Papers, Box 1, file folder "1968".

them thought that perfect forecast in price distribution was an extremely strong assumption. So, Prescott suggested to Lucas, in the letter, that either they could use Muth's definition of rational expectations to defend the hypothesis - although he was not sure if it was really possible - or they could argue that people had eventually learned about the true distribution of prices after participating in the market for a sufficient long period. This last alternative shows that, back in 1968, Lucas and Prescott were still considering defending the rational expectations hypothesis by arguing in favor of its reasonability, its connection to the real world. Anyway, Prescott preferred the other option, as he considered Muth's approach more general and, thus, superior - since it postulated perfect forecast only in prices' mean not in prices' whole distribution -, what shows that the dominant criterion for the authors was the mathematical criterion, not the criterion of reasonability. Prescott also says to Lucas in the letter that he would work on the paper and try to use Muth's definition – what he was never able to do.

Few months later, in a letter addressed to Prescott, dated from December 2nd, 1968, Lucas mentions the effect caused by the presentation of the same paper in a symposium on uncertainty and capital theory at Cowles Foundation, in Yale, in the end of November of 1968.[3] Once again, the adoption of the rational expectations hypothesis had been source of protest by the participants of the seminar. They wanted to know what exactly the hypothesis meant and if it was reasonable at all. According to Lucas, most of the people thought that the hypothesis was unreasonable and that he and Prescott were "cheating" (Lucas's quotes) by postulating equilibrium at each point in time. Basically, they wanted to know how firms obtained information to form expectations.

"Investment under Uncertainty" (Lucas and Prescott, 1971) was submitted to Econometrica seven months later, in June of 1969. In the published version of the paper, Lucas and Prescott (1971) eventually chose to present the rational expectations hypothesis as Muth's (1961) hypothesis, not as a result of people's learning in the market, although they could not actually use Muth's (1961) definition of actual and expected prices as random variables having only the same mean. The solution to this discrepancy was to make a safety clause and to inform the reader that they were extending Muth's (1961) definition to the case in which actual and expected prices were random variables with a common distribution (Lucas and Prescott, 1971, p. 660, n. 4).

[3] The complete list of participants in the symposium includes: George Akerlof, David Cass, Duncan Foley, John Gould, Robert Hall, Al Klevorick, Robert Lucas, Edmund Phelps, Mike Rothschild, Harl Ryder, Joe Stiglitz and Hiro Uzawa.

Lucas and Prescott (1971) needed actual and expected prices to be random variables with the same distribution and not only with the same mean because they were dealing with an infinite horizon of expected future values o p_t (p^e_t, p^e_{t+1},…, p^e_{t+n}; $n \rightarrow \infty$) in the present value maximization of the firm. They needed the distribution of p^e_{t+n} to be *stationary,* having the same distribution of the observed past and current values of p_t, otherwise the variance of price forecasts for future periods (p^e_{t+n}) would increase infinitely with n, making these forecasts highly uncertain and ultimately useless.[4] That is also the reason why Lucas and Prescott (1971: 660) argue that modeling expectations as rational would be a manner to avoid the difficulty imposed by the adoption of the alternative adaptive expectations hypothesis, which would imply different probability distributions to price forecasts and actual prices (non-stationarity of the price series), and what would be "persistent, costly to forecasters, and readily correctible".

In adopting the rational expectations hypothesis, Lucas and Prescott (1971: 660) intentionally avoid discussing the "process" by which firms translate information into price forecasts, what was a typical discussion related to adaptive expectation schemes. Proceeding this way, Lucas and Prescott (1971) also avoid the discussion over the most reasonable adaptive rule of price expectation formation. Nonetheless, Lucas and Prescott (1971: 664, n. 9) make a defensive comment, in a footnote, exactly on the reasonableness of the rational expectation hypothesis, arguing that the hypothesis is as subject to objection as the hypothesis that the stochastic component of the demand has a regular and stationary structure. So, if this last hypothesis was reasonable, the first should be too.

The adoption of the rational expectations hypothesis by Lucas and Prescott (1971) created an "operational investment theory", meaning that it allowed linking current investment to *observable* current and past explanatory variables instead of to some kind of *expected* future variables. This is so because the rational expectations hypothesis postulates a property of the outcome of some unspecified expectation formation process, which is that the future price sequence at time *t* is the same function of the stochastic and stationary component of the demand as is the actual price sequence. It means that future and actual prices have the same distribution of probability and, thus, firms know the true

[4] Stationarity is a very useful assumption when dealing with stochastic processes since it allows certainty on predictions of future statistical properties of a series (of prices, for example). This assumption was adopted by other users of rational expectations, such as Thomas Sargent. Sent (2006: 82) argues that Sargent used this assumption mostly for convenience to deal with time-series, despite criticisms on the reasonability of the assumption to deal with some economic events. See Sent (2006, chapter 3) for more details on that discussion.

distribution of prices for all future periods. This assumption implies that the industry is always in equilibrium or, in other words, that prices and quantities are always market-clearing values. It also implies that all future values can be forecasted and, thus, the firm can maximize its present value for all future periods.

As we can see from this episode in 1968, the rational expectations hypothesis had been criticized for not being reasonable even before making its way into macroeconomics in the early 1970's, but Lucas and Prescott avoided this kind of discussion by putting emphasis on the operationality of the hypothesis instead. Another criticism to Lucas's models in the early 1970's would be related to the complete rejection of the standard macroeconometric models of the time implied by his equilibrium models with rational expectations. The rejection of the standard macroeconometric models of the 1960's, which contained some kind of adaptive expectations, was advocated by Lucas not only in October of 1970 with the presentation of "Econometric Testing of the Natural Rate Hypothesis" (Lucas, 1972b), but also in another seminar, few years later, in another famous paper: "Econometric Policy Evaluation: a Critique" (Lucas, 1976a).

In April of 1973, Lucas presented a more substantial and general criticism to the standard econometric models that intended to evaluate the impact of alternative economic policies. The paper "Econometric Policy Evaluation: a Critique" (Lucas, 1976a) was presented at the first Carnegie-Rochester Conference Series on Public Policy. There we can find a more elaborated version of the same theoretical criticism made in his previous paper (Lucas, 1972b): standard tests ignore the shift in the parameters of a model under different policies. The difference was that in the new paper Lucas is more emphatic about policy rules being the only scientific way to conduct economic policy, noting that it would also be the democratic way of doing it and, thus, exposing the intrinsic relationship between his theory and his political ideology.

Lucas's (1976a) complete rejection of the standard macroeconometric models would be promptly criticized by Robert J. Gordon in a series of letters exchange between them just after the conference, and more formally in a paper published in the same volume of the Carnegie-Rochester Conference Series on Public Policy (Gordon, 1976) – which also included a reply by Lucas (1976b). Gordon (1976) argues that Lucas (1976a) is right about the weakness of econometric simulations for alternative policies based on models that simply extrapolate fixed estimated parameters, but Lucas (1976a) is too pessimistic about the possibilities of remedying it. Gordon (1976) argues that, in some cases, it is possible to estimate or to deduce the shift in the parameters of the models and, thus, the

effect of different policies could be correctly evaluated. That is to say, Gordon (1976) defends the standard Keynesian macroeconometric models, but admits that they need some kind of revision.

So, not only the rational expectations hypothesis was subject to criticism in Lucas's macroeconomics of equilibrium, in the early 1970's, but also the complete rejection of what he then called the standard macroeconometric models. The complete rejection was considered an extreme and unnecessary attitude by Gordon (1976), since it was possible to incorporate Lucas's criticism into the standard models - when appropriate - instead of just discarding them.

3. Criticisms of Lucas's macro equilibrium models: reasonability *versus* operationality of rational expectations

In October of 1970, at the Federal Reserve conference, Lucas (1972b) exposed the implications of rational expectations to the modeling and testing of the natural rate of unemployment hypothesis. Lucas (1972b) presents the natural rate of unemployment hypothesis in a model in which prices and quantities are market clearing outcomes and prices expectations are rational. The model is composed by an aggregate supply equation, an aggregate demand equation, a policy rule equation and a rational expectations' equation for future prices. The rational expectations' equation for future prices applied to the aggregate supply equation constitutes the natural rate of unemployment hypothesis itself.

When introducing the rational expectations hypothesis into the model, Lucas (1972b: 96) defines it as meaning that the expectation of the difference between actual and expected prices equals zero, or what he calls "*rational* in the sense of Muth (1961)". Then Lucas (1972b: 96, n.7) discusses briefly the adequacy of the hypothesis in a footnote:

> My concern in this paper will be to show that rational expectations can lead to **workable, testable** cycle models. For the argument that this hypothesis is also **plausible and consistent with a variety of evidence**, the reader is referred to Muth (1961).

So Lucas (1972b) avoids any further discussion about the plausibility (or reasonability) of the rational expectations hypothesis and its correspondence to the real world simply by redirecting the reader to Muth's (1961) paper. He makes clear that his criterion for using the rational expectations hypothesis over the adaptive expectations hypothesis, for example, is based on its operationality – it is a "workable, testable" hypothesis.

Lucas (1972b: 94) says that an alternative adaptive expectations equation for future prices applied to the same aggregate supply equation would not constitute the natural rate of unemployment hypothesis, since it would allow the existence of both short and long run Phillips curves. Lucas (1972b: 99) argues that the wrong test on the existence of the natural rate of unemployment would be on the restriction that the sum of the coefficients of current and past aggregate demand - that include the Phillips curve parameter and the policy parameters - is equal to zero, meaning that aggregate demand shifts would not affect real output in the long run. This kind of (wrong) "standard" test - which imply a test on the magnitude of the parameter of the Phillips curve in a model with adaptive expectations - had been performed by Lucas and Rapping (1969b), and also by Cagan (1968) and Gordon (1970). The last two had been endorsed by Tobin (1968) and Solow (1970), respectively, the economists that Lucas elected as references for this kind of macroeconomic framework.

The solution of Lucas's (1972b) system of four equations – with rational expectations – implies that real output depends on the Phillips curve parameter (the response of real output to the difference between current and expected prices) and on policy parameters. Lucas (1972b: 99-100) says that the assumption of rational expectations actually implies restrictions "across equations", between policy parameters and behavioral parameters in the model. The right test on the natural rate of unemployment under rational expectations would be, then, a test on these restrictions.[5] Therefore, the existence (or not) of the natural rate of unemployment could be characterized as "a 'system priority', like stability or identifiability". Proceeding this way, Lucas (1972b) proposes to evaluate economic policy through a technical criteria, based on a model that assumes that prices are constantly clearing markets.

[5] See Hoover (1988: 177) for a more detailed description of this test.

Lucas (1972b: 99-100) also claims that what is necessary for a successful test is a period in which the policy rule could be described in a "stable, demonstrable stochastic structure", so that the parameters of this policy could be estimated in a "reliable" way. The implication of this claim is that any other kind of policy would not be scientifically reliable. Again, Lucas (1972b) is proposing to legitimize a specific economic policy through a scientific argument, based on an equilibrium model that carries a political ideology.

In his summary paper of the conference, Tobin (1972a: 13) comments on Lucas's paper saying that it was a rigorous and sophisticated defense of the natural rate of unemployment hypothesis, but criticizes the reasonability of the rational expectations hypothesis by saying that it was a too much strong assumption regarding the capability of agents of receiving and processing information:

> The participants [of the economy] not only must receive the correct information about the structure [of the economy] but also must use all of the data correctly in estimating prices and in making quantitative decisions. These participants must be better econometricians than any of us at the Conference.

Besides being a too much strong assumption, the rational expectations hypothesis and the consequent Lucas's (1972b) modeling of natural rate hypothesis would not even be useful for the policy makers, as Tobin (1972: 13) says:

> […] a pragmatist might conclude that he agrees with the natural rate hypothesis in principle but also believes that, in as long a run as can be of concern to policy-makers in an uncertain and unchanging world, a trade-off does exist for policy makers as well as for statisticians.

Lucas immediately responded to this criticism of the rational expectations hypothesis as being a too much strong assumption in a letter to Tobin dated from

November 2nd, 1970. He argues that, although he assumes in the paper that each agent knows the entire structure of the economic system, this assumption is not crucial to the existence of the natural rate of unemployment. One could still obtain the natural rate even if the agents formed their expectations about the correct distribution of future prices conditioned on only a part of the available information or even on no information on current realizations at all. They just need to know the correct conditional distributions of prices, but that does not mean that they know the structure of the entire system. They could infer the correct conditional distributions from a histogram of past prices, which, for its turn, depended of the entire structure of the economy. In the end of the letter, Lucas says he is attaching a paper that deals with this issue in a more precise and artificial setting. The paper is "Expectations and the Neutrality of Money" (Lucas, 1972a).

Not long after the Federal Reserve Board conference in Washington, D.C., in October of 1970, Tobin delivered the presidential address at the meeting of the American Economic Association, in New Orleans, in December of 1971. The subject of his talk would be exactly the relation between inflation and unemployment. Interestingly enough is the fact that Tobin (1972b:8) refers to Lucas and Rapping's (1969a) labor market model to illustrate the natural rate of unemployment argument, but does not refer to Lucas's (1972b) natural rate model with rational expectations presented just one year before, which was defended by Lucas as the right way to model and test the natural rate, substituting his own early work with Rapping.

One decade later, after the successful introduction and consolidation of rational expectations into macroeconomics literature and economic policy, Tobin (1984) exposed his recollections about the 1970 Federal Reserve Conference in which Lucas (1972b) presented his natural rate model with rational expectations. Tobin (1984) says that, at the time, he really thought that Lucas (1972b) had a nice model and a good argument in defense of the natural rate hypothesis, but he did not think that it would become important in the future. It is interesting that only ten years after the 1970 Fed conference, Tobin (1984) is very critical about the already established new classical economics, especially about the assumption of constant market-clearing, but not that much critical about the rational expectations hypothesis itself. Tobin (1984) says that the rational expectations hypothesis can be used in some circumstances, mostly because the other assumptions about expectations would leave the models exposed to criticisms, but he does not think it is an interesting hypothesis to work with. Tobin (1984) also says that Lucas (1972b) assumes market-clearing just because it is convenient, not because it is realist. He thinks

that realism of assumptions is important and criticize Lucas for the use of the "as if" methodology. So, Tobin (1984) is very critical about the unrealism of assumptions, especially about market-clearing and microfoundations, but he is not so critical about the rational expectations hypothesis itself now in the beginning of the 1980's.

Back to the Federal Reserve Board conference in October of 1970, it was not only James Tobin who criticized Lucas's (1972b) macro equilibrium model with rational expectations. Another strong criticism came from MacAvoy (1972), who cannot be considered a Keynesian but commented on the papers of the first session, which included Lucas (1972b). MacAvoy's (1972: 116) first criticism to Lucas (197b) is about the high level of aggregation of the model, which would make impossible for the applied researcher to analyze the different pricing practices of the sectors of the economy. He continues to criticize Lucas (1972b) by saying that government would not have parameters of a competitive economy in his model, since the government himself was able to control prices. He also says that the Federal Reserve monetary policy would eventually change the rational expectations function $P_t = E(P_t^*) + \eta_t$, (where P_t is the current price level, P_t^* is the future price level and ηt is a random variable). MacAvoy (1972: 117) criticizes, then, the reasonability of the rational expectations hypothesis:

> The author [Lucas (1972b)] could have rendered a great service by venturing into **testing and measuring**, as well, to show that his expectations function has **more than plausibility**. At present, this function **lacks documentation from observed behavior** in competitive industries and may be descriptive of noncompetitive industries only because those controlling output set present and future prices by making η_t "step" price adjustments (so that markets do not clear with demand changes, violating another assumption).

So MacAvoy (1972) criticizes the rational expectations hypothesis in Lucas (1972b) because he thinks that it has no correspondence in reality. He looks at the real world in which firms control prices in some industries, while the government is able to control some other prices too, and does not see a good description of that in Lucas's

(1972b) model. MacAvoy (1972: 117, n.1) is, then, even more emphatic about the non reasonability of the rational expectations hypothesis:

> Lucas cites Muth [1961] for consistency of his function with a "variety of evidence", but I found only indications in this source of the relative implausibility of the simple cobweb (p. 344). The cobweb is not the null hypothesis, the rejection of which implies the acceptance of Lucas rational expectations.

Few days after the conference, Lucas wrote a letter to MacAvoy in which he sent a revised version of his paper (Lucas, 1972b), and where he says that MacAvoy's interpretation of Muth's (1961) rational expectations hypothesis as specific to the solution of the cobweb model was completely wrong. He did not discuss MacAvoy's (1972) criticism to the reasonability of the hypothesis any further, though.

Another criticism to Lucas's (1972b) model in the same conference was made by Franklin M. Fisher. Fisher (1972: 113) also criticizes the reasonability of rational expectations hypothesis by saying that although he agrees that a policy that goes long enough can make people have correct expectations on average, he disagrees that after a policy change average expectations will be correct in the short run. He, then, exposes his idea of what would be the proper definition of rational expectations, according to his reasonability criteria:

> A proper view of rational expectations seems to me to be that the limit of the expected value of the expected prices is the same as the limit of the expected value of actual prices given that there are no policy shifts; I see no reason, however, why the two expected values should be equal at every moment in time.

Fisher (1972: 113) goes on emphasizing this criticism and the idea that in Lucas's (1972b) model individuals participating in the economy would have to be able to

understand the new policy as fast – or even faster – as the policy maker himself. In the end, he concludes saying that he does not think that the natural rate model is better than a standard Keynesian short-run macro model in guiding economic policy.

4. Debating econometric models

On April of 1973, two years and a half after the Federal Reserve Board conference in Washington, D.C., Lucas had the opportunity to present again, in another conference, his criticism to standard econometric models. The paper "Econometric Policy Evaluation: a Critique" (Lucas, 1976a) was presented at the first Carnegie-Rochester Conference Series on Public Policy. This time Lucas (1976a) did not restrain his criticism of the effectiveness of economic policy in determining the rate of unemployment - through the natural rate of unemployment example - and extended it to the effects of policies on consumption and investment too. Lucas (1976a) also sketched his first interpretation of the history of macroeconomics and made even clearer the ideological aspect of his criticism of the econometric models through the argument that a known policy rule would be not only a scientific but also a democratic way to conduct economic policy.

Lucas (1976a: 19) starts the paper sketching his interpretation of the evolution of economics in recent years. He says that economics is experiencing a conflict between economic theory and econometric practice, meaning a conflict between the natural rate of unemployment hypothesis and the econometric forecasting models that imply the existence of a long run tradeoff between inflation and unemployment. He goes on saying that this conflict is irreconcilable and, then, suggests that the econometric models used to evaluate different economic policies - what he calls "theory of economic policy" - are wrong and in need of major revision. The argument for that is the same presented in Lucas (1972b), about the shift in the parameters of models used to estimate and evaluate alternative policies. When evaluating different policies, the theory of economic policy ignores that the parameters of the model shift with each different policy. Therefore, long run estimations of these models become invalid, comparisons between different policies are meaningless and, thus, the theory of economic policy cannot be used at all.

Just after the conference, Robert J. Gordon wrote a comment on Lucas's (1976a) paper. Gordon (1976) argues that Lucas (1976a) is right about the weakness of econometric simulations for alternative policies based on models that simply extrapolates

fixed estimated parameters, but he is too pessimistic about the possibilities of remedying it. Gordon (1976) argues that, in some cases, it is possible to estimate or to deduce the shift in the parameters of the models and, thus, the effect of different policies could be correctly evaluated. That is to say, Gordon (1976) defends the econometric tradition of the theory of economic policy but admits that it needs some kind of revision.

When discussing Lucas's (1976a) defense of the natural rate of unemployment, Gordon (1976: 53) presents a simple model in which the change in the Phillips curve parameter can be actually estimated, according to the size of the change in the inflation rate and to people's willingness to incorporate the perception of this change into their supply function. So Gordon (1976: 53) is trying to write down a reasonable model, based on people's behavior in the real world, which softens the rational expectations hypothesis and tries to conciliate Lucas's (1976a) criticism of changing parameters after a policy change with the standard macroeconometric models. Gordon (1976: 56) makes even clearer his methodological difference with Lucas in another related criticism of Lucas's (1976a) natural rate model:

> In theoretical models like Lucas', economic booms and recessions are entirely symmetrical, whereas, in the real world a firm has a single option in a boom, to attract more labor input by raising its wage offer, and two options in a recession, either to reduce the wage offer or to discharge employees.

So Gordon (1976: 56) is comparing Lucas's (1976a) model with the real world in order to evaluate the model. That is the criterion adopted by Gordon (1976), which makes possible a conciliation of Lucas's criticism with the standard econometric models. The idea is to find a combination of mathematical rigor and realistic hypothesis that makes the assumptions of the model reasonable.

Lucas (1976b) wrote a short reply to Gordon's (1976) comment that was also published in the same volume of the Carnegie-Rochester Conference Series on Public Policy. Lucas (1976b) mentions their agreement on the criticism to the econometric simulations based on models that extrapolates fixed estimated parameters, but is emphatic about their disagreement on the proper research strategy that follows from this criticism.

Lucas (1976b) claims that it is impossible to remedy the problems with these models through minor modifications in it.

Both Gordon's (1976) comment and Lucas's (1976b) reply were written after the conference, between June of 1973 and January of 1974, a period in which they exchanged letters discussing Lucas's (1976a) paper. Lucas sent a revised version of his paper to Gordon on June 1, 1973, and Gordon sent Lucas a copy of his comments by the end of the same year. Lucas replied to Gordon's comments on January 3, 1974:

> As I'm sure you can guess, I do think your summary of my conclusions is misleading. Nor do I want you to have credit for showing that "in all the examples discussed by Lucas…it is possible either to estimate or deduce the shift in parameters", since most of my paper was devoted to showing exactly that.

Gordon wrote back to Lucas on January 15, 1974, attaching a revised version of his comments. He stood by his position that Lucas was too pessimistic about the possibilities of remedying the problems of the theory of economic policy, but eventually gave credit to Lucas on the possibility of either to estimate or to deduce the shift in parameters. So, at the same time that Lucas wanted to criticize the theory of economic policy he wanted to have credit for suggesting a possible revision of it.

Lucas's (1976a) criticism of econometric policy evaluation is also revealing of his point of view regarding the relationship between policymakers, society and democracy. In the last paragraph of the paper, Lucas (1976a: 42) says:

> In short, it appears that policy makers, if they wish to forecast the response of citizens, must take the latter into their confidence. This conclusion, if ill-suited to current economic practice, seems to accord well with a preference for democratic decision making.

Lucas (1976a: 42) is defending that economic policy should be known and clear to all the participants of the economy. His opinion is backed up by his idea of democracy. Lucas (1976a: 42) is blaming current economic practice for not being democratic, since it does not take into account citizens' preferences. That is an idea that fits well with his econometric criticism of the theory of economic policy. A policy formulated by a democratic elected government that is not shared with the population before its implementation is not democratic. On the other hand, the same policy, if announced by the same democratic elected government with the proper antecedence for citizens to react to it, is democratic. The last sentences of Lucas's (1976b: 62) reply corroborates this point of view:

> For my part, I have always been uneasy about the relationship between economic experts and "policymakers" which Gordon values so highly. At the risk of being unduly "optimistic", I would hope for the eventual return to a view of economic decision making in which our fellow citizens also take an informed part.

The point is not to judge Lucas's idea of democracy, but to show that his criticism of the theory of economic policy has not only a theoretical dimension but also a political dimension. More than this, Lucas was emphatic in showing this political dimension of his criticism and in using it as an argument.[6]

5) New keynesians *versus* old keynesians: playing with different rules?

By the mid-1970's, macro equilibrium models with rational expectations and Keynesian policy implications started to be formulated as a response not only to Lucas's (1972a,b, 1976) models but to new classical models in general. The first new Keynesian models did not take too long to appear in macroeconomics literature. Probably the most

[6] As pointed by De Vroey (2010a), the same Lucas's opinion on the role of the policymaker would be exposed again, few years later, in his "Rules, Discretion and the Role of the Economic Advisor" (Lucas, 1980a: 210).

referential new classical model to the new keynesian response was Sargent and Wallace's (1975) one that asserted that monetary policy had no effect in real variables, following Lucas's (1972a,b, 1976) agenda.

The model introduced by Taylor (1975) may be the first new Keynesian response to the new classical proposition that monetary policy has no effect in real variables. The way Taylor (1975) found to deny this proposition was to use a weak version of the rational expectations hypothesis – the one in which agents learn with their mistaken predictions – and to assume that there is a transition period, after a structural change in monetary policy, in which new information is combined with old information in the formation of new beliefs. During this transition period, monetary policy could affect real variables, indeed. Taylor (1975) deals with the relation of rational expectations to the real world, trying to make the hypothesis about the process by which people form their expectations more reasonable in this sense. Taylor and Lucas exchanged letters in October of 1974, when they discussed Taylor's (1975) approach to rational expectations and the consequent implications to monetary policy. Lucas wanted to know how exactly expectations were formed – since it was differently from his rational expectations - and, thus, how policies were designed in order to reach the result of non-neutrality.

Taylor's (1975) modeling of rational expectations, with a transition period to full rational expectations, did not live too long in macroeconomics literature, though. Soon after the publication of the paper (Taylor, 1975), Taylor himself – with Phelps's assistance - abandoned it in favor of a mechanism of price setting in advance as the way to enable monetary policy to have real effects, even though expectations were rational and people knew the policy rule (Phelps and Taylor, 1977). This time the reasonability of the rational expectations hypothesis was not contested and if not for this price setting in advance mechanism, monetary policy would have no effect in real variables at all.

A similar solution was developed by Fischer (1977) to show that monetary policy could have effect to real variables, at least in the short run. Fischer (1977) builds a model in which there are overlapping labor contracts and the money stock is changed more frequently than these contracts. This non-synchronism creates short-run wage stickiness and make possible for the monetary policy to affect the short-run behavior of output. Just like Phelps and Taylor (1977), the rational expectations hypothesis itself is not subject to criticism, and if not for the stickiness implied by the labor contracts, monetary policy would not have effect in real variables too.

So, new keynesians were not against the use of the rational expectations hypothesis at all in the mid-1970's. They avoided a deep discussion on the reasonability of this assumption in favor of its operationality when building their models (except for Taylor, 1975). Instead, they looked for rigidities in markets in order to restore the importance of active monetary policy. That was not the reaction of the old keynesians to the new classical challenge. That was not the reaction of Tobin, for example, when first faced with Lucas's (1972b) model. It is true, though, that the complete rejection of rational expectations by the old keynesians in the first moment became a partial tolerance ten years later, as we can see in a series of interviews in the early 1980's (Klamer, 1984).

Modigliani (1984: 128) says that the rational expectations is a perfectly acceptable hypothesis to deal with situations in which expectations are important – like financial markets, for instance -, but he has strong reservations in applying this hypothesis to macroeconomics in general. Modigliani (1984: 128) says that Lucas and Sargent are extending the idea of rational expectations too far, and his argument is that rational expectations applied to macroeconomics implies that every rational person have the same vision about the world, what he thinks it is an absurd. So, one can say that Modigliani (1984) thinks that rational expectations applied to macroeconomics is not reasonable; and this is so because the hypothesis does not reflect how people actually behave in real life. Modigliani (1984) also criticizes the market-clearing approach of the new classicals and praises Fischer (1977) for having a model that can deal with sticky prices and bring back relevance for stabilization policies.

Solow (1984: 147) thinks that the rational expectations hypothesis can be useful to deal with security markets or with a very obvious stationary stochastic process such as flipping a coin, but not with complex situations such as wars or innovations. He is in favor of the Knightian distinction between risk and uncertainty. So, he criticizes the rational expectations hypothesis applied to macroeconomics for its lack of reasonability, meaning its lack of resemblance to the real world. But Solow (1984: 147) is even more critical with the market-clearing approach of new classical than with the rational expectations hypothesis itself; and so is Tobin (1984).

Tobin (1984: 112) says that the idea of rational expectations should be separated from the new classical macroeconomics because the last included constant market-clearing besides the rational expectations hypothesis. Tobin (1984: 115) also says that he does not agree that the Keynesian macroeconometric models should be abandoned just because of Lucas's criticism. He says that these models are pragmatic and not rigorous,

meaning that the equations do not come from individual maximization, but he does not see it as a problem, since it has to deal with the behavior of different agents. So, it is impossible to base the model on the behavior of different agents and on the maximization of individual utility at the same time.

5. Conclusion

This paper showed the first Keynesian reactions to Lucas's macroeconomic models in the early 1970's. The first Keynesian reaction to Lucas's models was a criticism of the adoption of the rational expectations hypothesis, based on the argument that the hypothesis was not reasonable or, in other words, that it was not a good description of how agents make predictions at the macroeconomic level. This criticism revealed the fundamental methodological difference between Lucas and his first critics, since Lucas's defense of the rational expectations hypothesis was based on its operationality, not on its reasonability. This paper also showed that Lucas's complete rejection of what he then called the standard macroeconometric models was considered by Robert J. Gordon as an extreme and unnecessary attitude, and that it was possible to incorporate Lucas's criticism into the standard macroeconometric models, making the necessary adjustments. Finally, it was showed that new keynesians promptly incorporated the rational expectations hypothesis into their models while the old keynesians such as Tobin, Modigliani and Solow did not. This was the result of a move of new keynesians towards the operationality of assumptions, that characterized new classical models, and away from the reasonability of assumptions, that characterized old Keynesian models.

6. References

Cagan, P. (1968). Theories of Mild, Continuing Inflation: A Critique and Extension. Inflation: Its causes, Consequences and Control, Sthepen W. Rousseas (ed.). New York: New York University Press, 1968.

De Vroey, M. (2010a). Lucas on the Relationship between Theory and Ideology. *Economics e-journal*. Discussion Paper 2010 – 28. Link: http://www.economics-ejournal.org/economics/discussionpapers/2010-28

Eckstein, O. (ed.). (1972). *The Econometrics of Price Determination Conference*. Washington D. C. Board of Governors of the Federal Reserve System.

Fisher, F. M. (1972). Discussion of Papers in Session I, in *The Econometrics of Price Determination Conference.* Washington, *D. C.*, October 30-31, 1970.

Fisher, S. (1977). Long term contracts, rational expectations, and the optimal money supply rule. *Journal of Political Economy* (8): 191-205

Gordon, R. J. (1976). Can Econometric Policy evaluation be salvaged? A comment. *Carnegie-Rochester Conference Series on Public Policy*, 1 (1): 47-61.

Hoover, K. D. (1988). *The New Classical Macroeconomics.* Oxford: Blackwell.

Klamer, A. (ed.). (1984), *Conversations with Economists.* USA: Rowmand & Allanheld.

Lucas, R. E. Jr. (1966). Optimal Investment with Rational Expectations. *Unpublished*, Carnegie Tech.

Lucas, R. E. Jr. (1967). Adjustment Costs and the Theory of Supply. *The Journal of Political Economy* 75 (4): 321-334.

Lucas, R. E. Jr. (1972a). Expectations and the Neutrality of Money. *Journal of Economic Theory* 4 (2): 103-124.

Lucas, R. E. Jr. (1972b). Econometric Testing of the Natural Rate Hypothesis, in R. E. Lucas Jr. (ed.), *Studies in Business-Cycle Theory*. Oxford: Basil Blackwell, 1981, pp. 90-103. Reprinted from Otto Eckstein (ed.) *The Econometrics of Price Determination Conference*. Washington D. C. Board of Governors of the Federal Reserve System, 50-9.

Lucas, R. E. Jr. (1976a). Econometric policy evaluation: A critique. *Carnegie-Rochester Conference Series on Public Policy*, 1 (1): 19-46.

Lucas, R. E. Jr. (1976b). Reply. *Carnegie-Rochester Conference Series on Public Policy*, 1 (1): 61-62.

Lucas, R. E. Jr. (1980a). Rules, Discretion and the Role of the Economic Advisor, in S. Fischer (ed.), *Rational Expectations and Economic Policy.* Chicago: University of Chicago Press.

Lucas, R. E. Jr. (1984). Robert E. Lucas Jr., in A. Klamer (ed.), *Conversations with Economists.* USA: Rowmand & Allanheld.

Lucas, R. E. Jr. (2004). Robert E. Lucas, Jr. in W. Breit and B. T. Hirsch (eds.) *Lives of the Laureates: eighteen nobel economists.* Fourth edition. Cambridge, USA: The MIT Press.

Lucas, R. E. Jr., Prescott, E. C. (1971). Investment under Uncertainty. *Econometrica* 39 (5): 659-681.

Lucas, R. E. Jr., Rapping, L. A. (1969a). Real Wages, Employment and Inflation. *Journal of Political Economy* 77 (5): 721-754.

Lucas, R. E. Jr., Rapping, L. A. (1969b). Price Expectations and the Phillips Curve. *American Economic Review* 59 (3): 342-350.

MacAvoy, P. W. (1972). Discussion of Papers in Session I, in *The Econometrics of Price Determination Conference.* Washington, *D. C.*, October 30-31, 1970.

Modigliani, F. (1984). Franco Modigliani in A. Klamer (ed.), *Conversations with Economists.* USA: Rowmand & Allanheld.

Muth, J. F. (1961). Rational Expectations and the Theory of Price Movements. *Econometrica,* 29 (3): 315-335..

Phelps, Edmund S & Taylor, John B, 1977. "Stabilizing Powers of Monetary Policy under Rational Expectations," *Journal of Political Economy*, University of Chicago Press, vol. 85(1), pages 163-90, February.

Sargent, T. J. and Wallace, N. (1975). "Rational expectations", the optimal monetary instrument and the optimal money supply rule. *Journal of Political Economy,* 83 (2), 241-54.

Sent, E-M. (2006). *The Evolving Rationality of Rational Expectations: an assessment of Thomas Sargent's achievements.* Cambridge, UK: Cambridge University Press.

Solow, R. M. (1970). Discussion of Robert J. Gordon's "The Recent Acceleration of Inflation and Its Lessons for the Future". *Brookings Papers on Economic Activity.* Arthur M. Okun and George L. Perry (eds.), vol. 1.

Solow, R. M. (1984). Robert M. Solow., in A. Klamer (ed.), *Conversations with Economists.* USA: Rowmand & Allanheld.

Taylor, J. B., 1975. "Monetary Policy during a Transition to Rational Expectations," *Journal of Political Economy*, University of Chicago Press, vol. 83(5), pages 1009-21, October.

Tobin, J. (1968). Discussion of Phillip Cagan's "Theories of Mild, Continuing Inflation: A Critique and Extension". *Inflation: Its causes, Consequences and Control,* Sthepen W. Rousseas (ed.). New York: New York University Press, 1968

Tobin, J. (1972a). The Wage-Price Mechanism: Overview of the Conference, in *The Econometrics of Price Determination Conference.* Washington, *D. C.*, October 30-31, 1970.

Tobin, J. (1972b). Inflation and Unemployment. *American Economic Review*, vol. 62 No. 1/2: 1-18.

Tobin, J. (1984). James Tobin, in A. Klamer (ed.), *Conversations with Economists.* USA: Rowmand & Allanheld.