

Friedman, Phelps, Lucas and the Natural Rate of Unemployment

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Resumo

Este trabalho tem como objetivo construir uma narrativa acerca do desenvolvimento da macroeconomia no período do pós-guerra através de debates sobre a chamada “taxa natural de desemprego”. As definições desse conceito nos trabalhos seminais de Milton Friedman (1968a) e Edmund Phelps (1967, 1968) e sua origem nos trabalhos anteriores desses autores serão apresentadas - assim como o ambiente político-econômico do final da década de 1960, nos EUA. Será dada ênfase ao desenvolvimento e à estabilização do conceito por parte de Robert Lucas, especialmente à sua interação com Edmund Phelps. Este trabalho irá argumentar que a pesquisa de Lucas acerca do tema estava conectada pessoal e teoricamente à pesquisa de Phelps, que era seu verdadeiro interlocutor nesse assunto, apesar das recorrentes referências de Lucas a Friedman. A conexão teórica entre Lucas e Phelps se daria através da abordagem de equilíbrio geral à questão do *tradeoff* entre inflação e desemprego, enquanto que a interação pessoal pode ser verificada através da vívida correspondência entre os dois. Lucas (1972a, b) acabaria se valendo do arcabouço de equilíbrio geral com expectativas racionais para, de fato, modelar a hipótese da taxa natural de desemprego.

Abstract

This paper attempts to build a narrative on the developments of macroeconomics in the postwar period through the debates about the so called “natural rate of unemployment”. The definitions of the concept in the seminal papers of Milton Friedman (1968a) and Edmund Phelps (1967, 1968) and its origins in their previous works will be presented – as well as the political-economic context of the U.S., in the late 1960’s. Emphasis will be given to the further development and stabilization of the concept by Robert Lucas, especially to his interaction with Edmund Phelps. This paper will argue that Lucas’s research on the topic was personally and theoretically connected to the research of Phelps, who was his true interlocutor in the subject, in spite of Lucas’s recurring references to Friedman. The theoretical connection with Phelps would be established through the general equilibrium approach to the tradeoff between inflation and unemployment, while their personal interaction can be verified through their vivid correspondence. Lucas (1972a, b) would eventually use the general equilibrium framework with rational expectations to actually model the natural rate of unemployment hypothesis.

Palavras-chave: Taxa Natural de Desemprego, Lucas, Phelps, Correspondência, Equilíbrio Geral.

Key words: Natural Rate of Unemployment, Lucas, Phelps, Correspondence, General Equilibrium.

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1. Introduction

This paper attempts to build a narrative on the developments of macroeconomics in the postwar period through the debates about the so called “natural rate of unemployment”. The definitions of the concept in the seminal papers of Milton Friedman (1968a) and Edmund Phelps (1967, 1968) and its origins in their previous works will be presented. It will be shown that this concept is a new interpretation of the ineffectiveness of the economic policy in determining the rate of unemployment of the economy, in which expectations about future prices play a fundamental role. The specific theoretical background in which this concept was built will be presented, paying special attention to the debates about the tradeoff between inflation and unemployment in the American academy and politics, in the 1960’s. Emphasis will be given to the further development and stabilization² of the concept by Robert Lucas, especially to his interaction with Edmund Phelps. This paper will argue that Lucas’s research on the topic was personally and theoretically connected to the research of Phelps, who was his true interlocutor in the subject, in spite of Lucas’s recurring references to Friedman.

In his presidential lecture to the American Economic Association, in Washington, D.C., on December 29th, 1967, while discussing the role of the monetary policy and, specifically, its limitations, Milton Friedman (1968a) used the term “natural rate of unemployment” in order to express the idea that the level of unemployment in a society could not be pegged by monetary policy, once it was a result of real economic forces only. In his own words, follows the definition of the “natural rate of unemployment” and the description of the real forces related to it:

“The ‘natural rate of unemployment’, in other words, is the level that would be ground out by the Walrasian system of general equilibrium equations, provided there is embedded in them the actual structural characteristics of the labor and commodity markets, including market imperfections, stochastic variability in demands and supplies, the cost of gathering information about job vacancies and labor availabilities, the costs of mobility and so on” [Friedman, 1968a:8].

We could interpret Friedman’s (1968a: 8) natural rate of unemployment as if it was the outcome of imperfections, frictions and rigidities either in the labor or in the commodity market that prevented a Walrasian general equilibrium in the economy. As a consequence of this interpretation, unemployment would be nothing else but a non-market-clearing position in the labor market. However, it must be already noted that Friedman was not a Walrasian (Hoover, 1988: 218; De Vroey, 2001: 130), what may suggest that his definition of the natural rate of unemployment - placed in a Walrasian system of general equations – was a rhetorical instrument of exposition applied to the American Economic Association audience.³

Milton Friedman was not the only one working on the idea of a natural rate of unemployment, in the period. The same concept, without the “natural rate of unemployment” label was being developed, simultaneously and independently, by Edmund Phelps (1967, 1968). The basic idea of both authors, as mentioned before for Friedman (1968a), was that economic policy could not be used to peg the rate of unemployment of the economy, at least not in the long run. Surely, it was an old idea in the American academy,⁴ but it was also an out of fashion guide for economic policy in the U.S., at the time. In the 1960’s, unemployment was mainly diagnosed as an aggregate demand problem, not as an outcome of imperfections in the labor or commodity markets,⁵ and policy-makers – some of them with strait

² In the sense given by Weintraub (1991).

³ The question of why Friedman (1968a) places the natural rate of unemployment in a Walrasian general equilibrium framework, despite his Marshallian approach to economics, will not be addressed in this study. Further discussion can be found in De Vroey (2001).

⁴ See, for example, Simons (1936: 15).

⁵ According to the Economic Report of March 6, 1961, “Some have attributed the growth of unemployment in recent years to changing characteristics of the labor force rather than to deficiencies in total demand...Measures to improve the mobility of labor to jobs and jobs to labor...are and should be high on the agenda for economic policy. **But they are no substitute for fiscal, monetary and credit policies for economic recovery**” (Economic Report, 1961/1988: 30; emphasis added).

connections to the academy - were relying on demand-oriented prescriptions in order to mitigate it (Sloan, 1985: 90).

One of the empirical economic relations that backed up these demand-oriented policies at that time was the Phillips curve, due to Phillips (1958), which established a tradeoff between the rate of unemployment and the rate of change in money wage rates. Later, Samuelson and Solow (1960) modified this tradeoff to be between the rate of unemployment and the rate of inflation, and this version became standard in the economics literature afterwards, as an addition to the IS-LM model of the neoclassical synthesis.⁶ Samuelson and Solow's (1960) Phillips curve backed up fine-tuning policies that aimed at exploiting this tradeoff, as if the scatter diagram relating unemployment and inflation was a menu of combinations available for policy makers to choose. It is important to notice that this was not the original intention of Phillips (1958), which was embedded in the broader context of the discussion over the distinction between demand-pull and cost-push post-war inflation in the U.K. (Wulwick, 1987: 838-9).⁷

Meanwhile, in the political-economic scenario, the inflation of the late 1960's and, later, the stagflation of the 1970's, in the U.S., contributed to raise serious doubts about the suitability of the demand-oriented policy prescriptions to deal with unemployment and inflation, making room for alternative economic approaches and, specifically, creating a favorable environment for the adoption of the natural rate of unemployment hypothesis in the academy. For instance, in 1969, a study of the American labor market made by Lucas and Rapping (1969a) was published, in which Friedman's (1968a) concept of the natural rate of employment was put in the center of the analysis and, according to Hoover (1988: 27), was the first paper that deserved the "new classical" label.

The point that I want to make in this paper is that Robert Lucas is the third protagonist in the story of the natural rate of unemployment, and his research in the late 1960's and early 1970's – which, of course, includes Lucas and Rapping (1969a) and culminates with Lucas (1972a) – was responsible for the stabilization of the concept in the economic literature. More than this, I want to show through Lucas's correspondence with Phelps, as well as through the analysis of Lucas's published and unpublished papers, that Phelps was his true interlocutor in the natural rate of unemployment matter, instead of Friedman.

The next section of this paper is devoted to the search of the origins of the natural rate of unemployment concept in Friedman (1968a) and Phelps (1967, 1968), and also in their previous works. The third section deals with the academic background behind Friedman (1968a) and Phelps (1967, 1968), namely, the Phillips curve and the tradeoff between inflation and unemployment. The following section presents the political-economic environment in which this theoretical debate was embedded. The fifth section reconstructs Lucas's research on the natural rate of unemployment, stressing his close interaction with Phelps. The last section concludes the paper.

2. Origins of the Natural Rate of Unemployment

2.1. Friedman

Milton Friedman (1968a) can be considered responsible for the baptism of the "natural rate of unemployment", as claimed by himself, ten years later, in his Nobel Prize lecture.⁸ But before its baptism, the idea of a natural rate of unemployment was already present in Friedman's work and can surely be found in his papers, books and speeches prior to his famous conference in December of 1967. In April of 1966, for instance, Friedman (1966b: 60) referred to a "natural level of unemployment" while discussing wage-price guideposts with Robert Solow, in a conference held at the University of Chicago. The idea

⁶ According to Pearce and Hoover (1995: 205), the Phillips curve was promptly incorporated into Samuelson's textbook *Economics*, in the appendix of its fifth edition (1961), as if it was a menu from which society should choose the ideal relation between inflation and unemployment. The first time it appeared in the main text of the book was in its eighth edition (1970), being kept in the appendix in the sixth (1964) and in the seventh (1967) editions.

⁷ An additional comment must be made. According to Laidler (2001), Phillips's research agenda was focused on macrodynamics and his 1958 piece cannot be considered an important part of this agenda. On the contrary, it was a marginal product of his research.

⁸ "The 'natural rate of unemployment', a term I introduced to parallel Knut Wicksell's 'natural rate of interest', is not a numerical constant but depends on 'real' as opposed to monetary factors - the effectiveness of the labor market, the extent of competition or monopoly, the barriers or encouragements to working in various occupations, and so on" [Friedman, 1977: 458].

still seemed incipient, but, definitely, was the same from the natural rate, regarding its independence from the monetary forces of the economy:

“In my opinion, there is what might be termed a “natural” level of unemployment in any society you can think of [...] for any given labor market structure, there is some natural level of unemployment at which *real* wages would have a tendency to behave in accordance with productivity [...] If you try, through monetary measures, to keep unemployment below this natural level, you are committed to a path of perpetual inflation at an ever-increasing rate” [Friedman, 1966b: 60-61].

Just after this conference, on October 17th, 1966, the *Newsweek* magazine published an article in which Friedman (1966c/1975: 60-1) makes a prediction about the inflationary recession that would take place in the American economy in the following year. There, we can find his idea of the non-existence of a long run tradeoff between inflation and unemployment. Later, it would be part of Friedman’s (1968a) argumentation about the existence of a natural rate of unemployment:

“Our record economic expansion will probably end sometime in the next year. If it does, prices will continue to rise while unemployment mounts. *There will be an inflationary recession*. Many will regard this prediction as a contradiction in terms, since it is widely believed that rising prices always go with expansion and falling prices with recession. Usually they do, but not always” [Friedman, 1975:60-61].

We could go back in time and find the idea of the ineffectiveness of the monetary policy in pegging the rate of unemployment in a critique made by Friedman (1963/1968b), in a conference in India, in 1963, about the causes and consequences of inflation. This critique would also be part of his later (Friedman, 1968a) argumentation about the existence of a natural rate of unemployment:

“I did not say that full employment led to inflation. I said that a full employment *policy* led to inflation. That is quite a different thing. A full employment policy is likely to mean that you do not have full employment, because a full employment policy tends to be an open invitation to everybody to try to push up wage rates here, there, and elsewhere. The rises in wage rates lead to unemployment. In trying to counter the unemployment, the Government is likely to increase the money supply and this tends to produce inflation” [Friedman, 1968b: 39].

Despite these previous manifestations, Friedman (1968a) only introduces the term “natural rate of unemployment”, in fact, in December of 1967, in his argumentation about the ineffectiveness of the monetary policy to peg the rate of unemployment for long periods, as said before. In this famous conference, Friedman makes an analogy between his “natural rate of unemployment” and Wicksell’s “natural rate of interest”, saying that in the same way that monetary policy could not peg the rate of interest of an economy, it could not peg the rate of unemployment, too. We can see, by the use of the word “natural”, that Friedman (1968a) treated frictions in the labor and commodity markets - which are, eventually, the only responsible for the positive rate of unemployment - as phenomena that could not be remediated by nominal measures. Thus, Friedman (1968a) naturalizes unemployment and, consequently, market imperfections.

Friedman (1968a: 8) presents the natural rate of interest and the “normal” real wage as being, respectively, the long run prices of capital and labor. So, in the same way as the natural rate of interest in the capital market, the “normal” real wage should be compatible with a situation of no excess of demand (or supply) in goods’ and labor’s markets. If, for example, the monetary authority tried to peg the rate of unemployment below its natural rate, by increasing the rate of monetary growth, it would be just temporarily successful, until price and wage expectations by firms and workers adjusted to the new rate of

monetary growth, the real wage came back to its long run equilibrium value and unemployment to its natural rate.⁹

It is interesting to notice that Friedman (1968a: 8) calls attention to the resemblance between his idea of the natural rate of unemployment and the Phillips curve, regarding the fact that both imply that changes in wages reflect pressures in the labor market. But Friedman (1968a: 8) criticizes Phillips (1958) for relating, mistakenly, these pressures to changes in nominal wages instead of in real wages.¹⁰ According to Friedman (1968a: 8), this was the same mistake made by Wicksell when analyzing the behavior of the interest rate, namely, do not distinguish nominal forces from real forces in the economy. And this is the strong argument used by Friedman (1968a) to justify the ineffectiveness of the monetary policy to peg the rate of unemployment: monetary policy deals with nominal forces while the rate of unemployment is a real phenomenon and is determined, thus, by real forces, such as minimum wage, unions and incomplete information in the labor market. Following this line of argumentation and going against the tradeoff exploitation idea suggested by the Phillips curve, Friedman (1968a: 11) states that a temporary tradeoff between inflation and unemployment would always exist, due to unexpected inflation – what would imply, eventually, a continuous growth of the inflation rate for the monetary policy to be effective -, but a permanent tradeoff would not exist, even under high rates of inflation.

To sum up, based on Friedman's (1968a) argumentation about the existence of a natural rate of unemployment, we can say that he considers unemployment as an outcome of real imperfections of an economy that tends to a general equilibrium position. This equilibrium can only be disturbed by monetary policy in the short run, when there is, indeed, a tradeoff between inflation and unemployment that can be exploited, because agents fail to anticipate prices correctly.

2.2. Phelps

Together with Milton Friedman, Edmund Phelps is responsible for elaborating the concept of the natural rate of unemployment, in the end of the 1960's, although they have worked independently in their respective elaborations. Phelps (1967) presents a macrodynamic model from which an optimal path of the employment level of the economy is derived, through the maximization of a dynamic social utility function by the fiscal authority. The model contains a Phillips curve representing the tradeoff between inflation and unemployment, but it does not mean that the fiscal authority can freely choose the level of employment through the management of the aggregate demand. On the contrary, the tradeoff represented by the Phillips curve would be just a static relationship, in a specific point in time, and in a dynamic model the actual rate of unemployment would converge to an equilibrium rate of unemployment, to be reached when the actual rate of inflation equalized the expected rate of inflation, through an adaptive mechanism. If, for example, the fiscal authority tried to peg a rate of unemployment that was lower than the equilibrium one, through expansionary policy, it would be effective only in the present. But by raising the inflation expectation it would move the economy to a new path, in which the equilibrium (equality between actual and expected inflation) would be reached with a higher actual rate of inflation and with the same equilibrium rate of unemployment. Thus, in the same way proposed by Friedman (1968a), aggregate demand stimulus would only generate a higher rate of inflation, in the long run, with no permanent effects in the rate of unemployment:

“The quantity u^* measures the “equilibrium” unemployment ratio, for it is the unemployment rate at which the actual rate of inflation equals the expected rate of inflation so that the expected inflation rate remains unchanged [...] The dynamical approach recognizes that any optimal time-path of the unemployment ratio must approach the steady-state equilibrium level, u^* ; perpetual maintenance of the unemployment ratio below that level (perpetual over-employment) would spell eventual hyper-inflation [...] The policy trade-off is not a timeless one between permanently high unemployment and permanently high inflation,

⁹ For a more detailed interpretation of Friedman's (1968a) analysis, see De Vroey (2001).

¹⁰ Forder (2010) argues that although Phillips (1958) did not treat the nominal/real wage question properly, his followers were aware of the problem and immediately corrected it through the addition of the change in the price index as an explanatory variable of the change in the nominal wages.

but a dynamic one: a more inflationary policy permits a transitory increase of the employment level *in the present* at the expense of a (permanently) higher inflation and higher interest rates in the *future steady-state*” [Phelps, 1967: 255-6].

Two aspects of Phelps’s (1967) model must be taken into account if we intend to trace the origins of this idea of an “equilibrium” unemployment ratio (or, without loss of meaning, a natural rate of unemployment). The first is the dynamic optimization approach present in his analysis and the second is his concept of equilibrium as being the equality between the actual and expected rates of inflation. The two aspects combined imply the ineffectiveness of the economic policy to peg the rate of unemployment in the long run and, thus, the existence of an equilibrium rate of unemployment (natural rate of unemployment).

Roots of the dynamic optimization approach of Phelps’s analysis can be found in his early works, specifically about fiscal policy and economic growth, in the 1960’s (Phelps, 1961, 1965). Phelps (1965) can be considered as part of the literature on economic growth that was established in the 1960’s and applied the mathematical tools used by Ramsey (1928) in trying to combine agents that maximize utility with aggregate control of the economy (Duarte, 2009: 164).¹¹ Phelps (1967: 264) gets inspired by Ramsey’s (1928) model to build his social utility function and, thus, to reach the conclusion that the choice between inflation and unemployment would be a dynamic one to be faced by society, given the intertemporal utility maximization criteria. In this context, the relative weights given to the present and to the future – and expressed by the intertemporal discount rate - would play a fundamental role in the agents’ choices.

With respect to the equilibrium approach, Phelps (1995: 16) gives credit to Abba Lerner (1949) and William Fellner (1959) for introducing the idea of the neutrality of the inflation to the unemployment equilibrium path. Abba Lerner’s (1949) work deals, basically, with the inflationary process itself, specifically with its definition, the harms associated with it, its origins and possible remedies. According to Lerner (1949), the inflationary process could do harm to the economy by disturbing the price system and, thus, the efficiency of the resources allocation. However, if inflation could be anticipated by the agents, in a way to equalize the actual and the expected inflation rates, there would not be any disturbance in the price system at all and, so, we could say that an efficient equilibrium position would be reached by the economy (Lerner, 1949, 194).

William Fellner (1959) formalizes the concepts of demand inflation and cost inflation and investigates the role played by collective bargaining in the inflationary process. The author relates the existence of the cost inflation to the monopoly power of firms and unions, which exert some kind of control over prices and wages. On the other hand, in a competitive environment, demand inflation could emerge, without impact, however, in the resource utilization level (Fellner, 1959: 227).

It is interesting to notice that one year after the publication of his paper (Phelps, 1967) on the “equilibrium” rate of unemployment, Phelps (1968) introduces a slightly different idea about the subject, by switching the focus from the ineffectiveness of the monetary policy to peg the equilibrium unemployment rate to the peculiarities of the labor market that would make this unemployment rate to be positive. In his 1968 paper, Phelps studies the wages dynamics in a labor market that is out of long run equilibrium. The model contains heterogeneous workers and heterogeneous job vacancies; firms and workers incur in search costs in the labor market because they do not have perfect information about it. This friction avoids the unemployment rate to be led to an equilibrium value that would be typical of a Walrasian auction. However, there is, indeed, a “steady-state” unemployment rate (u^*) that implies no demand excess in the labor market ($\dot{u} = 0$). Thus, any attempt to reach a lower rate of unemployment, through expansionary policies, triggers a nominal wages and prices hyperinflationary process, fed by the recurrent underestimation of the expected rate of inflation by the adaptive mechanism. The labor market equilibrium requires, as in Phelps (1967), equality between nominal wages’ actual and expected rates of

¹¹ It must be noticed, however, that the model known as “Ramsey-Cass-Koopmans”, which emerged in the post-war period, was different from the original Ramsey (1928) model (Duarte, 2009: 177).

inflation. Recollecting on the differences and similarities between his ideas on the natural rate of unemployment and those from Friedman (1968a), Phelps (1995: 15) states that:

“Modeling the natural rate idea led to two propositions. One of these was a conclusion from the model sketched in my 1968 paper (Phelps, 1968, part 2). Management of monetary demand cannot engineer an arbitrary unemployment rate other than the natural level without sooner or later generating a continuing disequilibrium manifested by rising inflation or mounting deflation - then collapse. [...] The other proposition was implied by my 1967 paper (Phelps, 1967) and rather a similar thesis was forcefully argued by Milton Friedman in his 1968 paper (Friedman, 1968). Monetary policy can make a permanent difference only to nominal variables: a policy to generate a finite increase or decrease in the inflation rate will generate only a transient dip of the actual unemployment rate relative to the path it would otherwise have taken. In particular, the actual unemployment rate, though occasionally hit by such shocks, is constantly homing in on the natural rate. This last part – equilibration – makes this the stronger proposition of the two, as we could believe the former without having much faith in the homing in” [Phelps, 1995:15].

3. Phillips curve and the menu of choices

To better put Friedman's (1968a) and Phelps's (1967, 1968) formulations of the natural rate of unemployment hypothesis into the academic context, it is important to know in which debate they were inserted. We can promptly say that the authors were discussing both the validity of the Phillips curve – as conceived in the original Phillips's (1958) paper – and the validity of its later transformation into an instrument of economic policy.¹² As said before, the debate over the validity of the Phillips curve must be interpreted as a derivation of a broader debate, in which Phillips (1958) was actually inserted, namely, about the causes of the post-war inflation, in the 1940's and 1950's; more precisely, whether post-war inflation was the outcome of demand or supply pressure (Wulwick, 1987: 838-9). It is based on this context that we should analyze Phillips (1958) and, only then, interpret Samuelson and Solow's (1960) proposal to transform the Phillips curve into a menu of choice for policy makers.

Phillips's (1958) original work was an effort to explain the rate of change in money wage rates through the level of unemployment and through the rate of change of unemployment, in the U.K., between 1861 and 1957. The author specifies three different determinants to the rate of change of money wage rates: the excess demand for labor, the rate of change of the demand for labor and the rate of change of retail prices. He analyzes the effect of the two first into the rate of change of money wage rates, controlling for the third and, thus, isolating demand effects from supply effects (rise in costs). The results give support to the hypothesis that demand effects (level of unemployment and rate of change of unemployment) determine the rate of change of money wage rates. To conclude, Phillips (1958: 299) suggests that different levels of aggregate demand could determine different combinations of unemployment rates and rates of change of money wage rates, calling attention to the fact that this conclusion is just tentative.

Following Phillips (1958), Lipsey (1960) develops the results and conclusions of the former, (i) testing his hypothesis on the role of the rate of unemployment and its rate of change in the determination of the rate of change in money wage rates, (ii) building a theoretical model to the behavior of these

¹² Friedman (1968a: 8): “Phillips' analysis of the relation between unemployment and wage change is deservedly celebrated as an important and original contribution. But, unfortunately, it contains a basic defect—the failure to distinguish between nominal wages and real wages—just as Wicksell's analysis failed to distinguish between nominal interest rates and real interest rates.”

Phelps (1967: 256): “Of course, my criticism is founded also upon the postulated “instability” of the Phillips Curve. In fact, a situation of sustained “over-employment”—more precisely unemployment less than u^* by a non-vanishing amount—has been supposed to produce an explosive spiral through its effects upon the Phillips Curve. On my assumptions, the only steady-state Phillips Curve is a vertical line intersecting the horizontal axis at u^* .”

Phelps (1968: 682): “But is the Phillips trade-off real, serious, and not misleading? I shall discuss briefly two challenges to the Phillips curve to which this paper is relevant.”

variables in a market with only one good and, after that, expanding to the whole economy and (iii) analyzing specifically the post-1918 period, in the U.K.. The results of the tests show that there is, indeed, a significant relation between the rate of change of money wage rates and the level and the rate of change of unemployment, as proposed by Phillips (1958). On the other hand, the model proposed by Lipsey (1960) shows the existence of problems regarding the inverse relation between the rate of change of money wage rates and the level of unemployment if the last is maintained constant for a long period.¹³ Finally, the author calls attention to the absence of theoretical explanation and of independence tests to understand the high correlation between the movements in money wages and in price level (Lipsey, 1960: 30-1).

This warning is made necessary because there was an increase in the importance of the movement in the price level as an explanatory variable to the changes in money wages in 1923-39 and 1948-59 compared to the period before World War I (Lipsey, 1960: 26). At the same time, the unemployment rate (U) lost its importance in the determination of changes in money wages, in the same period. These results lead the author to conclude that the data and the model are compatible with the cost inflation hypothesis, although Phillips (1958) had used the same results as evidence in favor of the demand inflation hypothesis. Bearing this in mind, Lipsey (1960: 31) finishes the paper saying that these results were more important to economic theory than to economic policy.

One can say that the American version of the Phillips curve, which was developed by Samuelson and Solow (1960), was not strictly cautious about this last point made by Lipsey (1960), namely, the extrapolation of the analysis to economic policy. Samuelson and Solow (1960) relate, in the first place – as Phillips (1958) and Lipsey (1960) did –, the rate of unemployment to the rate of change of money wage rates and, after that, modify the original curve to relate the rate of unemployment to the rate of inflation. This procedure is understandable if we think that the authors were deliberately interested in deriving anti-inflation policies from the debate over cost-push and demand-pull inflations. Samuelson and Solow (1960) found an inverse relation between the rate of unemployment and the rate of change of money wage rates, in the U.S. that was very similar to the relation found by Phillips (1958) to the U.K... The next step was the modification of the original curve, graphically representing the rate of unemployment against the annual rate of inflation and, also, presenting this negative relation as if it was a menu of choice between rates of unemployment and rates of inflation from which the policy makers could choose.¹⁴

4. The Political-economic environment

The circumstances surrounding the advocacy of the Phillips curve as an instrument of economic policy, presented in Samuelson and Solow (1960), are examined by Leeson (1997). The American elections of 1960, the dispute between John F. Kennedy and Richard M. Nixon and the debate over unemployment and inflation shape the context in which this advocacy is embedded. According to Leeson (1997: 129), Samuelson and Solow (1960) made explicit use of the Phillips curve as a weapon in the battle over economic policy in the elections of 1960, in the U.S.. More than this, they used it to show that a rate of inflation of 4% to 5% would be necessary to keep high levels of employment and output in the following years. This battle was being engaged against the anti-inflationary policy of the republicans and, also, against the left Keynesianism of Galbraith and the structuralists, who claimed for explicit price controls.

Recollecting about the first years of the Kennedy administration, Solow and Tobin (1988) explain the predominant view of the Council of Economic Advisers regarding the tradeoff between inflation and unemployment that was presented in the Economic Reports:¹⁵

¹³ Desai (1975: 2) highlights the under identification problem in the estimation of Lipsey's (1960) model.

¹⁴ According to Laidler (1997: 93-4), Samuelson e Solow (1960) do not give any information about the sources of their data, nor even how the estimations are made.

¹⁵ The first Economic Reports of the Kennedy administration contain the following texts, which can be found in Solow and Tobin (1988):

1) The American Economy in 1961: Problems and Policies, Statement of the Council of Economic Advisers (Walter W. Heller, Chairman; Kermit Gordon; James Tobin) before the Joint Economic Committee, Monday, March 6, 1961.

2) Economic Report of the President, January, 1962

“The intellectual framework that led the Council in this direction is clear in retrospect and was quite clear then. We believed we were trying to shift favorably the *level* of the Phillips curve, by talking it down in the first instance and by informal intervention if necessary. Phillips curves appeared on the backs of our envelopes [...]. Since then there has been much debate about the meaning and validity of a ‘trade-off between unemployment and inflation.’ The use made of this notion in the 1962 Economic Report has sometime been characterized as naive. We do not think it was; but we may have banked too heavily on the stability of the Phillips curve indicated by postwar data through 1961.

The Council’s estimate in 1961 was that 4 percent unemployment was a reasonably safe ‘interim target’. We meant to state our belief that expansion of aggregate demand could return the economy to an unemployment rate of 4 percent – last achieved in 1957 – without much danger of wage-induced inflation. Since then, much research effort has gone into estimation of the ‘natural rate of unemployment’, a closely related but much more theory-laden concept. Some of that research suggests that 4 percent was too low a target unemployment rate in 1961, and some suggests that it was close to being right. We observe that the unemployment rate did indeed get down to 4 percent at the very end of 1965 without signs of labor-market strain and with negligible acceleration of inflation. It took the clear wartime excess demand of 1966-68 to set off a wage-price-wage spiral” [Solow and Tobin, 1988: 15].

Despite the awareness of the tradeoff between inflation and unemployment by the Kennedy economic staff, in the beginning of the 1960’s, and being clear the identification of this tradeoff with the Phillips curve, we cannot say that the economic policy of that period was based on estimations of Phillips curves for the American economy. Forder (2010: 338-9), for instance, argues that the Council did not use the Phillips curve, in that period, in the Economic Reports, despite its expansionary policy and its concern about unemployment and inflation. In fact, the words “Phillips curve” cannot be found in the Economic Reports of 1961 and 1962, not even a graph similar to Phillips’s (1958).

The fact is that the American inflation was rising in the late 1960’s, when economists really started to face it as a huge problem. The Vietnam War and the refusal to accept the tax increase proposed by the Council of Economic Advisers were considered by the American policy makers at the time as the great villain of the New Economics fine tuning,¹⁶ responsible for the acceleration of inflation from 1966 onwards. This was the context in which Friedman and Phelps were developing their ideas about what became known as the natural rate of unemployment. The never ending debate over the right economic policy to deal with inflation and unemployment, which had been influenced by the Phillips curve in the 1960’s, in the U.S., would gain a new concept - surely based on old ideas - that would enter the economic literature and make room for new approaches.

5. Stabilizing the Natural Rate of Unemployment

It is interesting to notice that although Milton Friedman and Edmund Phelps are considered the formulators of the natural rate of unemployment hypothesis, there are controversies about the actual formalization of this hypothesis in their seminal works (Friedman, 1968a; Phelps, 1967, 1968). Both authors are known for having introduced the inflationary expectation term into the original Phillips curve; however, the formation of this expectation through an adaptive mechanism would not imply the existence of a natural rate of unemployment (or a vertical Phillips curve, in the long run). The natural rate of unemployment hypothesis would only be formalized, indeed, by Lucas (1972a, b), with the introduction of rational expectations regarding inflation (Hoover, 1988).

3) The Annual Report of the Council of Economic Advisers, 1962.

It is interesting to notice that Solow and Tobin (1988: 15) talk about a “natural rate of unemployment” when referring to the rate of unemployment that would be compatible with a “negligible acceleration of inflation”. As said before, this term was not used in the beginning of the 1960’s, but, apparently, it was so well diffused in the late 1980’s that the authors chose it in spite of any other term.

¹⁶ See Lesson (2000:7) for more details.

To understand how Lucas (1972a, b) reached the actual formalization of the natural rate of unemployment hypothesis it is necessary to investigate the evolution of his research that culminated in this result. De Vroey (2001: 127) argues that although both the monetarist approach embedded in Friedman (1968a) and the new classical approach embedded in Lucas (1972a) can be considered two stages of the same process of attack to the Keynesian paradigm, it does not imply that there is a line of continuity between them. There would be, instead, fundamental methodological differences between the two, not to mention the obvious substitution of Friedman's (1968a) adaptive expectations by Lucas's (1972a) rational expectations. According to De Vroey (2001: 143), these methodological differences would be the following: i) to Friedman (1968a), the effect of nominal shocks into real variables would be a Marshallian disequilibrium result, while to Lucas (1972a) it would be a Walrasian equilibrium result; ii) to Friedman (1968a), the concept of equilibrium (or disequilibrium) would be an aspect of the real world, while to Lucas (1972a) it would be just a way to model the world.

But, if on the one hand Lucas's research on the natural rate of unemployment deviates methodologically from Friedman's research, on the other hand it comes close to Phelps's research on the subject.¹⁷ This section intends to reconstruct the relation between Lucas and Phelps, having the natural rate of unemployment as a conducting wire, showing that Lucas's research on the subject had a personal and theoretical connection to the research of Phelps, who was his true interlocutor, in spite of Lucas's recurring references to Friedman.

3.1. The Construction of Lucas's Natural Rate of Unemployment

We can say that Lucas's first work related to the natural rate of unemployment – more precisely, to the tradeoff between inflation and unemployment - was his model with Rapping of the labor market tested for the U.S., for the period from 1929 to 1965, which appeared in the September/October of 1969 edition of the *Journal of Political Economy* (Lucas and Rapping, 1969a). In this paper, the authors cite the works of Friedman (1968a) and Phelps (1968) and show their personal gratitude to Phelps's comments in early versions.

The first written contact between Lucas and Phelps that can be found in the Lucas's archives¹⁸ was a letter from the first to the second, dated from December 6th, 1967,¹⁹ in which Lucas sends a preliminary copy of his paper with Rapping to Phelps. In Phelps's answer, dated from December 12th, 1967²⁰, Lucas is invited to give a talk about his research with Rapping in a seminar in the University of Pennsylvania, on February 9th of the next year. The title of the talk would be "An Aggregative Model of the U.S. Labor Market, 1929-65", according to a letter from Lucas to Phelps dated from January 18th, 1968.²¹ Apparently, no written version of the paper was distributed to the audience or even to Phelps during the talk. Only on April 4th, 1968, two months after the talk, Lucas sent an updated written version of his paper with Rapping to Phelps. The letter also contains some lines of thankfulness for the Phelps's comments and for his qualification of their model as "fascinating".²² This was the last correspondence with Phelps found in Lucas's archives before the publication of his paper with Rapping in the *JPE*, in the September/October of 1969 edition. However, we should remember that, in the meantime, in January of 1969, the famous conference coordinated by Phelps, which gave origin to the "Phelps volume" (Phelps, 1970), was held at the University of Pennsylvania, and Lucas had the opportunity to present the final

¹⁷ De Vroey (2001: 128) says that his work is detained only to a comparison between Lucas's (1972a) and Friedman's (1968a) approaches, leaving aside, intentionally, the other parts involved in the debate, as Phelps (1967, 1968).

¹⁸ Inventory of the Robert E. Lucas Jr. Papers, 1960-2004 and undated. Rare Book, Manuscript, and Special Collections Library, Duke University, Durham, North Carolina, USA.

¹⁹ Lucas Papers, Box 1, file folder "1967".

²⁰ Lucas Papers, Box 1, file folder "1967".

²¹ Lucas Papers, Box 1, file folder "1968".

²² "Dear Ned:

Enclosed is Leonard's and my labor market paper. We appreciate your plug, although the adjective "fascinating" which you apply to our model is an obvious hedge. Still, I guess I prefer it to 'ludicrous' or 'bizarre'.

I doubt if any of your objections will be withdrawn on seeing the written version, but some of the material is more carefully developed than was possible orally. We would appreciate any further comments" [Lucas Papers, Box 1, file folder "1968"].

version of his paper with Rapping, while Phelps also presented his paper about labor market (Phelps, 1968).

In the published paper, Lucas and Rapping (1969a) reconcile the apparent contradiction between an elastic labor supply in the short run with an inelastic labor supply in the long run by building a model that describes the dynamics from short run equilibrium to long run equilibrium in the labor market. Besides this, the authors make an effort to understand the empirical negative correlation between inflation and unemployment – the Phillips curve – in a purely supply-demand framework, leaving aside other possible explanations to this correlation, such as collective bargaining. Lucas (1984) explains how he came up with this idea and how he developed it with Rapping's assistance:

“The labor part of macroeconomic models, in those days, was pretty disgraceful [...] Rapping and I knew some labor economics, and it's hard to get up in front of a class and talk nonsense deliberately. So we were trying to cook up simple supply and demand models which would fit what you see happening over business cycles. We got interested enough in that so that we thought we'd pursue it as a research topic [...] In the tradition of Friedmann and Lewis it is hard to think about labor markets without supply and demand. You have to tell how wages and employment arise from shifts in supply and demand curves [...] We were really developing a supply and demand model for employment and wages. Unemployment gets tacked on a side story. We introduced a Phillips curve to make contact with macroeconomic stuff. We wanted to make sure that the labor supply piece didn't assume away business fluctuations” [Lucas, 1984: 35-36].

To reach this intent, the model proposed by the authors assumes that the labor market is always in short run equilibrium (there is no involuntary unemployment), as a result of individual's utility maximization (that determines the labor supply) and firm's marginal productivity (that determines the demand for labor). The agents form their expectations about future prices through a weighed mean of the expectation of future prices made in the previous period and the prices of the current period (adaptive expectations). Bearing in mind that the prices tend to some long run normal level, the agents incorporate these expectations into their labor supply function. Thus, it becomes rational for the agents to raise their labor supply during inflationary periods, when the current price level is higher than the normal, because they think that the price level will be lower in the future – go back to its normal level. This kind of behavior by the agents creates a positive correlation between inflation and employment in the short run. Only in the long run, when future prices' expectations are equal to current prices, agents do not raise their labor supply, short run equilibrium is the same as long run equilibrium and there is no tradeoff between inflation and unemployment at all. It is no surprise that Lucas and Rapping's (1969a) conclusion is very similar to the ones of Friedman (1968a) and Phelps (1967, 1968), namely, that the negative correlation between inflation and unemployment - the Phillips curve – is just a short run phenomenon and that, when inflation is correctly anticipated, the rate of unemployment reaches its long run equilibrium value, in a way that a prudent monetary policy becomes ineffective in determining it.²³

Before finishing the paper, however, Lucas and Rapping (1969a) call attention to two fundamental questions to be taken in account in order to better understand the labor market behavior – that were not contemplated in the paper – and that would become the subject of Lucas's research in the future: i) the analysis of the labor market in a general equilibrium framework (involving all the economic sectors) and ii) the expectations' formation process. In the following passage, we can realize how general equilibrium analysis was becoming an important matter to Lucas's research:²⁴

23 “It appears that a policy designed to sustain an inflation can temporarily reduce unemployment, but unless the higher rate of increase in prices can be permanently maintained a subsequent attempt to return to the original rate of inflation will result in an offset to the initial employment gains” [Lucas and Rapping, 1969a: 739].

24 The movement towards general equilibrium analysis in postwar economics comes from the neoclassical synthesis, through models that try to incorporate aspects such as unemployment, money and time into the general equilibrium framework (Weintraub, 1985). We can say that Lucas's and Phelps's research were following this movement.

“We conclude with a brief mention of two problems which we regard as central to an understanding of labor markets and which our study cannot be used to answer. One is tempted to use our estimated structural equations to study the dynamics of the labor-market response to changes in prices and output. As we have stressed at several points above, however, this question is illegitimate: movements over time in labor-market variables will be determined simultaneously with changes in other sectors. Thus, while we know that our model is consistent with a gradual approach to full employment equilibrium, we cannot say whether or not the speed of approach is consistent with the observed business cycle. Second, our model emphasizes the crucial role of expectations formation, while testing only the very crudest expectations model. We have used an adaptive scheme which will clearly hold only under reasonably stable rates of price increase. To define what is meant by reasonable stability, and to discover how expectations are revised when such stability ceases to obtain, seem to us to be a crucial, unresolved problem” [Lucas and Rapping, 1969a: 748].

These two questions would become the centerpiece of Lucas’s (1972a, b) actual formalization of the natural rate of unemployment hypothesis. The issue about the expectations’ formation process would only be solved with the introduction of rational expectations, an idea that Lucas was developing in a parallel branch of his research agenda. The general equilibrium approach to the tradeoff between inflation and unemployment would be strongly stimulated by Phelps’s comments on Lucas and Rapping (1969a). This kind of approach was specifically suggested to Lucas by Phelps himself:

“[Lucas:] My most influential paper on ‘Expectations and the neutrality of money’ [Lucas, 1972a] came out of a conference that Phelps organized where Rapping and I were invited to talk about our Phillips curve work. Phelps convinced us that we needed some kind of general equilibrium setting. Rapping and I were just focusing on labor supply decisions. Phelps kept on insisting that these labor suppliers are situated in some economy, and that you have to consider the whole general equilibrium looks like, not just what the labor supply decision looks like. That’s what motivated me” [Snowdon and Vane 1998: 126].

“In the introduction to the Phelps volume, Phelps had written that “...perhaps Lucas and Rapping are 180 degrees to the truth,” by which he meant that perhaps we should have emphasized income effects in our theory of employment fluctuations rather than the substitution effects we did emphasize” [Lucas, 2001: 19].²⁵

However, both questions would have to wait a little bit to be tackled by Lucas. In a paper developed immediately after Lucas and Rapping (1969a), but published before it, in June of 1969, in the *American Economic Review*, Lucas and Rapping (1969b) still test their Phillips curve with adaptive expectations, to the period between 1904 and 1965, in the U.S.. In the paper, there are also references to Friedman (1968a) and Phelps (1968), with special thanks to Phelps’s comments on early versions of it. Before the publication of the paper, in an answer letter²⁶ addressed to Rapping, on July 8th, 1968²⁷, Lucas shows his unbearable dissatisfaction with the results obtained from the Phillips curve estimation with adaptive expectations – that implies persistence of expectations:

“I guess I am now convinced that our original results (with lagged prices and unemployment) don’t mean anything – except possibly as part of a general argument to the

²⁵ Actually, the exact quote “...perhaps Lucas and Rapping are 180 degrees to the truth,” cannot be found in the introduction of the Phelps volume (Phelps et al., 1970), but, interestingly, Lucas refers to the same quote in a letter to Phelps, on November 7th, 1969 (Lucas Papers, Box 1, file folder “1969”).

²⁶ Rapping had written to Lucas, previously, saying that he thought to be “...possible, as you suggested, to rationalize the presence of a lagged unemployment in our Phillips curve in terms of the search process” (Lucas Papers, Box 1, file folder “1968”).

²⁷ Lucas Papers, Box 1, file folder “1968”.

effect that estimating Phillips curve is more complex than is generally recognized. The newest results indicate that trying to account for effects on unemployment other than expectations simply by postulating serial correlation doesn't mean much either. This would seem to me to add urgency to the search for a model which incorporates sources of persistence in unemployment other than the persistence of expectations".

Despite Lucas's frustration with the results - "I never liked the paper. It doesn't have any results in it" (Lucas, 1984: 37) -, the authors are still emphatic about the ineffectiveness of the Phillips curve as a monetary policy weapon.²⁸ However, Lucas and Rapping's (1969b) strongest criticism is really about the use of adaptive expectations, to which the authors attribute the existence of the long (and short) run tradeoff between inflation and unemployment in the model, and that they claim to be a theoretical deficiency:

"As with the other empirical Phillips curves, (8) [Phillips curve with adaptive expectations] implies a long run as well as a short run inflation-unemployment trade-off, with the consequent promise of a permanent decrease in unemployment if the economy is willing to tolerate a sustained inflation. This long run trade-off is, however, built into (8) in a transparent way by the expectations hypotheses (6) [adaptive expectations for real wages] and (7) [adaptive expectations for the price level]. Thus the reason (8) offers a long run trade-off lies in the assumption of an unreasonable stubbornness on the part of households: if a sustained inflation policy is pursued by the government, households following (7) will continue forever to underpredict future prices.

There is no entirely satisfactory way to remedy this deficiency in the theory within the framework of adaptive expectations. Any forecaster predicting future prices as a fixed function, however complicated, of past prices can be systematically fooled by a clever opponent manipulating the actual series at will. But since there is little reason to believe that the government systematically manipulates prices, it may be worthwhile to examine adaptive schemes which, unlike (6) and (7), permit a short run Phillips curve without deciding the question of the existence of a long run curve a priori" [Lucas and Rapping, 1969b: 344].

So, we know that Lucas was not happy with the adaptive expectations used in his papers with Rapping because they led to systematic errors in worker's expectations about future prices - what would generate a never ending disequilibrium path in the labor market, opposing to the idea of a natural rate of unemployment (Hoover, 1988: 28). Nevertheless, it is important to notice that the rational expectations hypothesis was already known by Lucas long before the publication of his two papers with Rapping. It was only after the frustration with the Phillips curve estimation using adaptive expectations that he realized the impact that the adoption of rational expectations would have in the econometric tests and in the estimations (Lucas, 1984: 38). The first Lucas's published paper in which he refers to the rational expectations hypothesis is his "Adjustment Costs and the Theory of Supply", in the *Journal of Political Economy*, in August of 1967. Lucas (1967: 323, footnote 4) presents - without actually using it in his model - Muth's (1961) rational expectations as an alternative to the hypothesis that the actual price level would be maintained constant in the future - what he calls "static expectations". With the introduction of rational expectations, the future price level would be correctly anticipated by firms, instead of just being constant. Lucas refers to his unpublished paper "Optimal Investment with Rational Expectations" (Lucas, 1966) to further appraisal on the adoption of this alternative hypothesis. Besides these two papers, Lucas

28 "First, it is clear that the existence of a short-run Phillips curve is consistent (in practice as well as in principle) with the absence of a long-run inflation-unemployment trade-off. Second, the expectations view as we have developed it appears to have promise in the sense that the additional explanatory variables it suggests are frequently (though by no means uniformly) significant. Third, and most important, statistical Phillips curves are highly unstable over time, and this instability is far too serious to be dismissed by a vacuous reference to structural change in either 1929 or 1946. Until the variables which are shifting these curves can be identified, and verified as important by testing over the entire period, we see no alternative to the conclusion that empirical Phillips curves (ours included) are a weak foundation on which to base policy decision" [Lucas and Rapping, 1969b: 349].

also worked in another paper, in 1966, developed in a symposium organized by Hirofumi Uzawa, in Chicago, in which the rational expectations hypothesis is already present. In a letter²⁹ to Uzawa, on October 28th, 1966, Lucas says:

“Dear Hiro:

Enclosed is a paper developed from the first two sections of the paper I gave at your symposium in August. As you had suggested, I developed the treatment of the competitive industry in somewhat more detail. In the new version, the competitive industry is also analyzed under rational rather than static expectations”.

The discussion about this last paper that Lucas established with Edward Prescott during the following years would give origin³⁰ to the first published paper in which Lucas – with Prescott – uses, indeed, the rational expectations hypothesis in a model: “Investment under Uncertainty”, of *Econometrica*, from September of 1971 (Lucas and Prescott, 1971). In this paper, the authors determine the behavior, through time, of investment, output and prices in a competitive industry with a stochastic demand. The rational expectations hypothesis implies that actual and anticipated prices have the same probability distribution. This way of modeling expectations must be interpreted as a technical device employed by the authors to deal with time series data and to allow for unrestrictive forecasts, putting aside the discussion about the process by which firms translate their current information into prices forecast.³¹

In a letter³² addressed to Lucas, dated from August 22nd, 1968, Prescott refers to this paper, saying that it was welcomed in a seminar presented by him. However, the rational expectations hypothesis would have been motive of conflict among the participants, because of the strong assumption of perfect foresight in prices distribution:

“The question of expectations came up. Some felt it was an extremely strong requirement to assume perfect forecast of the distribution of prices. We could use Muth’s definition of rational expectation though I am not sure if it is possible. Alternatively we might point out in a footnote that the process has continued for a sufficiently long time that people have learned about the true distribution. If it can be done, I think the Muth approach is superior”.

In a letter³³ addressed to Prescott, dated from December 2nd, 1968, Lucas mentions the impact caused by the presentation of the same paper in a symposium on uncertainty and capital theory, in Yale, in the end of November of that year. Once again, the adoption of the rational expectations hypothesis would had been motive of protest by the participants of the seminar:

“The rest of the time was spent on the assumption of rational expectations: what does it mean, is it reasonable and so on. On the whole, I think I won very few converts to our view

²⁹ Lucas Papers, Box 1, file folder “1966”.

³⁰ See Lucas (2001: 15).

³¹ “Typically the forecasting rule postulated takes the form of anticipated prices being a fixed function of past prices-“adaptive expectations.” But it is clear that if the underlying disturbance (in our case, the demand shift) has a regular stochastic character (such as a Markov process), forecasting in this manner is adaptive only in a restrictive and not very interesting sense. Except for an unlikely coincidence, price forecasts and actual prices will have different probabilities distributions, and this difference will be persistent, costly to forecasters, and readily correctable. To avoid this difficulty, we shall, in this paper, go to the opposite extreme, assuming that the actual and anticipated prices have the same probability distribution, or that price expectations are rational Thus we surrender, in advance, any hope of shedding light on the process by which firms translate current information into price forecasts. In return, we obtain an operational investment theory linking current investment to observable current and past explanatory variables, rather than to “expected” future variables which must, in practice, be replaced by various “proxy variables.”” (Lucas and Prescott, 1971: 660).

³² Lucas Papers, Box 1, file folder “1968”.

³³ Lucas Papers, Box 1, file folder “1968”.

on this: most people felt it was an unreasonable assumption – and that we somehow ‘cheated’ in postulating equilibrium at each point in time. One difficulty was the problem of how firms obtain information. This could have been solved by initiating the discussion with the last session of the paper, but by the time I realized this all hell had broken loose”

The fact is that in the end of 1969, Lucas had already overcome his dissatisfaction with the adaptive expectations hypothesis in dealing with the tradeoff between inflation and unemployment by replacing it by the rational expectations hypothesis. Not only he had done that, but he had also moved his analysis of the tradeoff between inflation and unemployment from a partial equilibrium labor market framework to a general equilibrium framework, as suggested by Phelps. Proceeding this way, Lucas had just tackled the two issues raised in his first paper with Rapping (Lucas and Rapping, 1969a: 748). On November 7th, 1969, in a letter³⁴ addressed to Phelps, Lucas already refers to his paper “Expectations and the Neutrality of Money” (Lucas, 1972a) – attached to the letter - and discusses both the adoptions of the rational expectations hypothesis and the general equilibrium approach with him. Lucas refers to the suggestion made by Phelps - the “180 to the truth” remark - and emphasizes, again, that the adoption of the rational expectations hypothesis was a technical device to deal with forecasting problems and that it should not be judged by its reasonability:

“Dear Ned:

The two enclosed papers are in a sense ‘spin offs’ from the conference in January. I would appreciate any comments you may have on either.

The paper ‘Expectations...’ is, in part, an attempt to get at your ‘180 degrees to the truth’ remark on Leonard’s and my first paper [Lucas and Rapping, 1969a]. It didn’t seem to me possible to get at the question at the level of trying to decide which expectations hypothesis is most ‘reasonable’. So I tried to push the question back to assumptions on the nature of the underlying disturbances which create the forecasting problem in the first place.

The problem seems to be that of getting monetary expansion systematically linked, in fact or in people’s minds, with real demand changes. In a first attempt, I assumed that money entered only to finance real government expenditures (e.g. wars). To get a plausible positive inflation-real output relationship out of such a scheme, it is necessary to let income effects dominate – as you proposed – and to let expectations be sort of extrapolative. That is, the story goes: ‘inflation’ implies ‘high government demand’ implies (due to autocorrelation) ‘high future government demand’ implies ‘capital loss to labor suppliers and money holders’ implies (due to income effect) ‘increased labor supply’. The difficulty with this scheme is psychological: people perceive expansionary periods as bad, depressions as good. A second problem is the fact that most observed cycles occurred when government demand was too small a piece of the total to be a plausible triggering force.

So this formulation was scrapped in favor of the one described in the enclosed paper.

Sincerely,

Robert E. Lucas, Jr.”

We can see that Lucas says, explicitly, that the paper (Lucas, 1972a) is a result of the discussion established in the conference organized by Phelps, in January of 1969, at the University of Pennsylvania. As mentioned before, the paper was an attempt to make the 180 degrees move to the truth – proposed by Phelps – in his paper with Rapping (Lucas and Rapping 1969a). This move would be a change in the explanation given to the empirical evidence of the positive correlation between inflation and employment: from a labor market model in which labor supply increases with inflation because agents have the wrong impression – the “monetary illusion” type – that their work is better paid today than tomorrow, to a general equilibrium model in which labor supply increases in inflationary periods because agents cannot

³⁴ Lucas Papers, Box 1, file folder “1969”.

identify the source of the rise in the price of their goods, due to information problems, so they cannot distinguish between a favorable change in relative prices and a rise in the general price level.

It is a clear symptom of Lucas's relationship with Phelps and Friedman that a letter³⁵ was sent to the last with, apparently, the same paper (Lucas, 1972a) attached, in the same day of the letter sent to Phelps. It seems that Lucas considers both of them as his interlocutors in the Phillips curve, neutrality of money and natural rate of unemployment issues. But, if on the one hand, Lucas discusses technical aspects of the paper with Phelps through a whole page, on the other hand, he uses just a line and a half to ask for Friedman's comments:

“Dear Professor Friedman,
I would be grateful for any comments you may have on the enclosed paper.
Sincerely,
Robert E. Lucas, Jr.”

It shows how Lucas's research was, indeed, being shared with Phelps but not with Friedman. There is no answer from any of them in Lucas's archive. There is no reference to any kind of Lucas's correspondence in the electronic finding aid of Milton Friedman Papers at Hoover Institution.

“Expectations and the Neutrality of Money” was first submitted to the American Economic Review in 1970, suffering a “withering rejection” (Lucas, 1981: 10). This is an indication of how innovative and restricted to the knowledge of a small group of economists was the technical approach present in the paper.³⁶ It was, finally, submitted and accepted by the Journal of Economic Theory, in the same year, and published in the April of 1972 issue of the journal (Lucas, 1972a). In the paper, Lucas explains the positive correlation between nominal prices and real output without claiming any monetary illusion from the agents. The monetary shocks have real effects, in the short run, because agents have information problems; they cannot distinguish whether the price change is relative or absolute. In the long run, however, the neutrality of money applies. Lucas (1972a: 103-4) says that his work is similar to Friedman (1968a) and that it presents some of Friedman's (1968a) propositions about the American economy in a *rigorous* way. We can say that it presents Friedman's (1968a) proposition of the natural rate of unemployment in a different methodological way (De Vroey, 2001) and using a new mathematical formalization that was not familiar to Friedman.

It is also said in the paper that another precursor of his work is Phelps (1968, 1970), because he shows, just like Lucas (1972a), the existence of the Phillips curve in a framework in which all the neoclassical postulates are assumed, except the perfect information one. Lucas (1972a: 104) argues that his concept of equilibrium is new, although it resembles the dynamic program one – the one used by Phelps (1967, 1968, 1970). His equilibrium prices and quantities are functions of the possible states of the economy, what allows relating the information available to the agents with rational expectations in a better way than with adaptive expectations.

In a deliberated effort to make “Expectations and the Neutrality of Money” accessible to a larger audience, Lucas prepared, during the summer of 1970 (Lucas, 2001: 21), a paper called “Econometric Testing of the Natural Rate Hypothesis” (Lucas, 1972b), which would be presented at the Fed conference “The Econometrics of Price Determination”, in Washington, D.C., in October of the same year. In the paper, Lucas shows why econometric tests of long run effects of monetary policy in real output are not the proper tests to be made to the Friedman's and Phelps's natural rate of unemployment hypothesis. Lucas (1972b: 90) admits that there is, indeed, a negative correlation, in the U.S. data, between inflation and unemployment rates. Hence, two questions should be posed to the natural rate of unemployment advocates: i) if this correlation does not proof the existence of an exploitable tradeoff between inflation and unemployment, should the natural rate of unemployment be judged only on theoretical grounds? ii) If monetary policy cannot be evaluated by extrapolating this negative correlation, should quantitative policy

³⁵ “Lucas Papers, Box 1, file folder “1969”.

³⁶ See Gans and Shepherd (1994: 172) for more details.

evaluation be abandoned? According to Lucas (1972b: 91), the answers to these questions depend on how one translates the natural rate of unemployment hypothesis into theory.

The first device that Lucas (1972b: 91 footnote 2) uses to translate the natural rate of unemployment hypothesis into theory is to treat observed prices and quantities as the result of market clearing equilibrium. According to the author, the discussion whether observed prices and quantities are, indeed, market clearing outcomes creates more heat than light. So, one should simply assume that they are market-clearing outcomes because: i) the alternative hypothesis brings logical difficulties to the analysis and ii) because it allows dealing with intertemporal substitution and expectations questions, eliminating the standard dynamical prices and quantities adjustment (*tâtonnement* process).

The second device used by Lucas (1972b: 95-6) is the adoption of the rational expectations hypothesis – instead of the adaptive expectations hypothesis – to determine expected prices. With this kind of expectation, a relation between actual and expected prices is established in a way that the expectation of the difference between actual and expected prices equals zero. If, on the one hand, adaptive expectations imply that inflationary policy leads to real output unlimited growth – and the existence of an exploitable short run and long run Phillips curve trade-off -, on the other hand, the adoption of rational expectations is equivalent to natural rate of unemployment hypothesis itself, by construction, and leads to the a model in which quantitative monetary policy evaluation can, indeed, be made.

Based in a model that contains these two devices, policy parameters can be tested: if monetary policy is able to alter real output or it affects only the price level. The test on the Phillips curve parameters – as made in Lucas and Rapping (1969b), for example - would not be the right way to test the natural rate of unemployment hypothesis (Lucas, 1972b: 99). The natural rate hypothesis restricts the relation between behavior (Phillips curve) and policy parameters. So, the correct test of the natural rate of unemployment is on the policy parameters. To Lucas (1972b), the natural rate of unemployment is an *a priori* assumption of his model, but its test can only be made under the restrictions it imposes to policy parameters. It is a test on the effectiveness of the policy, not on the Phillips curve parameters itself.

So, the first question regarding the natural rate of unemployment, namely, whether the economy is or is not in equilibrium is answered by Lucas (1972b), by assumption: observed prices and quantities are always market-clearing outcomes and, thus, the market-clearing equilibrium hypothesis is not subject to tests. The second question, namely, whether economic policy can lead the economy to this market-clearing equilibrium is, hence, false, and must be replaced by the question whether monetary policy has impact in real output. It should be answered through the test on the parameters of the model with rational expectations.

6. Conclusion

Lucas (1972a, b) changed the way in which the natural rate of unemployment was originally elaborated by Friedman (1968a) and Phelps (1967, 1968). But, if, on the one hand, Lucas's research diverges methodologically and theoretically from Friedman's, on the other hand, it is connected more closely to Phelps's research. In addition to sharing methodological and theoretical understanding, Lucas and Phelps had close personal interactions. The methodological and theoretical connection with Phelps was established through the dynamical general equilibrium approach to the tradeoff between inflation and unemployment, while their personal interaction can be verified through their vivid correspondence. Lucas (1972a, b) used a new technique, namely, a general equilibrium framework with rational expectations to actually model the natural rate of unemployment hypothesis and to demonstrate the neutrality of money. Not only it was a new modeling technique, but it would, also, exert great influence on the developments of macroeconomics afterwards.

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