

UNCERTAINTY AND INDETERMINACY IN ECONOMIC POLICY

Marco D'Errico

University of Milan – Bicocca, Piazza dell'Ateneo Nuovo 1, 20126 Milan, Italy.
marco.derrico@eseg.it

Andrea Mangone

University of Milan – Bicocca, Piazza dell'Ateneo Nuovo 1, 20126 Milan, Italy.
andrea.mangone@eseg.it

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Summary

In this paper we want to show and analyze from another point of view one of the limits of the action of a policymaker. We start our analysis considering Lucas' approach and the Lucas critique (1976) showing the importance of the rational expectations theory. The behavior of private agents is usually forecast not taking into account the consequences of public choices on the parameters of the functions that describe the behavior, thus supposing that the estimated values (through econometric analysis) are not affected by the policy. This implies that these values are given and don't vary. The Lucas critique points out that a policy can instead change the parameters, underlining that the traditional models does not consider this kind of interaction between the private and the public sector. This active role of the private sector can affect the constraints. Thus the optimal policy *ex ante* does not coincide necessarily with the optimal policy *ex post*: if the variability of the parameters is low, the policymaker can cope with this problem, but the problems arise when the variability is high. Our conjecture is that this problem can be analyzed as an uncertainty (or indeterminacy) related problem, as in physics. To explain it better we focus at first on the role of intermediate targets in economic policies (such as monetary policies) and of rational expectations. We further our analysis providing a model showing the difference between the optimal policy *ex ante* and *ex post* when the intermediate task changes, underlining the role of the estimated parameters and the role of uncertainty. This formal approach allows us to understand more deeply the nature of the estimated parameters and the presence of indeterminacy. In particular we analyze the model showing the meaning of deep

parameters in comparison with other parameters. We then introduce the concept of uncertainty in physics. We compare the Lucas critique with the principle, introducing the concept of uncertainty relation, showing that a similar approach can be useful for economic variables. In fact, the uncertainty principle is related to the ondulatory nature of particles. Since also economic variables can be seen as cyclical variables, we focus on some important characteristics of this kind of variables, and compare them to some recent developments in economic theory (in particular the Real Business Cycle theory). In particular we suggest that the uncertainty as stated by Lucas critique can be seen as an issue related to economic cycle and the nature of variables.

INTRODUCTION

When analyzing economic policies, the *policymaker* needs to process historical data in order to determine the functions describing the economy, thus estimating parameters through econometric analysis. One of the aspects to be considered in this case is the *limit* of a policy. In this paper we show a particular approach when determining this limit, starting from the Lucas critique and comparing it with the Heisenberg uncertainty principle. This kind of approach is strongly connected with the Goodhart's law (in particular this one refers to monetary policies). Our aim is to provide a conceptual and formal analysis of this problem and try to further it in order to find new aspects to be investigated. Moreover, we want to focus on the relationships with some other modern theory concerning business cycles, as one of the main factors of unpredictability. The concept of uncertainty has an impact on forecasting capability of an economic system and on policies implementation by the policymaker. This can strongly affect any evaluation process, above all those ones that stand behind anti-cyclic policies.

LUCAS' APPROACH RATIONAL EXPECTATIONS

The role of rational expectations is one of the most discussed topics in economic theory. We won't deepen this aspect since it's not the aim of this work but we want to underline that rational expectations have an important impact in determining the macroeconomic equilibrium. In the aggregate demand and supply model (AS – AD) with rational expectations, monetary policies (an expansive policy, enhancing money supply, for example) have real effects only in the short run, when the agents make momentary errors, thus showing that monetary policies don't have any relevant long run effect. Trying to sum up this approach we can say that:

- i) agents use information in an optimal way;
- ii) expectations are related to the real behaviour of the economic system.

Thus, this model differs from a perfect forecast model because expectations are subject to non systematic errors. If ε is the error, then we have that $\varepsilon = p - p^e$, but the mean of the errors is zero: $E(\varepsilon) = E(p - p^e) = 0$.

THE LUCAS CRITIQUE

The theory of rational expectation offers the basis for the so-called *Lucas critique* (1976). It states that we can't predict the effect of a policy if we consider that the behaviour of the private sector is exogenous, thus believing that the functions describing the behaviour of private sector are not influenced by the policy itself. If we consider that there is no reaction from the private sector we suppose that policymaker's decision do not influence the behaviour of the private sector.

Thus the implemented policy has no influence on the function chosen as the constraint in policy optimization. A simple analysis of the AS-AD model with rational expectations shows that agents' forecasting activity is in contrast with what we should expect from the model. For example, consider a policymaker that wants to increase the output (GDP) in a given period, trying to enhance consumption. The policymaker has to estimate, with econometric techniques, the parameters that describe the economy *before* implementing the policy, stating – for example – that an increase in transfers to private sector could help to reach the tasks. Now the policymaker is going to estimate the impact of consumption *before* implementing the policy. But *after*, the new level of transfers can have effects on the utility functions of the private sector, thus having an impact on the parameters of the function describing the economy and influencing a *posteriori* the results of the policy. This implies a change *ex post* in the optimal policy, leading to a difference between the optimal policy *ex ante* and the optimal policy *ex post*.

Now a question arises: does an optimal policy really exist? The Lucas critique states that there's a form of *uncertainty* in economic policy, as pointed out for monetary policies by the Goodhart's law.

The Lucas critique focuses on this aspect: the traditional approach supposes that the parameters are fixed and don't vary even *after* the policy. The previously estimated function is the constraint even after, but if it changes, the policy won't be actually optimal anymore. We can now define two main problems:

- how many parameters are to be estimated?
- is there any implication between the policymaker and private agents that is not captured by traditional approaches?

The first question is related to the variability of the parameters: a huge number of parameters will not ensure the real efficacy of the policy, especially if they have high variability. In fact, high variability parameters can be more influenced by the policy. The second question is instead related to the different role of the private sector: according to the Lucas critique, the private sector plays an active role in determining the policy, implying a strategic approach (for example, this approach can be now analyzed with the help of game theory). The progresses in

economic education as well lead private agents to understand deeply some aspects and provide better evaluations.

AN ANALYTICAL APPROACH

When using a formal approach it's important to model the *deep parameters* that are related to *individual* behaviour in order to understand the real effective policy to be adopted. In this section we provide a model¹ that shows the implications of the Lucas critique. We consider a variable z_t following an auto-regressive process and representing the intermediate target in the economic policy, and we extend it to n periods, thus:

$$z_t = \phi_1 z_{t-1} + \phi_2 z_{t-2} + \dots + \phi_n z_{t-n} + \varepsilon_t = \sum_{i=1}^n \phi_i z_{t-i} + \varepsilon_t$$

In this relation the parameters ϕ_i represent the discount factors and ε_t a stochastic white noise (with mean zero and finite variance). The value at time $t+1$, given the information set at time t , Ω_t is:

$$E(z_{t+1} | \Omega_t) = \phi_1 z_t + \phi_2 z_{t-1} + \dots + \phi_n z_{t-n+1} = \sum_{i=1}^n \phi_i z_{t-i+1}$$

This process describes the behaviour of any economic variable subject to an auto-regressive process. We chose this one because we want to show the effect of all the previous periods on the variable. The private sector function is defined as follows:

$$y_t = \alpha x_t + \beta E(z_{t+1} | \Omega_t) + \eta_t = \alpha x_t + \beta \sum_{i=1}^n \phi_i z_{t-i+1} + \eta_t$$

This equation shows that the decisional variable depends on some parameters. The first parameter α can be determined with econometric analysis. The other parameters are more difficult to be estimated. Another problem arises: what happens if there is a change in the intermediate task of the policy? For example, what is going to happen if the intermediate task switches from the money supply to the interest rate? In this case we have another function to be determined, for example another auto-regressive process that doesn't take into account the previous periods. We can then model it with a *random walk*, as follows:

$$z_t = z_{t-1} + \varepsilon_t$$

This kind of process has a different nature. This change in the intermediate target will have an impact on the whole constraint assumed to be the one to describe the economy. Thus:

¹ The original version of the model has been proposed by Cuthbertson and Taylor. (*Elementi di Politica Economica*, N. Acocella).

$$E(z_{t+1} | \Omega_t) = E(z_t) + E(\varepsilon_t) = z_t$$

This implies that the private sector behaviour function becomes:

$$y_t = \alpha x_t + \beta z_t + \eta_t$$

This equation is different from the previous one. The policymaker now has to decide which the actual constraint in its policy is, and there isn't a unique answer. Using an intermediate task or another one will modify the constraint and of course will also modify the estimates of the parameters as well. The policymaker won't be able to decide whether using a constraint or another, thus leading to an uncertainty situation.

PARAMETERS ANALYSIS

Since it's not the aim of this paper to further this kind of analysis focusing only on the parameters, we only want to stress that estimating parameters is not only a matter of computation. In fact the constraint function has the same parameters α and β , that don't vary. These are, according to Lucas' approach, the *deep* parameters, opposed to the other parameters ϕ . But, if we investigate further we can see that also those deep parameters are subject to uncertainty due to the fact that we have a multiple regression. Thus the uncertainty is related to the choice between these two systems of equations:

$$\left\{ \begin{array}{l} z_t = \sum_{i=1}^n \phi_i z_{t-i} + \varepsilon_t \\ y_t = \alpha x_t + \beta \sum_{i=1}^n \phi_i z_{t-i+1} + \eta_t \end{array} \right.$$

$$\left\{ \begin{array}{l} z_t = z_{t-1} + \varepsilon_t \\ y_t = \alpha x_t + \beta z_t + \eta_t \end{array} \right.$$

Choosing one of them implies that we the policymaker already knows which is the function describing the economy, thus the policymaker should already have implemented the policy, in order to evaluate the constraint and estimate its parameters. But the policymaker can use alternative models – that are not related to that policy itself – in order to estimate deep parameters, and then use them in the constraint, reducing the uncertainty.

UNCERTAINTY AS A PRINCIPLE

In general, agents' adaptation to new information moves from an uncertain and cyclical context. Once again we can see the absence of influence of nominal fluctuations and money supply, showing the substantial inefficacy of money policies in the short run. Is this issue related to the policymaker activity or to the nature of variables?

To answer this question we consider the Heisenberg *uncertainty principle*, developed at the beginning of the last century. It states that there is a limit in measuring the value of two conjugate variables of a single particle (such as momentum and position) at the same time: increasing the accuracy in measuring one of them will reduce the accuracy in measuring the other one. At a first sight, the uncertainty principle can be seen as a limit to observation experience. Even if it is a complex model to be analyzed we have to underline that the principle is actually a theorem, which derives from quantum mechanics axioms.

Is this kind of indeterminacy due to the measurement activity or is it related to some other aspect? Heisenberg considered the problem from another point of view: the principle still holds even if we measure variables in a physical system and after in a perfect copy of it. Thus, we can explain it as a principle related to the ondulatory nature of particles: they have some typical features of waves and it's possible to cope with this problem using a stochastic forecasting model that attributes some probability functions to each variable. We can now evaluate an *uncertainty error*. If we define Δp and Δq as the errors for two variables (starting from their standard deviations) we can apply the well known Cauchy – Schwartz inequality to find a lower limit for their product (the *uncertainty relation*):

$$\Delta p \Delta q \geq \frac{h}{4\pi}$$

Where h is the *Planck's constant*. The errors have an inverse relation: the more is the accuracy for one of them, the less we have to expect for the other one. There are two important aspects to be considered. The first one is that we have a lower limit in the product of the errors, so we can decide *a priori* which variable to observe with more accuracy and we will know how big the error will be on the other one. Moreover the error depends on a physical constant; this implies that the minimum error is not related to the physical system considered.

A COMPARISON

According to Lucas critique it's not possible to establish the optimal economic policy because of the interactions that lead to uncertainty. Trying to compare this theory with the uncertainty principle can lead us to understand that the cyclical characteristics of economic variable are the reasons why the critique is related to uncertainty. If we consider the Lucas critique from the same point of view of the uncertainty principle, we can imagine the deep parameters as constants and the other parameters as the conjugate variables in the system. If we consider the previously provided example the deep parameters α and β can be the starting points in determining the error of the estimates, with such a relation:

$$\Delta \phi_1 \Delta \phi_2 \geq \gamma$$

This approach allows to have a lower limit of the uncertainty error γ , which depends on the other two. The deep parameters can be associated to constants of the economy, thus estimating the errors on the other ones after the econometric analysis and that can have effects also on the variables. Lucas explained that both the variables and the parameters can be changed by the policy (in par-

ticular the historical series and the estimated parameter), reflecting this change on the whole system.

If we consider, as we are going to do now, economic variables as cyclical variables we can say that parameters are affected by the nature of the variables, thus reflecting the uncertainty that, at first, seemed to be due to the policymaker's activity.

REAL BUSINESS CYCLES (RBC)

Nelson and Plosser pointed out that traditional theories, according to which the output grows following a regular trend, don't cope with several problems. In fact there isn't a uniform development process but several shocks influence output's growth in a permanent way. If we consider it as a cyclical variable, the system presents a hysteresis phenomenon. There are two well known examples of this feature. The first one is related to exports: once a big effort has been made in order to start exports in a country (for example huge changes in incentives) the policymaker is not required to do much more in order to keep them going on. Another example deals with inflationary policies: assuming that wages are sticky and that labour market is imperfect, inflationary expectations are thus sticky downward. This implies that inflationary policies lead to permanently enhance the unemployment rate.

In brief, we can say that it should be preferable to separate a *trend* component and a *cyclical* component. Incidentally this could explain why uncertainty is related to Lucas critique: the *trend* component is associated with *deep* parameters and the *cyclical* component is associated to *non deep* parameters. Cyclical fluctuations thus can explain the meaning of uncertainty in economics. The randomness of output fluctuations is the base of the *Real Business Cycles* theory (RBC). The RBC theory says that random fluctuations in output are due to shocks that have different impacts on the different markets.

Thus, parameters estimation is extremely difficult. If each market always reacts to shocks it's more useful to base estimation on microeconomic data, using *calibration* techniques and not basing it only on aggregate data. In general the agents' reactions are to be analyzed in a cyclical (due to shocks fluctuations) and uncertain contest (that's the reason why we have previously used a stochastic model). Once again we have to underline the fact that nominal fluctuations and money supply have less impact on economic policies.

CONCLUSIONS AND REMARKS

Trying to evidence similarities between economic theory and natural sciences has always been one of the most discussed approaches in social sciences. In this work we have made a first attempt to explain some common characteristics as well as showing the limits in economic policy as pointed out by the Lucas critique. In general it leads to a new conception of the roles of the private sector in relation with the policymakers, thus limiting the action of this one.

Analyzing this aspect in a cyclical context, the periodical nature of economic variables can be associated with shocks, as we have previously underlined. If

there is some similarity between natural and social sciences we can thus investigate economic cyclical variables under a new point of view. For example, one of the aims of the policymaker often wants to achieve is to reduce the *amplitude* of the economic cycle, acting with *anti-cyclical variables*. It's now important to consider *when* the best moment to intervene with a policy is: the *dynamic* aspect becomes now very important. These similarities with *waves* do not exclude that one of the limit of the policymaker is that, if not well implemented, some policies could instead enhance amplitude, through a *resonance* process.

Another important aspect to be further analyzed is related to expectations. Rational expectations play a key role when are formulated by agents that have a deep knowledge of the economy and have the necessary information, covering its costs. From this point of view, will the policymaker take advantage of the spread of economic information as well as economic education? How should be this information used in anti-cyclical way? Can short run speculative effects be limited with less information? If we consider, for example, a speculative rational bubble the answer is not simple. There are a lot of problems that can be investigated. We think that the concept of uncertainty is not only limited to economic policy but affects a lot of other problems related to social sciences.

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NETIKRUMAS IR NEAPIBRĖŽTUMAS EKONOMINĖJE POLITIKOJE

Marco D'Errico, Andrea Mangone
Milano universitetas

Pagrindinės sąvokos: *Lucaso kritika, Goodharto teisė, optimali politika, neapibrėžtumų principas, verslo ciklai*

Santrauka

Rašto darbas skiriamas politikos kūrėjų veiksmų laisvės ribų problemai. Pirmiausiai aptariama Lucaso teorija bei šios teorijos kritika (1976), skirianti daug dėmesio teisėtų lūkes-

čių klausimui. Pavieniai individai dažniausiai neanalizuoja, kokias pasėkmes jų veiksmai sukels visuomenei ar aplinkiniams bei mano, jog politika negali pakeisti ar kitaip įtakoti pagrindinių vertybių.

Lucaso nuomone politikų uždavinys yra pasistengti pakeisti tradicinį modelį, ignoruojantį viešojo ir privataus sektorių bendradarbiavimo galimybę. Privačiojo sektoriaus aktyvumas yra pajėgus pralaužti tradicines užkardas.

Darbe detaliai atskleidžiami galimi privataus ir viešojo sektoriaus sąveikos modeliai.

Rašto darbas baigiamas išvada, jog Lucaso pasiūlyti modeliai yra gana universalūs ir gali būti taikomas ne tik politologijoje bet ir ekonomikoje (pvz. Tiriant ir vertinat verslo ciklus), ar taikomas kaip praktinė priemonė kintamumo sąvokai perprasti.



THIN CAPITALIZATION RULES: A TAX REASON TO CONSIDER INTRA-GROUP FINANCING STRUCTURES

Sophia Bezborodkina

*Saint-Petersburg State University (Russia),
Law Faculty, graduate*

Keywords: tax, capitalisation, fiscal rules, company law.

Summary

The paper is devoted for the problem which is becoming more and more rigid in Russia and other post-Soviet states. This problem is called thin capitalization and basically relates to the special rules of deductibility of interest paid or accrued under the loans to a lender company when its financial position is not very good.

In the majority of the EU states a rules of detecting thin capitalization are well functioning and are successfully applied by the fiscal institutions. The general principle of those rules is described in the paper.

INTRODUCTION

This paper is devoted to the tax issue that has become more and more topical in Russia and other post-soviet countries during last years. The issue is