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## GOOD PREDICTIONS AND BAD POLICIES\*

LUIS ROBERTO MARTINEZ ARMAS†

### Abstract

Relatively little has been said on economic policy by participants in the debate on the realism of assumptions in economic models. What has been said is that a ‘Friedmanian’ methodology which accepts unrealistic assumptions and is only concerned with correct predictions is appropriate from the perspective of a practical economist who is in charge of designing policy. This paper tries to show that this is not true. Even if a model provides very accurate predictions of an event, its ability to provide valid explanations is determined by the realism of its underlying assumptions. Different assumptions yield different explanations and unrealistic assumptions tend to provide no explanation at all. There is a strong relation between the way a phenomenon is explained and understood and the actions that are consequently recommended. Therefore, a model based on unrealistic assumptions is not a reliable source of advice on policy.

*Key words:* Milton Friedman, unrealistic assumptions, economic policy, economic models, instrumentalism.

*JEL Classification:* B41.

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# BUENAS PREDICCIONES Y MALAS POLÍTICAS\*

LUIS ROBERTO MARTINEZ ARMAS†

## Resumen

Relativamente poco ha sido dicho sobre política económica por parte de los participantes en el debate sobre el realismo de los supuestos de los modelos económicos. Lo que se ha dicho es que una metodología ‘Friedmaniana’ que acepta supuestos que no son realistas y a la que sólo importan las predicciones correctas es apropiada desde la perspectiva de un economista práctico encargado de diseñar políticas. Este artículo busca mostrar que esto no es cierto. Así un modelo brinde predicciones muy acertadas sobre algún evento, su habilidad para brindar explicaciones válidas está determinada por el realismo de los supuestos subyacentes. Distintos supuestos dan lugar a distintas explicaciones y los falsos supuestos tienden a no brindar explicación alguna. Dado que existe una relación estrecha entre la manera en que un fenómeno es explicado y comprendido y las acciones que son recomendadas, un modelo basado en supuestos que no son realistas no es una fuente confiable de información en asuntos de política.

*Palabras clave:* Milton Friedman, supuestos irrealistas, política económica, modelos económicos, instrumentalismo.

*Clasificación JEL:* B41.

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## 1. Introduction

"No one who attempts to lay down propositions for the guidance of mankind, however perfect his scientific acquirements, can dispense with a practical knowledge of the actual modes in which the affairs of the world are carried on."

John Stuart Mill, 'On the Definition of Political Economy...'

The debate on the realisticness of assumptions in economic models has been the focus of most methodological debate in economics. It started with Milton Friedman's (1994 [1953]) claim that theory assessment should take into account the predictions offered by competing theories, but definitely not the realisticness of the basic assumptions underlying them, and continues today. Even though there is a vast literature on the subject (Mäki (2009) discusses some of the main contributions), the implications for economic policy of the assumptions debate have seldom been studied up to this day. Are unrealistic assumptions irrelevant for discussions on policy? Should policy makers distrust models based on unrealistic assumptions? This paper attempts to contribute to the ongoing assumptions debate by providing answers to these questions.

What has been said about economic policy in the context of the assumptions debate? Concerns about practical issues and policy-making seem only to have played an important role in the arguments of those defending the irrelevance of assumptions thesis. It has been said, for example, that "for some policy-oriented economists, the intended job is the generation of true or successful predictions" (Boland, 1979, p. 508) and that "the purpose of economic theory for Friedman is prediction for purposes of testing and evaluating alternative policies" (Frazer & Boland, 1983, p. 129). Even some authors who seem not to be quite sympathetic to the irrelevance of assumptions thesis seem to have conceded that for practical matters a theory which delivers correct predictions is satisfactory enough. For example, Hausman (1992, p. 288) claims that "the realist can also recognize that engineers and policy-makers may be more interested in reliable predictions than in theoretical truths." In a similar vein, Yuengert (2006, p. 89) says:

"Economics is supposed to inform policy. It is supposed to help policymakers understand what is at stake in law and regulation, by predicting the effects of legislation, and understanding the effects and role of a social order's institutions. The role of empirical fit, even when it is not based on a thorough understanding, is obvious. Policymakers want to know how taxes and regulation will affect economic growth and government finances, even if forecasters are not certain of the theories underlying their forecasts."

The handful of authors that we have just mentioned apparently share the idea that for practical matters the useful knowledge provided by a model's predictions is all that is needed. The purpose of this paper is to investigate if it is indeed true that economists who are concerned exclusively with the useful application of economic theories in policies can safely ignore the unrealisticness of the assumptions underlying those theories. The argument that I will try to defend is that just as it may be unwise to operate a machine if we do not quite understand how it works, it is not advisable to implement policies based on models which provide correct predictions but which, due to the unrealisticness of their basic assumptions, do not provide equally acceptable explanations.

## 2. Do economists care about the realisticness of assumptions?

Is the assumptions debate still relevant today? One way of answering this question is from a methodological perspective, focusing on the extent to which a consensus has been reached amongst philosophers of economics on the philosophical problems posed by the assumptions debate. From this viewpoint, we would obtain mixed results: While some authors have recommended that it is time to move on and let the assumptions debate rest in peace (McCloskey, 1994), other people's work seems to suggest that still today this topic is worthwhile discussing (Mäki, 2009). We could also try to answer the question on the relevance of the assumptions debate from the perspective of the economics profession, in which case we should try to assess the impact that the assumptions debate has had on contemporary economics. It is this route the one that I want to follow in this section. More specifically, the question that I want to answer is how has Friedman's irrelevance of assumptions thesis contributed to the way economists do their work (McCloskey's workday rhetoric) and to the way in which they conceive their work (McCloskey's official rhetoric). In order to accomplish this task, I will have to say a few things on the methodological ideas prevalent in contemporary economics.

It is widely recognized that Friedman's essay has had a profound effect on the methodological ideas shared by most economists over the last 50 years. However, the question that is still left unanswered has to do with what is it exactly that economists have embraced from Friedman's arguments. If we take into account the fact that for the last 30 years Friedman's methodological stance has been mainly labeled as instrumentalist (Hausman (1992), Hands (2001)), a good starting point might be to ask ourselves if mainstream economic methodology can be described as instrumentalist. In answering this question I am particularly interested in instrumentalism as a doctrine regarding the objectives of science, according to which scientific theories aim only to provide valid predictions and not to explain and/or describe the way in which the world works (For a discussion on the complexities of the concept, see Mäki (1998)). As Hausman (1992, p. 286) puts it: "Instrumentalists insist that the goal of science is the development of tools which enable one to make reliable and useful predictions."

Lawson (2001, p. 175) suggests that economists are indeed methodological instrumentalists: "A good number of economists are of the view that the realisticness of their theories is not a problematic issue, and proceed, in effect, as though theories can serve primarily as instruments of prediction." Is this really the way in which Friedman has influenced the economics profession? Is it true that economists are instrumentalists who do not intend to explain anything with their theories and are only concerned with predictions? I find Lawson's conclusion inadequate due to the fact that it does not fit with the way in which economists see themselves and the work they do: if you ask ten economists, nine of them will say that explanation is one of the important objectives that they pursue with their models. Another source of evidence on the importance that explanations have in the economics profession is the emphasis that is put, via mathematical models, on the mechanisms that cause observed phenomena. Consider, for example, basic demand theory. Its purpose is not just to predict that an increase in the price of a (normal) good will lead to a decline in the quantity demanded, but also to provide an explanation (In terms of income and substitution effects) for the occurrence of this phenomenon. Therefore, instrumentalism is not an appropriate diagnostic of contemporary economics: economists do want to explain and understand.

We have reached an interesting preliminary conclusion: Economists nod in acceptance of Friedman's methodological prescriptions (Boland, 2003), and yet cannot be properly described as instrumentalists, which is the name with which philosophers of economics have for quite some time labeled such methodological prescriptions. So it must be something else. Perhaps we should think of a simpler, even trivial, connection between Friedman's essay and the prevalent methodological ideas in

economics. Unrealistic assumptions provide us with just that: Economic models always include some unrealistic assumptions and Friedman claims that doing so constitutes sound methodological practice. I would dare say that the only significant way in which Friedman's arguments have been incorporated into the economics profession is in terms of an oral tradition, according to which Friedman 'demonstrated' (whatever that may mean) that the unrealisticness of a model's assumptions is irrelevant for theory assessment. As Mäki (2009) suggests:

"There has been a popular legacy of F53 [Friedman's essay], based on a vague understanding of its key ideas, sustained and transmitted without any detailed analysis or reflection of the text of the essay, often without citation or reference."

I cannot say what share of economists have read Friedman's essay, but I am quite confident that most economists are not concerned with the philosophical debates surrounding that paper. Therefore, I think that the popular legacy that Mäki is talking about is nothing more than economists' shared belief that Friedman proved that there is nothing wrong with using simplified models based on unrealistic assumptions as long as they provide correct predictions. Friedman legitimized, at least to the eyes of economists, their common practice of building models using unrealistic assumptions. How did he accomplish this? Why Friedman's essay was found so persuasive amongst economists? I would tentatively suggest that more than Friedman being right about deep issues in methodology and epistemology (see (Mäki, 2003) for some of the inconsistencies in Friedman's argument), it was the fact that he said what economists had wanted to hear for decades that caused his ideas to be so widely accepted by methodologically illiterate economists. Ultimately, Friedman's persuasiveness is more a matter of authority than of philosophical insight.

We now have two pieces of the puzzle regarding the methodological situation in which economics currently finds itself. First, economists want to explain the way in which the world works and so cannot be described as instrumentalists. Second, the use of unrealistic assumptions is pervasive in modern economics and was legitimized by Friedman's essay. The next step is to ask ourselves why it is that unrealistic assumptions play such an important role in contemporary economics. Why are economists willing to give up on a lot of things but not on their precious assumptions?

Leaving behind the usual statements regarding the need to simplify a complex reality, I would like to point out what seems obvious: Economists cherish unrealistic assumptions because they need them to build formal mathematical models. That economists are in love with formal argument and mathematical rigor seems to be an old story these days. Nobel Prize recipient Paul Krugman (2008) is straightforward about it: "We just don't see what we can't formalize." Blaug (2002, p. 36), who even accuses 'formalism' of being a disease corroding economics, agrees with Krugman and claims that "if a topic cannot be tackled by formal modeling it is simply consigned to the intellectual underworld." It is not exaggerated to say that nowadays mathematical models are the *sine qua non* of economic discourse.

What has only been analyzed in recent times is the link between unrealistic assumptions and formal mathematical models. Particularly, it has been recognized that there are certain assumptions, known as 'Tractability assumptions', whose function is to "facilitate the formal treatment of a problem" (Mäki, 2008, p. 18). Hindriks (2005) further defines these assumptions as those that are needed in order to transform a problem, which could not be solved without them, into something solvable. The history of economics provides us with several examples that highlight the importance of this type of assumptions: both Mäki (2008) and Krugman (2008) mention how a few decades ago economists just ignored issues having to do with 'increasing returns' and 'monopolistic competition' simply because they lacked the appropriate mathematical tools to deal with these topics.

We now have the full picture: economists are in love with math, and it is unrealistic assumptions which allow them to build the mathematical models that they are so fond of. Friedman proved that there is nothing wrong with unrealistic assumptions, as long as models predict well, and so economists found a way of legitimizing that which they like to do so much (For an opposite view on the relation between Friedman's essay and the rise of formalism in economics, see Hands (2003)). Almost 40 years ago, Leontief (1971, p. 2) already understood how the interaction of unrealistic assumptions and formal models constituted the basic methodological framework of modern economics:

"In the presentation of a new model, attention nowadays is usually centered on a step-by-step derivation of its formal properties... By the time it comes to interpretation of the substantive conclusions, the assumptions on which the model has been based are easily forgotten."

From this perspective, contemporary economic methodology can be summarized in four simple instructions:

1. Build mathematical models if you want us to listen to you.
2. We know that you might need to include some unrealistic assumptions. Don't worry about it.
3. Just make sure that your model provides correct predictions.
4. (Rarely used) If anyone asks about your model, try something like "We economists use simplifying assumptions." If they keep bugging you, explain to them that Nobel Prize recipient Milton Friedman proved that they are wrong and that your model's assumptions are just fine.

So far, so good, one might think. However, despite the apparent feeling of methodological soundness, there is a fundamental inconsistency between the desire that economists have to explain and understand the way the world works and the 'Friedmanian' methodology that they embrace, that methodology that legitimates the inclusion of unrealistic assumptions in economic models and puts all the load of theory assessment on a model's predictions. For reasons that will be discussed in the next section, a model's assumptions determine the type of explanation that the model provides. In fact, it will be argued that wildly unrealistic assumptions simply eliminate any possibility of a feasible explanation. It therefore appears to be the case that economists, without knowing it, follow methodological prescriptions when building their models that are incompatible with the objectives that they want to achieve with those models.

How could this happen? As I said a few lines ago, economists believe that Friedman proved that their methodology is a good one, but for the most part have never bothered to read with care Friedman's arguments or to study, even superficially, what has been written on Friedman's essay. In McCloskey's (1994 [1983], p. 400) words, "a watered down version of Friedman's essay is part of the intellectual equipment of most economists, and its arguments come readily to their lips." More generally, most economists lack any philosophical or methodological training and simply replicate what they have seen their teachers do, making it possible for inconsistent methodological practices to survive and perpetuate themselves (Hargreaves Heap, 2000). It is therefore advisable, even if it helps to prove me wrong, that economists get a basic hold of certain topics in philosophy and methodology.

One important thing that has contributed to the supremacy of the Friedmanian methodology is the fact that mathematical models, due to their transparency and tractability, may provide an illusory feeling of having explained what is going on in the world, when in fact no such thing has been achieved. It should definitely be recognized that mathematical models have the virtue of allowing a clear view of the mechanisms underlying a given phenomenon, but the validity of the explanation provided by such models is determined by the realisticness of the underlying assumptions. Unrealistic assumptions provide only 'as-if' explanations, no matter how rigorously these pseudo-explanations are constructed. What happens then

is that economists feel satisfied because their models allow them to tell stories that apparently explain how a given phenomenon came about, but forget, or probably ignore, the price that they have paid by including unrealistic assumptions in their models.

Let us ask ourselves again: is the assumptions debate still relevant today? From what I have just said, I feel that the answer is definitely YES. Contrary to the common belief, assumptions are still a problematic issue today. Let us now explore how assumptions determine explanations and how explanations have an effect on policy.

### 3. From Assumptions to Explanations

The argument that I want to present is rather simple: A model's assumptions affect the type of explanation that the model provides for the phenomenon being studied; In turn, the explanation provided affects the types of policies that are recommended. Assumptions condition explanations and explanations have an effect on policy. Therefore, it is unwise for policy makers to blindly trust models whose predictions are correct but which are based on unrealistic assumptions. This section analyzes that first link between assumptions and explanations.

Predictive success is generally necessary but definitely not sufficient for explanatory success. The fact that a given theory's predictions fit with the data does not necessarily mean that the theory offers a correct explanation. Friedman (1994 [1953], p. 185) himself concedes that "if there is one hypothesis that is consistent with the available evidence, there are always an infinite number that are." For example, Yuengert (2006) shows how the two main types of models built by economists to understand addictive behavior, which are rational choice models and time inconsistency models, both have the same predictions but provide quite different explanations of addiction. In Yuengert's (2006, p. 78) words, these two models "are nearly indistinguishable by conventional econometric methods... are underdetermined by data... [and yet] offer distinct understandings of human decision-making in the presence of addictive goods". Another example is provided by Blaug (1992, p. 216), who argues that Mincer equations do not allow us to distinguish 'human capital' explanations of the positive returns of education from 'signaling' explanations. Both models predict that education has a positive effect on labor income, which is what can be tested with a Mincer equation, but "the question is not whether schooling explains earnings but rather why it does."

Nevertheless, too often economists think that their models provide satisfactory explanations because they deliver correct predictions. Calibration exercises are paradigmatic in this respect, since their whole purpose is to replicate some facts about the world, without in any way assessing the extent to which the model correctly explains the underlying mechanisms. To illustrate the problems with such a procedure consider the following example: a middle school student is asked to build a volcano as a science project and makes use of some chemical reaction (baking soda and vinegar, for instance) to replicate a volcano eruption. The mistake that economists sometimes make is to think that just because the 'model' volcano is able to replicate the way in which a real volcano erupts, then it is the case that real volcanoes erupt because of the way in which baking soda and vinegar react inside of them. This is just another way of saying that, as mentioned in the previous section, the methodological contradiction in which economists find themselves today is that they want to understand the way in which the world works and yet have no problem in building models from unrealistic assumptions and assessing them by their predictive capabilities. A concrete example from the history of economics is provided by Real Business Cycle models, where the ability of the models to account for certain stylized facts was taken as

evidence for the underlying explanation that business cycles were the result of optimum decisions by all economic agents at all times. Incidentally, real business cycle explanations of macroeconomic phenomena brought with them very specific and extreme policy advice, since in a world where everyone is as good as they can be at all times no interference was ever justified.

Opposite to what happens with predictions, a model's assumptions do have a strong connection with the explanations that the model offers. Frank Hahn (1985, p. 18) is straightforward about it: "Whatever it is a theory suggests that we understand, that understanding is contingent on both the axioms and assumptions" (p. 18). In the case of addiction models, Yuengert (2006) shows that different assumptions about the situation in which addicts find themselves can give rise to radically different explanations. In fact, Yuengert (p. 83) finds that both types of addiction models are based on "forward-looking, utility-maximizing consumers" and that the only significant difference between the models has to do with the way in which addicts discount the future. It is this small difference in assumptions what causes a large discrepancy in terms of explanations: while rational choice models portray addicts as people who know what they are doing, time inconsistency models portray these individuals as victims of an internal struggle beyond their control.

How is it exactly that assumptions affect the explanations that a model may offer to us? Explaining basically means answering a 'Why?' question. Therefore, in order to explain a given phenomenon we must be able to tell a story which renders it intelligible. For example, we can explain the existence of Giffen goods because we can provide compelling reasons, in terms of relative income losses which counteract substitution effects, to account for the fact that a price increase is sometimes followed by an increase in the quantity demanded of that same good. Following Cartwright's (2001) idea that models are blueprints for socio-economic machines, we can more easily understand the connection between a model's assumptions and the explanations it provides, since different assumptions imply different machine set-ups. Even if the output at the end of the process is the same (the predictions are the same), the way in which the machine is assembled and the way in which its different components and mechanisms operate will affect the way in which the model answers the 'Why?' question. From this perspective, mathematical models prove quite useful since they have the virtue of providing a clear look at the underlying mechanisms of the phenomenon being studied. As was mentioned in the previous section, the tractability which mathematical models provide is one of the most appealing features of such models to economists who are concerned with understanding how the world works.

We can also understand the connection between assumptions and explanations if we focus on the narrative aspect of explanations. An explanation is a story that can make sense of some observed event. In the case of economic models, the story begins with the model's assumptions and finishes with its predictions. Different assumptions imply that different stories are told and so different routes are taken to get to the predictions. For example, human capital theory tells us that education has a positive effect on income because more educated people have a larger stock of this type of capital and therefore receive higher returns; Signaling theory argues that this effect of education on income is due to the fact that education is interpreted by employers as a sign of higher skills and abilities.

What happens in the extreme case in which extremely unrealistic assumptions are included in an economic model? In this case, the potential that a model has to explain the way the world works is substantially reduced. Think of the following situation: We build a model in which we assume that more educated people have a special smell which employers find irresistible, causing them to be willing to pay higher wages to these more educated individuals. Even if this model predicts correctly that education has a positive effect on income, the extremely unrealistic assumption on which the explanation is based does not allow us to understand why it is that such a thing occurs. No matter how complex and mathematically sophisticated the model is and no matter how accurate the model's predictions are, what we find is that

unrealistic assumptions do not allow the economist to understand what is really going on. As was mentioned in the last section, the danger with mathematical models lies in the confidence with which we may think that we have understood the mechanisms underlying the event being studied because of the precision and the tractability of the model. However, if the model is based on unrealistic assumptions, we may have very detailed blueprints for a machine that exists nowhere.

Figure 1, proposed by Robert Sugden (2002), shows a simple logical interpretation of the way in which an economic model tries to explain an event. It allows us to further understand the disconnection caused by unrealistic assumptions between the explanation that a model provides and the real ways of the world. Figure 1 shows that a model can be thought to have captured a significant causal connection if both its predictions (premise 3) and its assumptions (premise 2) are considered realistic representations of certain features of reality. The problem with unrealistic assumptions is then that they make premise 2 false, thereby disconnecting the model from reality. More specifically, unrealistic assumptions do not allow us to infer premise 4, they do not allow us to state that we have identified a real causal mechanism, even if premise 3 is true and the model provides correct predictions. Returning to our previous example, a model may well posit that nice smelling educated individuals earn higher wages (premise 1), but we have no reason to believe that such extremely seducing smell is a characteristic of any educated individual in the real world (premise 2 is false). Hence, it is impossible for us to state that highly educated individuals indeed have higher earnings due to their nice smell (premise 4 cannot be inferred), even if the prediction of a positive relation between education years and labor income is validated by empirical evidence (premise 3 is true).

Figure 1: Nature of Explanation:

- |  |
|--|
| <ol style="list-style-type: none"><li>1. In the model world, R is caused by F.</li><li>2. F operates in the real world.</li><li>3. R occurs in the real world.</li></ol> <p>Therefore, there is reason to believe:</p> <ol style="list-style-type: none"><li>4. In the real world, R is caused by F.</li></ol> |
|--|

Source: Sugden (2002, p. 125)

Summarizing, I have so far argued that there is a connection between a model's assumptions and the explanations that it provides. Based on this premise, I have also tried to show that unrealistic assumptions tend to reduce a model's potential to explain real world events. This conclusion could be interpreted as a serious threat to the whole modeling enterprise in contemporary economics insofar as this commitment to mathematical models appears to irremediably involve unrealistic assumptions. However, some relatively recent contributions to the assumptions debate have helped establish that not all assumptions are alike (Musgrave (1981), Mäki (2000)). It has been suggested that different assumptions have different roles in economic models and that some of these roles may require assumptions to be unrealistic. Exploring these issues will allow us to determine if there is any room for unrealistic assumptions within the argument presented in this section and if it is necessary to make any corrections or amendments to the argument.

#### 4. Realism versus Realisticness: Some Complications

One of the main contributions in the recent literature on the assumptions debate has been the distinction between 'realisticness' and 'realism' proposed by Mäki (1994, 2002). Mäki claims that while 'realism' is a concept related to the legitimate and achievable purposes of science, 'realisticness' is a characteristic of theories or of the statements contained in them, which has to do with their ability to represent correctly what is going on in the world. Mäki considers that the assumptions debate has taken place in the wrong terms because both philosophers and economists have been speaking about the 'realism of assumptions', thereby mixing up two separate issues. It is one thing to ask if economic theories should try to achieve the realist objective of allowing us to understand how the world works; it is quite a different thing to ask if economic theories contain unrealistic assumptions and if there is any problem with that. Mäki has accepted that underlying the whole discussion is his aim of bringing together the realist objectives that economists have with the unrealistic assumptions with which they build their models. The purpose of this section is precisely to analyze the reasons that make Mäki think that unrealistic assumptions can contribute to the development of valid explanations of real world events. This will allow us to determine if, and in what sense, my argument needs to be modified.

Mäki has developed two types of argument in order to justify unrealistic assumptions in economic models that try to capture real world mechanisms. On the one hand, he has defended that unrealistic assumptions are a way of isolating the mechanism which is being studied from the interference of the rest of the universe, in a way analogous to the manipulation of reality which takes place during an experiment in natural science. We shall call this the 'isolation argument'. On the other hand, Mäki has also developed an original idea of Alan Musgrave (1981), according to which the assumptions in economic models should not be taken at face value, because their meaning may be quite different from what it appears to be. Musgrave's insight was that assumptions may have to be paraphrased in order to reach their true meaning, in which case assumptions that appear to be irremediably unrealistic may actually have a chance of corresponding to reality. We can call this the 'paraphrasing argument'. The question that I would like to answer is to what extent do the isolation and paraphrasing arguments invalidate the conclusions from the previous section.

The isolation argument is based on the idea that an economic model can be interpreted as a similar exercise to an experiment in one of the natural sciences. In both settings, Mäki (2005) argues, the aim is to isolate what is being investigated from the interference of any 'disturbing causes'. In Mäki's (2008, p. 14) own words, unrealistic assumptions have the purpose of "theoretically isolating some important dependency relation or causal factor or mechanism from the involvement and influence of the rest of the universe." Therefore, to use one of Mäki's examples, when a macroeconomic growth model assumes a closed economy, this assumption has the strategic function of isolating the mechanism being studied (factor accumulation, for instance) from the interference of the rest of the world, literally.

What I would like to emphasize about the strategic purpose of certain unrealistic assumptions is that isolation is a valuable procedure only if there are reasons to believe that the mechanism which is being isolated operates in reality. In other words, you can have  $n-1$  unrealistic assumptions which allow you to leave out all of the disturbing causes that you want to control for, but that last assumption on which the mechanism you are studying is based must have some empirical support. There is not much point in abstracting away from all the complexity of reality in order to study the effect of a hypothetically appealing smell on the decisions made by an employer in the labor market! The assumptions cannot all be unrealistic because in that case the model describes a machine that operates nowhere.

Mäki (1994, p. 246) recognizes that this is so when he makes a distinction between 'core' and 'peripheral' assumptions: "Unrealistic peripheral assumptions help isolate what are believed to be the fundamental relations from less relevant ones." These core assumptions that capture the "fundamental relations" are the ones that cannot be entirely unrealistic if the model is to have any relation to reality. Notice that only by accepting this need for some realisticness can we understand how economic models, being partial representations incapable of telling 'the whole truth', are nevertheless able of telling "nothing but the truth" regarding the specific mechanism under study. Only this way can we understand why Mäki (1994, p. 246) criticizes Friedman for defending the maximization assumption (a core assumption) using an analogy with Galileo's assumption of no air resistance (a peripheral assumption).

It is not uncommon to hear in defense of economic theory that simplification via unrealistic assumptions is necessary because of the same reasons why a map on a scale 1:1 is useless. This argument is quite similar to Mäki's in that it claims that portions of reality must be left out in order to be able to say something significant about the portion that is being studied. The problem with the map argument is that while it is legitimate to leave things out of a map, the map does have to represent correctly those things on which it is intended to be a trustworthy guide. A map can leave out all of the trees surrounding a highway, but it cannot include hospitals and gas stations in arbitrary locations where none are to be found. In Mäki's case, a model can leave out all of the complexities of reality, but it must be a realistic representation of that small portion on which it intends to say something.

What about the paraphrasing argument? Following Musgrave (1981), Mäki (2000) proposes three main types of meanings that assumptions may have and that are not self-evident. First, Mäki argues that certain unrealistic assumptions may be interpreted as statements about the 'Negligibility' of a given factor for the phenomenon being studied. For example, the closed economy assumption may be read as saying that international trade does not contribute in any significant way to economic growth. Similarly, 'Applicability' assumptions appear to be unrealistic, but they may not be so since their actual meaning is that the model is an appropriate representation of reality only when the given assumption is true. From this perspective, the closed economy assumption is not a statement about the economy but a state about the model and about the conditions for its applicability: the model talks about reality only in the case of a closed economy. The important point in both cases is that what at first view appeared to be an untenable assumption becomes a statement which has a chance of being realistic.

The third category proposed by Mäki is that of 'Early Step' assumptions. In this case, the unrealistic assumptions are only temporarily employed statements, whose unrealisticness allows the economist to study a relatively unknown domain and which, hopefully, will be removed as science progresses. These early step assumptions are like the structures and supports that engineers use to assist themselves when building a ship: these auxiliary structures are necessary for the first parts of the ship to be put together, but will definitely be removed before the ship is set to sail. If the closed economy assumption was interpreted as an 'early step assumption' it would be read as saying: 'For the time being, let us assume that the economy is closed. However, we promise to relax this assumption in the future in order to get a more accurate representation of reality.'

The first thing that I would like to point out regarding these paraphrasing exercises is that, once again, they may justify the inclusion of some unrealistic assumptions, but they certainly require that some other assumptions are realistic. Just think about the extreme case in which all assumptions are either negligibility, applicability or early step ones. If all assumptions are negligibility ones, all what you have is a list of irrelevant factors, but you are unable to pinpoint any factors which are indeed relevant. I can say that your ability to run maximum likelihood regressions, your girlfriend's name and your favorite color do not have any effect on your ability to run a mile in less than 10 minutes, but I have not learnt anything valuable about the basic skills that a good runner should have by acting this way. Similarly, if all

assumptions are applicability assumptions the model becomes a 'conceptual exploration' (Hausman, 1992) in which the properties of a nowhere existing world are examined (Does general equilibrium theory ring a bell?). The possibility of paraphrasing can indeed excuse certain unrealistic assumptions, but definitely not all of them. Like I said before, it is the subset of core assumptions that includes affirmative statements about the functioning of the world the one that must have some empirical relevance if the model is to provide a valid explanation. Again, Mäki (1994, p. 246) recognizes that this is so when he claims that:

"The core assumptions are supposed to capture, in pure form, the 'essential features' of the 'more fundamental structure', while the peripheral assumptions, such as negligibility and early-step assumptions, are there to help see the essence of the matter undisturbed by eliminating the actual disturbances or complications."

Additionally, it must be recognized that the entire purpose of paraphrasing unrealistic assumptions is to give them a chance of being realistic. Paraphrasing is a way of saying 'My assumptions are not unrealistic, they have just been misunderstood', and therefore presupposes the necessity of realisticness in assumptions. When the closed economy assumption is interpreted as a negligibility assumption, the underlying objective is to transform an extremely unrealistic statement (The economy is closed) into a statement which has a chance, perhaps a very remote one, of fitting with reality (Openness does not have a significant effect on...). Why should we attempt such an intricate semantic maneuver if there was nothing wrong with unrealisticness?

The conclusion that we may draw from Mäki's contributions to the assumptions debate is that not all assumptions in an economic model need to be realistic but at the same time not all can be unrealistic. The argument from the previous section remains valid, but it must be understood in terms of those core assumptions whose realisticness matters a lot. The argument is particularly valid because, unfortunately, it is this subset of assumptions which are often quite unrealistic in economic models, as found by Hausman (1981, p. 382):

"The fundamental theory of microeconomics and of general equilibrium models seems simultaneously sophisticated, successful, bursting with explanatory power and full of false statements. These false statements are not only simplifications or auxiliary hypotheses which enable economists to apply the fundamental 'laws', but seem to include the fundamental 'laws' themselves. We know full well not only that commodities are not infinitely divisible (which is only intended as a simplification), but that businessmen do not always attempt to maximize their profits and that the preferences of consumers are not always transitive. "

I believe that Mäki's contribution to the assumptions debate is more valuable as an attempt to explore the hypothetical possibility of bringing together realist objectives with unrealistic assumptions than as a set of positive theories on the role that unrealistic assumptions play in contemporary economics. If we accept the latter interpretation, we will have to deal with some deep conundrums. For example, if unrealistic assumptions have the purposes that Mäki claims they have, why is it that economists seldom, or probably never, say so? If the closed economy assumption is meant to indicate that openness is not an important factor when attempting to understand whatever it is that the macroeconomist is studying, why is it that the macroeconomist fails to say so? If this same assumption is to be understood as an applicability assumption, why is it that macroeconomists use these models on a wide panel of countries without focusing on the ones that the model is meant to represent? Mäki may say that economists are unaware of the role their assumptions actually play, but this implies the strong psychological claim that there is a difference between what economists say they do and think they do and what they are actually doing.

More to the point, the study of the actual functions of assumptions in economic models reveals that mathematical tractability is the main motivation behind most of the unrealistic assumptions present in economic models. Mäki (2008, p. 19) recognizes that the ubiquity of tractability assumptions may put economics "on the wrong track", but suggests that the tension between economists' desire to understand the way the world works and their equally pressing urge to build mathematical models does not allow tractability assumptions to get out of control. Mäki apparently believes in tractability assumptions as 'early step' assumptions which are slowly replaced by more realistic ones. A look at contemporary economics reveals, however, that even if it might be true that a significant portion of the unrealistic assumptions prevalent in economic models are claimed to be 'early step' assumptions, the fact of the matter is that the promise to replace the unrealistic assumptions with more realistic ones seems never to materialize. Unrealistic assumptions simply perpetuate themselves as mathematics facilitating devices, legitimized by a dynamically inconsistent promise to make them more realistic in the future.

## 5. From Explanations to policies

"The conclusions of positive economics seem to be, and are, immediately relevant to important normative problems, to questions of what ought to be done and how any given goal can be attained."

Milton Friedman, "The Methodology of Positive Economics"

In section 3, I argued that there is a strong relation between a theory's assumptions and the explanations it offers for what is being studied. I would now like to suggest that the assumptions-dependent explanation provided by a model determines the policies that are recommended. In consequence, it is quite likely that two models which explain the same phenomenon using different assumptions will probably give different sorts of advice on matters of policy. Why does this happen? I can think of two different reasons, or rather, two different levels at which explanations may affect policy. First, different explanations may have an effect on the possibility of different policy interventions and on the likely effects of these actions. Second, from a wider perspective, the explanation offered by a theory can either legitimize the current state of affairs, in which case no interference is called for, or it can raise objections to the way things work.

A simple way to understand the relation between positive economics and policy making is in terms of event regularities. The positive science of economics finds stable relations such as: 'Print more money and Prices rise' or 'Increase government expenditure and the economy grows'. This knowledge is useful to the policymaker insofar as it states which buttons are to be pushed if one wants to accomplish a certain objective. From this perspective, explanations affect policies because different machine set-ups imply different connections between the constitutive mechanisms and, therefore, different levers and buttons which can be manipulated with diverging effects. Put simply, different assumptions can lead to different expected outcomes after a change in circumstances brought about by economic policy.

For example, according to human capital explanations of the positive returns to education the expected effect of a state-sponsored national exam to evaluate skills acquired in college will be quite different from what a signaling explanation predicts. The whole family of IS-LM models provides another clear example of the type of relation between explanations and policies that I am defending, since the effect of monetary and fiscal policies are, as every macroeconomics student knows, quite sensitive to whether the economy is open or closed, to the type of exchange rate regime and to the degree of capital

mobility, just to mention a few relevant assumptions. Yuengert (2006) also finds that the dissimilar explanations offered by the two types of model proposed by economists studying addictive behavior give rise to radically different advice on policy: while the rational choice account suggests that state intervention can only diminish addicts' welfare, the dynamic inconsistency model recommends helping addicts to overcome their situation.

What happens in the extreme case where the model is based on unrealistic core assumptions? As mentioned before, certain unrealistic assumptions are an obstacle for the purpose of obtaining valid explanations. They can make the policy maker believe that there is a button to be pushed when in fact there is none, or that a certain lever will have a particular effect when in fact it will have quite the opposite. Unrealistic assumptions turn economic models into black boxes which do not allow us to understand the way the world works, no matter the impressiveness of the model's predictive record. It is therefore quite dangerous for economists to make policy advice based on this type of models since, boldly put, we know what is happening but we do not know why it is happening. Altman (1999, p. 432) captures succinctly how reckless policy advice based on 'as - if' explanations can be when he says with regard to Friedman's famous billiards example that "a training program for billiard players concentrating on math and engineering courses would, by itself, not produce expert billiard players." If we want to modify the world in a desirable and predictable way, we cannot rely on 'as if' accounts of the way the world works. We must definitely strive towards 'as it is' explanations.

The famous 'Lucas critique' can be interpreted along this line as a warning about the dangers of designing monetary policy based on a Phillips Curve without understanding what is causing such a relation between inflation and unemployment to exist. According to Lucas, the Phillips curve is conditional on people's expectations on inflation, and so monetary policy will only be effective insofar as people do not incorporate it into their expectations. If people do expect increases in the money supply, the capacity of monetary policy to affect output will vanish and an expansionary monetary policy will only cause the price level to increase. In this case, pulling the lever without knowing how the underlying mechanism works will only cause this mechanism to stop working. Policies based on good predictions but lacking appropriate explanations miss the important fact that "there are no law-like regularities without a machine to generate them" (Cartwright, 2001, p. 288), a machine whose functioning can easily be disrupted by careless manipulation.

In a similar vein, Hausman (1992, p. 166) argues that the knowledge provided by a model which yields correct predictions but not valid explanations is as fragile and unreliable as a test drive of a few blocks when deciding whether to buy a used car. Hausman claims that checking under the hood of the car is a valuable exercise, even if all that is wanted from the car is that it works. He also suggests that the information acquired by checking under the hood is particularly important before using the car under new circumstances or when it breaks down. The metaphor is quite apt for our analysis on the policy implications of unrealistic assumptions because economic policy typically involves extrapolating a stable relationship found at a certain place and time to a somewhat new context. For example, development policies that worked in Asia some decades ago have been implemented throughout the developing world in recent years. Realistic assumptions provide a clear picture of the conditions necessary for a certain policy to be likely to work; unrealistic assumptions turn economic models into black boxes which provide valid predictions without us knowing what is really going on. Therefore, we also ignore the model's limits and we do not know when we should expect it to work since an assumption so unrealistic that it does not fit any part of reality does not provide any significant domain restriction.

It is not uncommon to hear economists say that the important issue regarding assumptions is whether a theory's results are robust to a change in assumptions. For example, Becker (1962) claims that there is no need to fight over the rationality assumption in microeconomic theory since the prediction of

a downward-sloping market demand curve is robust to different assumptions about consumer behavior. The problem with robustness as a desirable property of assumptions is that they commit us to the 'as if' view of the explanatory role of theories, since what we are saying is that no matter how it is that the world actually works, all possibilities lead to the same predictions. In Becker's case, what he forgets to mention is that the different assumptions considered (standard rationality, habit induced behavior, totally erratic decisions) not only provide very different explanations about human behavior, but they also have different implications for policy making, as the simple case of a new excise tax easily shows.

So far, we have focused on the dangers faced by policies based on models with unrealistic assumptions from a very operative perspective. Summarizing the argument, if you do not know how the machine works, you may push the button and the mechanism may not work or may have unexpected consequences. However, we mentioned at the start of this section that there is another way of looking at policy issues from which unrealistic assumptions are also not desirable. What I have in mind is the normative exercise of determining to what extent we find the way the world works to be satisfactory. Realistic assumptions providing valid explanations are important from this perspective because in order to agree or disagree with the way the world works, and to intervene if we are unsatisfied, we must first understand how it is that the world actually works.

I think that Lawson's (1995) arguments on the potential that economics has to contribute to the "emancipation" of mankind are related to the capacity that a truly enlightening economic science has to allow focused debate on the desirability of current states of affairs. Lawson (1995, p. 29) claims that "the aim must be to transform structures in order to enhance the scope for realizing human potential and to broaden opportunities generally." Economics can legitimize the status quo or it can call into question, and the extent to which economics portrays this world in which we live as the best of all possible worlds is directly related to the extent to which it offers idealizing 'as -if' explanations and not valid but troubling explanations. More importantly, economics can contribute to mankind's emancipation insofar as it can guide policies which try to transform the existing institutional framework rather than simply make use of a certain mechanism within the current structure. Policy can consist in pushing a button of the existing machine, but it can also have the wider objective of transforming the functioning of the machine. In Marschak's (1994, p. 283) words: "Policy change may consist in changing the very mechanism by which the environment influences economic variables."

Returning to the literature on addictions discussed by Yuengert (2006), if addicts are rational actors who are in control of themselves and know very well what they are doing the imperative to intervene and help addicts vanishes, while if they are divided individuals, torn apart by urges stronger than them, there are compelling reasons to try to help these people. The explanations offered for the phenomenon of addiction affect the judgments that we make on the responsibility that society and the state have to help addicts.

Another example is provided by the literature on the environmental Kuznets curve. This literature suggests that the relation between economic development and environmental damages has an inverted-U shape, similar to the one proposed by Simon Kuznets for the relation between development and inequality. The environmental Kuznets curve is compatible with several different explanations, two of which are that wealthier countries have highly educated and more environmentally aware populations or that as countries develop their more polluting industries move to poorer countries with less strict environmental regulations. If the first hypothesis is correct, then there is nothing to worry about, since economic development will take care of the world's environmental problems. But if the second hypothesis is the right one, an important asymmetry between the rich and poor nations of the world is established and serious concerns regarding the responsibility that the world's industrialized countries have in terms of pollution abatement arise. In fact, if we find that the environmental Kuznets curve is the

result of the migration of polluting industries, economic policy should try to stop this, even if it means destroying the mechanism which underlies the mentioned Kuznets curve.

Summarizing the argument, what I have tried to show in these last few paragraphs is that understanding of how the world works is necessary for mankind to be able to exercise choice as to the organization and functioning of relevant aspects of the economy. 'As if' explanations based on unrealistic assumptions are an obstacle to the achievement of such an understanding and should consequently be rejected if we are to take advantage of the full potential of economic policy.

## 6. Concluding Remarks

"For purposes of understanding, the status of the axioms matters a great deal"

Frank Hahn, 'In Praise of Economic Theory'

In the opening lines of this paper I said that the question that I wanted to answer was if models based on unrealistic assumptions could be found acceptable from the perspective of the needs of a policy maker. The answer is No. Even if the role that certain assumptions have in economic models requires them to be unrealistic, unrealistic core assumptions only allow for 'as if' explanations and stand in the way of a real understanding of the way the world works. Relatively correct predictions certainly are important, but understanding the reasons why an event takes place is necessary in order to be able to provide sound policy advice.

Regarding the methodological situation in which contemporary economics finds itself, the conclusion that can be drawn from this paper is that it is time for economists to reflect more often on the way in which they conduct their work. Samuelson's idea that "those who can, do science; those who can't prattle about its methodology" (Hands, 2001, p. 1) has only contributed to the perpetuation of an inconsistent methodology without economists being aware of it and should consequently be given up.

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