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SOME THOUGHTS ON HOMO OECONOMICUS

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1. Introduction

The dissatisfaction with the construct of homo oeconomicus has most certainly been the oldest umbraline ghost to awe the ones interested in the foundations of economic theory. Its diffuse shadow, like a Homeric σκιά[1], has tormented the great minds of Pareto, Robbins, Alchian, Stigler and many others, from the dawn of the 20th century to the inquisitive minds of our own students in the very lecture we delivered last week. They all have shared the same discomfort at the conceptual mess prevailing in the debate. Though some of those great thinkers have indeed leveled the field for the sole benefit of future generations of economists, it nevertheless seems that their efforts have been forgotten.

De definitione eius quaerendum est. One must ask about its definition. Perhaps with this short Latin sentence, medieval scholastic thinkers would begin their intellectual debates about homo oeconomicus, if they ever had the opportunity. The logical purity of their minds, cognizant, as they were, of the foundations of Dialectics in terms of the logical operations of the spirit, at least saved them from debating about things whose definitions were not previously agreed upon. They were *that* careful. We do not have to make things now as they did then, but we do have to come to an agreement of what homo oeconomicus really is. Is it the rational Cartesian agent with perfect knowledge and the computational mind of a von Neumann? Or is it the common salesman in the bookstore down the street?

With the help of the construct of cartesianity of epistemic modal logic and Lionel Robbins's and Armen Alchian's thoughts about the behavioural foundations of the economic agent, I want to make a sharp distinction between homo oeconomicus and homo cartesianus. The former will be characterized by Alchian's postulates about the behavior of economic agents, as put forth in his classical textbook, the best of all I have ever seen. The later will be defined, on the other hand, as the agent whose knowledge satisfies Kripke's S5 system of epistemic modal logic. The S5 system is a set of axioms about knowledge.

In section 2, I present Kripke's S5 system and the construct of homo cartesianus. The careful reader will notice that what criticizers of neoclassical economics (which I identify simply with marginalism) usually consider to be homo oeconomicus actually is homo cartesianus. In section 3, I introduce Alchian's postulates about homo oeconomicus and compile them into a set of *principia actionis*, the principles of action, which describe the way economic agents act in a world of scarcity. Based partly on Robbins, I identify rationality with transitiveness of the preference ordering. After presenting the economic meaning of transitiveness and completeness of preferences, it will be shown that rationality does not imply full knowledge. In section 4, I illustrate how we can derive standard economic propositions from the principia actionis. The first application comes from Alchian and Allen. The second one is about Lindahl taxes and the allocation of public goods. The main point here is to show that economic

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[1] Shadow. In Homeric times, the soul was identified with a shadow.

propositions can be achieved through two alternative, though equivalent, ways: by the economic way of thinking (in terms of homo oeconomicus) or by the formal mathematical model (in terms of homo cartesianus). Section 5 concludes the essay.

2. Homo cartesianus

The *homo cartesianus* is a well-defined concept in Epistemic Modal Logic. He is the individual whose knowledge abides to the axiomata of Kripke's S5 system. In this system, the requirements about knowledge in all possible worlds are maximal. However immense those requirements seem to be at first glance, it is not correct to deny their usefullness on the ground of a pressuposed unapplicability. As I will argue, the set of possible worlds (the universe of discourse) in the S5 system is not universal ad litteram, it is circumscribed, quite to the contrary, to a local universe of discourse in which perfect knowledge indeed makes sense. The meaning of this will be clarified later on. In order to present the axioms of the S5 system, some basic concepts are of necessity. They are fundamental, for instance, to Game Theory [Geanakoplos (1994) and Binmore (2009)] and Probability Theory.

Let Ω be the set of all possible worlds. Though this term is now quite common in modern Metaphysics [Fitting & Mendelsohn (1998), Girle (2000), Girle (2003) and Loux (2002)], it was Leibniz (1646-1716)[2] who first brought it to the philosophical realm. In the 20th century this idea was came back to life by the hands of Saul Kripke and David Lewis. A possible world specifies every gnoseologic relevant detail: it describes what every individual knows and what every individual knows about what every individual knows, and so forth; what every individual does and what every individual knows about what every individual does, and so forth; the logical system with which every individual reasons and what every individual knows about the logical system with which every individual reasons, and so forth. A possible world is then a complete and consistent description of how things might have been or how they actually are [Gensler (2010), pp. 275-276].

Modal Logic adds two new operators to the old ones of quantification, existence, and negation: diamond operator ◊ (or *losang*), according to which, should p be a proposition, the operation ◊p is set to mean "p is true in some possible world" or "it is possible that p"; and box operator □ (or *square*), according to which, if p is a proposition, then the operation □p is set to mean "p is true in all possible worlds" or "it is necessary that p". These operators had already been devised by Aristotle in his logical magna opera, particularly in his *Analytica Priora*, but they were not properly addressed. It was William of Ockham (1287-1347), in his *Summa Logicae*, the first one to properly address it[3]. The modal operators can be applied to many instances. Epistemic Logic is

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[2] Leibniz introduced this term in his *Monadologie*, §§53-55, with the following reasoning: *1. There are infinitely many possible worlds in God's ideas; 2. only one of them can be actual; 3. God uses the principle of suffcent reason to choose the actual universe; 4. Suffcent reason can only occur through perfection; 5. Therefore, this world is the best of all possible worlds*. According to the principle of suficiente reason, there must be a sufficient reason to consider a fact or a statement to be true, and not false.

[3] "Another division of the proposition is this: there exists the assetoric proposition and there exists the one about mode (or modal proposition). A modal proposition is that in which a mode is posed. An assertoric proposition is that one without mode. (...) Regarding this, it must be known that a proposition is said to be modal because of the mode which was added to the proposition. Not any mode suffices to make a proposition modal, it is necessary that the mode be predicable of the whole proposition, and hence it is said to properly be the mode of the proposition, as if verifiable from the proposition itself. It is because of such mode or adverb, if there is an adverb, or of the verb, that such predicate, such proposition is said to be modal. The modes, however, are more than the previous four, since, just like a proposition is

one of them. It translates □p as "it is known that proposition p is true" and replaces the box symbol by the letter K, in reference to the word *knowledge*.[4]

The *knowledge* of individual i is given by a partition $\mathcal{P}_i$ of Ω, that is: (a) $\Omega = \bigcup_{\pi \in \mathcal{P}_i} \pi$; (b) $\forall \pi, \sigma \in \mathcal{P}_i, \pi \neq \sigma \Rightarrow \pi \cap \sigma = \emptyset$. Condition (a) says that i's knowledge is made of pieces π of information which, all together, equal the totality of things, that is, the union $\bigcup_{\pi \in \mathcal{P}_i} \pi$ of all the pieces π in the partition $\mathcal{P}_i$ equals Ω. Condition (b) says that any two pieces π and σ of information in the partition do not intersect each other. Each piece $\pi \in \mathcal{P}_i$ is called a *cell*.

Exempli gratia, take a gamble which pays $10 if, after a dice is thrown, there results an even numbered face, and charges $10 otherwise. Assume the gambler cannot see the actual face, he only knows whether he wins or loses. Regarding the actual face of the dice, the gambler who won $10 knows that the totality of worlds is the set {1,2,3,4,5,6}, but he can only distinguish between even and odd numbers. In this case, his knowledge is given by the partition $\mathcal{P} = \{\{1,3,5\}, \{2,4,6\}\}$. The cells are {1,3,5} and {2,4,6}. Given any cell $\pi \in \mathcal{P}_i$, if $\omega, \omega' \in \pi$ are two possible worlds in the cell, then the individual cannot distintiguish ω from ω'. For instance, the gambler cannot distinguish 4 from 6, if he won $10. Given a world $\omega \in \Omega$, let $\Pi_i(\omega) \in \mathcal{P}_i$ be the cell which contains ω. From the point of view of individual i, every world $\omega' \in \mathcal{P}_i$ in the same cell which a possible world $\omega \in \mathcal{P}_i$ belongs to, is possible to happen as well, if ω happens.

An event is any subset $E \subset \Omega$. Given any event $E \subset \Omega$, assume $\omega \in \Omega$ is the true (actual) world. If $\omega \in E$, then E is said *to happen* or E is said to be *true*. If $\Pi_i(\omega) \subset E$, then we say that i *knows* E. If, $\Pi_i(\omega) \subset E$, for any $\omega \in E$, we say that E is *self-evident*. *Exempli gratia*, let $\Omega = \{\omega_1, \omega_2, \omega_3, \omega_4\}$ and $\mathcal{P}_i = \{\{\omega_1, \omega_2\}, \{\omega_3, \omega_4\}\}$. Suppose that the true world is ω_2 and consider the event $E = \{\omega_1, \omega_2, \omega_3\}$. Then E happens. Since $\Pi_i(\omega_2) \subset E$, then i knows E. However, $\omega_3 \in E$ and $\Pi_i(\omega_3) \not\subset E$, hence E is not self-evident.

The *knowledge operator* for individual i is given by $K_i(E) = \{\omega \in \Omega$ *such that* $\Pi_i(\omega) \subset E\}$. Notice that an event E is self-evident if, and only if, $K_i(E) = E$. Kripke built a system of modal logic based on five axioms about the knowledge operator. This is known as Kripke's **S5** system. When an individual i does not know E, we write $\sim K_i(E)$. Operator "$\sim$" denotes logical negation.

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necessary, or impossible, or possible, or contingent, so another proposition is true, or false, known or unknown, spoken or written, conceived or believed, doxastic or doubted, and so on". [*Alia divisio propositionis est quod quaedam est propositio de inesse et quaedam de modo vel modalis. Propositio modalis est illa qua ponitur modus. Propositio de inesse est illa quae est sine modo. (...) Circa quod est sciendum quod propositio dicitur modalis propter modum additum in propositione. Sed non quicumque modus sufficit ad faciendum propositionem modalem, sed oportet quod sit modus paredicabilis de tota propositione, et ideo proprie dicitur modus propositionis tamquam verificabilis de ipsamet propositione. Et a tali modo vel adverbio talis praedicabilis, si adverbium habeat, vel verbo dicitur propositio modalis. Sed tales modi sunt plures quam quatuor praediciti: nam sicut propositio alia est necessaria, alia impossibilis, alia possibilis, alia contingens, ita alia propositio est vera, alia falsa, alia scita, alia ignota, alia prolata, alia scripta, alia concepta, alia credita, alia opinata, alia dubitata, et sic de aliis.*] - *Summa Logicae*, II.1. All translations in this essay are mine.

[4] When □ refers to "it is imperative that" and ◊ to "it is allowed that", we have the Deontic Logic. *If* □ denotes "after every change" and ◊ denotes "after some change", we have the Dynamic Logic. In the Temporal Logic, □p is translated as "in all the future times, proposition p is true", and ◊p as "in some future time, proposition p is true". Doxastic Logic deals with beliefs, and the box is replaced by the letter B, in reference to the word *belief*.

Kripke's S5 system: Given the totality of possible worlds Ω, for any pair of events $A, B \subset \Omega$, the following holds:

(1) $K_i(\Omega) = \Omega$

(2) $K_i(A) \cap K_i(B) = K_i(A \cap B)$

(3) $K_i(A) \subset A$

(4) $K_i(K_i(A)) = K_i(A)$

(5) $\sim K_i(A) = K_i(\sim K_i(A))$

Axiom (1) says that it is self-evident that the conceived totality of worlds indeed contains all possible worlds. This axiom seems plausible when we throw a dice or a coin, not when we envisage the possible consequences of a moral action. In the dice gamble, $\Omega = \{1,2,3,4,5,6\}$, but when a man wears the ring of Gyges and gets the power of invisibility, what are the possible consequences? You might say that the man can get rich and powerful without hurting anyone, or that he can get all that but will hurt somebody, or that in either case he will suffer in the Tartarus or that nothing will happen in the afterlife. All these considerations may comprise the totality of worlds. However, after crossing the river Styx and arriving at the Hades, which he then (and only then) finds out to exist, he also finds out that he will have to drink from the river Lethe of oblivion and will have to reincarnate in order to recompose his morality and rediscover the ἀλήθεια, something he did not think about and about whose not-having-thought-about, he had not thought about either.

As Binmore (2011, chapters 7-8) argues in his explanations on Savage's expected utility theory, the comprehensive overview of the totality is plausible in a small universe. It requires that the individual carefully considers every logical implications from the data. Philosophers use the expression "*all things considered*" to refer to this ideia.

We must not overstress the meaning of the forementioned regards. It is true that there is a sharp distinction between the universe of a gamble and the universe of quotidian life decisions. In the cassino, the totality of any discourse[5], a gamble, for instance, is easily known and commonly agreed upon. In the realm of human life, this is not so. However, knowledge of totality does not mean totality in the absolute sense, it means the totality of the relevant universe of discourse. If we play cards, then the discourse is given by the rules of the game, by the requirement that we all know about it and also know how to talk within the rules of this game. If we are Mathematicians debating about the Markov property of Brownian motions in a classroom, then the universe of discourse is, say, given by a common knowledge about stochastic calculus or at least martingale theory. What happens outside it is totally irrelevant. If we are economists discussing about a particular Cournot-oligopoly phenomenon, then S5 is a natural assumption, provided we all know the Coutnot oligopoly model. This is because we all know the language of the model. In this context, we are all homines cartesiani.

Axiom (2) says that knowing A and knowing B is equivalent to knowing both A and B, that is, $A \cap B$. This axiom is harmless. According to axiom (3), if the individual knows the event A, then A is true. In other words, false knowledge is not knowledge. Axiom (4) says that, if the individual knows A, then he knows that he knows A. It is called *thesis of positive introspection*. Finally, according to axiom (5), if the individual

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[5] I cannot find any word better than *discourse* to describe the environment to which axiom (1) is assumed to apply. By discourse I mean the general Greek term λόγος. In our lives there are many λόγοι, so totality is definitely not what Hegel would have in mind. This advice of precaution has to be taken seriously.

does not know *A*, then he knows that he does not know *A*.[6] It rules away all those surprises about which we did not know anything beforehand and about whose not-knowing-about, we know nothing.[7]

The S5 system is the basis of the scientific discourse. When we throw a dice, we do not know which face will come up, but we do know that the face can be any integer from 1 to 6. This is why we can set the odds. I refer to Binmore (2011, chapters 7 and 8), for a thoroughly discussion about S5 in what he calls small and large universe[8].

Due to the amount of intellectual capacity required by S5, an individual who satisfies S5 is said to have strong logic omniscience. He knows all the tautologies and theses of epistemic logic, he has immediate access to every consequence of his knowledge, all the theorems that constitutes the logical structure of his knowledge, and so on [Girle (2000), p. 158]. There are three degrees of omniscience: logical[9], deductive, and factual. Strong logical omniscience is the more demanding and includes all the other degrees. An individual with strong logical omniscience is called cartesian individual. We will call him *homo cartesianus*. The homo cartesianus not only is rational[10], he is able to anticipate all the consequences of his actions. He may face risks, but not uncertainty in the Knightian sense.

When criticisms are thown over the rational and optimizer individual of the microeconomic formal models, they are said to be impinged upon the homo oeconomicus. I claim this to be wrong. They are rather thrown over the construct of homo cartesianus, not the homo oeconomicus.

3. Homo oeconomicus

When in 1889 Maffeo Pantaleoni, in his *Principii di Economia Pura*, backed up by Spencer's ideas, used the term homo oeconomicus, he wanted it to designate that which he considered to be the very foundation of pure economics: hedonism as a principle of human behavior. To him, hedonistic selfishness induces the homo oeconomicus to behave according to the law of least effort. Even Pareto disliked Pantaleoni's words, saying that people do not know how to calculate the final degree of ophelimity. However, the idea of final degree of ophelimity was still a vague one, which explains much of Pareto's suspicion about it. In a letter to Pantaleoni, in October 3rd, 1891, Pareto wrote:

> *I think that, in what concerns to Mathematics, we all agree. I do not deny that there are problems too complex not to be treated mathematically. I admit that the graphical method is quite often the simplest and most elegant means to solve some problems. I surely do not oppose myself to the mathematical*

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[6] Axiom (5) is a variant of the so called *Platonic Principle*, derived from the famous passage in Plato's *Apologia* 21d: ἔοικα γοῦν τούτου γε σμικρῷ τινι αὐτῷ τούτῳ σοφώτερος εἶναι, ὅτι ἃ μὴ οἶδα οὐδὲ οἴομαι εἰδέναι. "I seem, then, to be be a little bit wiser than this [man] in everything, since about whatever I do not know, I do not think to know as well."

[7] Axiom (5) implies axiom (4).

[8] Actually, Binmore talks about small and large worlds. His concept of "world" is what I call here universe. I restrict the word "world" to the elements of the universe, in a set-theoretical sense, in accordance with the language of modern Metaphysics and modal Logic.

[9] Logical omniscience is still subdivided into strong and weak logical omniscience.

[10] By rationality I mean completeness and transitivity of preferences. It is a very simple concept. The mess in the debate about *homo oeconomicus* is so big, that rationality became an equivocal term, in the aristotelic sense, and to not a few rationality and cartesianity are wrongly taken to be homonimous, also in the aristotelic sense.

political economy and I believe that sooner or later mathematics will be the foundation of economic Science. We also perfectly agree that the question about the usefulness of mathematics in political economy is different from the question about the validity of the theory of final degree of ophelimity.

Pareto's suspicion should not be taken out of context. The decades around the turn of the century were very confuse, for concepts were still very new. Whoever reads chapter 2 of Whicksteed's *The Common Sense of Political Economy*, published in 1910, about two decades later from Pareto's letter, will certainly get a glimpse of what was going on in Pareto's mind at the time. Those many pages of discursive marginal calculations of consumption goods, precise to the tiniest fractions, one after another, however immense Whicksteed's contribution to marginalism and neoclasical economics, are among the most tedious pages in the whole Economics literature, hence no wonder the ability to go through all those calculations was clearly not something to be impinged on any common man's mind who by chance stopped by to purchase a gazette at the kiosk.

Lionel Robbins, in *An Essay on the Nature and Significance of Economic Science*, 1932, gets back to Whicksteed and develops his ideas. When he talks about rationality, specially in chapter 4, he takes his side, provided it be taken in the more general sense of *consistency*, which is how he names *transitivity*, but he warns the reader not to extrapolate its limits and not to pressuppose perfect knowledge of consequences. In a sense, Robbins was well aware of the wrong turns taken in the long debate about homo oeconomicus and called for caution. Indeed, perfect knowledge of consequences is essential to homo cartesianus, but only accidental to homo oeconomicus. According to Robbins, if rationality is to have any legitimacy in Economics, it has to be linked to *purpose*. The fundamental concept of Economics is, to Robbins, the relative marginal valuation, which is exactly what Armen Alchian and William Allen (1964 and 1983) rely on in order to set their postulates of the economic agent.

My purpose here is to redelineate the debate about homo oeconomicus towards a less nebulous field and to make a sharp distinction between homo oeconomicus and homo cartesianus, on one hand, and mathematical formal model and the microeconomic modus cogitandi on the other. I propose, then, to adopt Alchian's postulates of Economics as the very definition of homo oeconomicus. This is in sharp contrast with the usual view about homo oeconomicus as the fictitious agent who consciously maximize a utility function he carries on in his mind and have perfect knowledge about parameters and variables.

Before introducing their postulates, Alchian and Allen make two important remarks. The individual is the only unit of decision. Groups are not (never were and will never be) decision-takers. What is meant by a collective decision is nothing but a voting algorithm that aggregates individual orderings into a social ordering. This does not imply that individual decisions are unaffected by laws, history, social and cultural patterns, that is, in a general sense, by institutions[11]. As Robbins (1932, p. 87) puts it, "[i]n the theory of simple exchange, for instance, we assume that Primus is free to acquire corn from Secundus by offering him wine. But we do not necessarily assume that he is free to acquire corn by killing him or otherwise doing him violence. We assume a legal framework for economic activity". The second remark refers to

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[11] By *institution* I mean anything to which behavioral prescription all the individuals agree to in a Nash equilibrium. *Exempli gratia*, an institution can be a law sufficiently enforced to make it privately optimal for all the individuals to abide to it in equilibrium, it can even be a social norm in the Hayekian sense.

uncertainty. No individual can perfectly forsee the future. This does not imply that uncertainty is not probabilizable. Economics is not about predicting the future, it is about recognizing behavioral patterns under specific circumstances that help us understand what the logical outcomes of certain actions are.

Principia actionis: The postulates of homo oeconomicus are:
(1) each individual seeks a multitude of goods;
(2) for each individual, some goods are scarce;
(3) each individual is willing to sacrifice some of any good or goods to obtain more of other good or goods;
(4) the more the individual has of a good, the lower his personal valuation of the marginal unit of that good;
(5) not all individuals have identical preference patterns.

This is the minimum set of principia[12] necessary to support the whole building of Economics, as set by Alchian and Allen (1964). The important feature of these principia is their resilience to negation within the realm of economic phenomena.

To make things familiar, let us borrow Primus from Robbins and consider an individual called Primus. A good is anything Primus wishes. If Primus is thirsty and wants water, then water is a good.

What is the meanining of negating postulate (1)? It means that for somebody, say Primus again, there is only one good, say apple, that he can possibly desire. To Primus, getting an apple requires absolutely no sacrifice. In other words, Primus not only would desire apples, perhaps as a manna or a gift from Secundus, he also would only desire apples and nothing else, not even leasure or honey. If postulate (1) is denied, there would be no economic problem to solve[13], because Primus would not engage into any economic transaction with Secundus and, even if he did, he would be unable to accrue a marginal valuation to any unit of apple. Indeed, by definition, the marginal value of an extra unit of a good is given by the amount of other good or goods Primus is willing to sacrifice in exchange for that extra unit. An argument can be raised against this reasoning. We might say that Primus *owns* resources in the form of other goods, say, pears, which he could use to engage into transaction with Secundus. Assume this is true. Let us say Primus owns 3 pears and 1 apple and that Secundus owns 2 apples and no pear. Secundus satisfies postulate (1), Primus does not. Since Primus only desires apples, then pears are not goods for him. He is not willing to sacrifice his apple for any extra peer, which means that Primus accrues zero marginal value to his pears. Secundus, on the other hand, values both apples and pears. If Secundus asks Primus his pears in exchange for an apple he is willing to give in, Primus would give them all in for that extra apple, so he would end up with 2 apples and no pears, while Secundus would end up with 2 pears and 1 apple. No further transaction would be possible. Indeed, Secundus would not give in her last apple for extra pears, because Primus would have no pear to offer and, even if had, Secundus would not be willing to give in his only apple, because, to him, apple *is* a good. It should be clear that Primus would not ever consider giving in only one pear to Secundus, so he could later use the remaining pear for further

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[12] Every science starts from principles. In Logic, for instance, the principles of *non-contradictio* and the principle of *tertium non datur* are indeed principles, in that they are all the conditions for any proof and that their negation leads to absurdity. This kind of confutation is quite common in the history of Philosophy [Berti (2012), ch. 5.2]. Requiring empirical or analytical proofs of *principia* is nonsensical.
[13] Some dynamic macroeconomic models assume the existence of an only good, but a good is also characterized by the period at which is consumed, so the space of goods is not unidimensional.

exchanges. This would mean that Primus not only desires apples, but that he also desires an extra apple in the future, which is another good. If there were only one good, Primus would not engage into saving either, nor into intertemporal decisions. It can still be argued that it is Secundus who would think intertemporally and, coming back to the initial distribution of goods, could ask Primus only 1 pear in exchange for 1 apple, so both could engage into further exchange. However, even in this case, when Primus's resources are gone, Primus will eventually cease to exchange. It should also be clear that Primus would not produce pears to exchange them for apples. Indeed, he would have to sacrifice inputs, say land, time and pears, in order to produce more pears. How could he ever decide on how much to sacrifice and produce, if he is unable to accrue any marginal value to any of these inputs? The only way to throw postulate (1) away, is to throw away the whole economic theory with it.

The negation of postulate (2) means that for somebody, say Primus, no good is scarce. A good is scarce whenever ones seeks it but there is not enough available. If Primus violated postulate (2), he could desire anything and would have not to sacrifice anything for whatever he desires. Not even in the Garden of Eden would have Primus such an abundance. Just recall the prohibition to eat from the tree of knowledge. Again in this case Primus would not engage into any transaction, because he can get anything for free and abundantly. He would be irrelevant to Economics. Notice that postulate (2) does not require that every good be scarce to everybody. Only some goods should be scarce, because one needs just this to justify economic action.

According to postulate (3), each individual is willing to sacrifice some of any good or goods to obtain more of other good or goods. What does it mean to negate it? It means that somebody, say Primus, is not willing to sacrifice any of his goods to obtain an extra unit of another good. This implies that Primus will not engage into any transaction (he will be autarkic) and once again he will be irrelevant to the economy. Postulate (3) is natural in the sense that any human being is willing to sacrifice something to get what he desires.

By postulate (4), the more Primus has of a good, the lower his personal valuation of the marginal unit of that good. What does its negation mean? Let us assume that Primus desires two goods, X and Y, and consider two different situations. In situation A, Primus already consumes some regular monthly quantum of X and certain quantum of Y. Given these quanta, if Primus wants to acquire an extra (incremental) unit ΔX of good X, then he would accept to forsake some quantum ΔY of good Y. Alchian and Allen call the rate $|\Delta Y|/\Delta X$ the *subjective consumption-substitution ratio*[14]. This willingness to substitute reflects the degree of abundance or scarcity of Y with respect to X. Scarcity is not an absolute term. No good is scarce in the absolute sense, only relatively. Apples may be scarce relative to pear, but may be abundant with respect to honey. Situation B goes a step further and Primus reduces his amount of Y in favor of an extra unit of X, so the degree of scarcity of Y with respect to X gets higher. Since Primus considers both X and Y goods, that is, he desires more of both, it follows that the more he reduces his available amount of Y in favor of bigger amounts of X, then the less he will be willing to sacrifice Y in favor of X. Assume this is not so. For the first extra unit of X, Primus would be willing to sacrifice a certain amount of Y, which will make Y scarcer than before with respect to X. However, for the second extra unit of X, Primus would be willing to sacrifice an even bigger amount of Y than in the previous

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[14] Do not confound it with the marginal rate of substitution, which is the ratio of marginal utilities. In *Exchange and Production*, Alchian and Allen give the subjective consumption-substitution ratio another name: *subjective marginal use value*.

step. This implies that Y is not actually a good but a bad, in the sense that Primus does not care about Y becoming *paulatim* scarcer with respect to X.[15]

By postulate (5), people's preference patterns differ. By different patterns it is meant different marginal consumption-substitution ratios at the same basket, whatever the basket. If all individuals were identical in this regard, there would be no possibility of arbitrage, hence no exchange, no matter what their initial endowments were.

In *Exchange and production* (1983), Alchian and Allen add a sixth postulate: (6) in hoping to improve their situation, people try to find opportunities and, among the opportunities they find, they choose consistently in the following sense: if alternative A is found to be preferred to B and if B is found to be preferred to C, then, when presented to the choice between A and C, they will choose A. They refer to postulate (6) by saying that "people are innovative but consistent" [Alchian & Allen (1983), p. 15]. By consistency they clearly mean transitivity of the subjective preference order. It seems they borrowed this term from Lionel Robbins, who talked of consistent choice to refer to rationality. When preferences are transitive (and complete), the individual is able to rank alternatives, hence to decide. To Robbins, rationality means complete awareness of rejected alternatives. So postulate (6) is just another way to say that decision-taker individuals are fully aware of their best forsaken alternative. He claims that it is just at this point that Economics acquires its practical significance. "It makes it possible for us to select a system of ends which are mutually consistent with each other" [Robbins (1932), p. 136].

Two important remarks about rationality should be made now. A common line of attack on rationality is based on empirical observations of irrationality, say intransitivity. Against this line of attack, I argue that no matter how many times irrationality is observed, individuals cannot be perennially irrational. In other words, irrationality, when it happens, must be accidental, not essential. Otherwise, we would not have survived history. A second line of attack comes from an unjustified identification of homo oeconomicus with homo cartesianus. Against it, I will argue that rationality does not imply perfect knowledge, provided by rationality we mean transitivity of preferences.

Suppose Primus faces three courses of action or alternatives and that he is irrational, that is, his ends are mutually inconsistent. The alternatives are apple, pear and orange. Denote by $\succ$ his preference order. What criticizers do not take into account is that, from the economic point of view, errors of decisions bring about losses of available resources, otherwise errors would not be considered to be bad, hence not errors after all, which is a *contradictio in terminis*. When they do recognize losses, they barely give any thought to what it means in terms of restructuring of preferences.

To fit this remark into our example, let us assume that Primus's available resources are given by 10 units of money. Of course it does not matter whether his resources are expressed in terms of money or in terms of physical goods. They could be the area where he gathers fruits, the fountain where he drinks water. The bottom line is that, should Primus make a mistake, resources will be lost. If he realizes he made a mistake, the feeling of pain caused by realizing the error is translated into the understanding of its causal relation with the loss of resources. If this were not so,

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[15] Suppose Primus owns three goods, X, Y and Z. Given a basket of these goods, what is Primus's marginal valuation of X? It is the amount of Y and Z he is willing to sacrifice for the extra unit of X. We can express this joint variation as $\Delta(Y,Z)$, which, to a first order approximation, is a linear combination of the single marginal variations, $(\Delta Y, \Delta Z)$, hence we can make sense of partial marginal consumption-substitution ratios $|\Delta Y|/\Delta X$ and $|\Delta Z|/\Delta X$. We only have to ask Primus how much of Y, and only Y, would he sacrifice for the extra unit of X, then repeat the question by referring it to Z.

mistakes would never be taken as painful. Here Secundus will play the role of mother Nature with all her wisdom. We can think of Nature as the market. This is the way Secundus will give Primus true knowledge. In addition to his initial $10, Primus also is endowed with one unit of apple, one unit of pear, and one unit of orange. Assume that Primus ranks apple, pear and orange in the following way: apple > pear > orange > apple.

Secundus offers him an apple in exchange for one pear and $1. Since Primus strictly perfers apple to pear, we may assume that $1 is a small enough amount of money for Primus to think he is still getting better off from this transaction, so he gives in his pear to Secundus for an apple and loses $1. Assume this happens likewise for the other pairs of goods as well. He has now one pear less, one apple more, and $1 less. Secundus now offers him a pear in exchange for an orange and $1. Given his preferences, Primus agrees to it. He gets back his initial amount of pears, loses one orange and loses $1 more. Then Secundus offers him an orange in exchange for an apple and $1. He again agrees to it. He gets back his initial amount of oranges and loses that first extra apple. Besides, he loses $1 once more. In the end, after three rounds of transactions with Secundus, he keeps the same initial amounts of goods, but he is $3 poorer. Secundus can proceed this way until Primus loses all his money. When he realizes it, he can sell his goods to get money. However, if Primus does not learn to correct his intransitivity, everything will eventually happen again and again until he loses all resources, gets unable to trade and finally dies. Once again, criticizers overlook the full consequences of irrationality because they only focus on the preference structure and disregard the effect of irrationality on total resources and consequent reestructuring of preferences, once the losses caused by irrationality are thought upon. It does not help to argue, by a game-theoretical argument, that Secundus may stop trading with Primus on the ground that, in anticipating Primus's death, he will prefer to wait for Primus's recovery, so as to start it all over again, provided both are patient enough. The only way for Primus to engage in an infinite flow of transactions is to become rational, which proves instead the first argument. If the horizon is finite, we are back to the previous sequence of fatal trades.

The overall lesson from this mental experiment is that Primus cannot be irrational forever. If he is, he will eventually die. This evolutionary argument explains after all why we, modern humans, are still on Earth and why we are economically better off today than the Neanderthals ever were. Primus can only survive Nature, or market for that matter, if he accepts the fact that Secundus is trying to give him knowledge about his irrationality, in the hope that he will correct his intransitive preferences before it is too late. People can be irrational sometimes, due perhaps to deficient information, but most of the time, at least for the relevant crossroads in the economic realm, people will be rational. In the evolutionary process of a market economy, the *homo oeconomicus* cannot consistently be irrational, otherwise he will be excluded from the market. Sooner or later, the irrational agent must correct his preference structure and start to behave rationally to survive. It is not necessary to get into the details of how this inner *enlightment* comes to be. It suffices to say that the pain caused by losses of resources - however wrongly taken to be immune to mistakes - is the trigger to think about one's irrationality. Once Primus accepts the knowledge Secundus is giving him, he will become rational and progress. The significance of transitivity is that it allows Primus to rank alternatives in a consistent manner. In this way, when he chooses his most preferred course of action, he is fully aware of the alternatives forsaken. Without this awareness, it would be impossible for Primus to accrue the marginal valuation of his action. If we think of transitivity in its mathematical aspect only, we miss its real significance for Economics, the awareness of the alternatives forsaken. If we understand this, the nonsense of those who claim that human beings are basically irrational becomes patent.

Another relevant aspect of rationality, defined as transitiveness or consistency of choices, is that rationality does not imply full knowledge of possible choices.

Suppose Primus has the strict ordering R = {(x,y),(y,z),(x,z),(w,y),(w,z)} over the set of alternatives X={x,y,z,w}. The element (x,y) ∈ X means that alternative x is strictly preferred to y. It can be written as x ≻ y. The ordering R is an array of the binary choices made by Primus. Then:

$$x \succ y \quad y \succ z \quad x \succ z \quad w \succ y \quad w \succ z$$

The ordering R is clearly transitive. Indeed, Primus knows that, if confronted with the choice between x and y, he prefers x. He also knows that, if confronted with the choice between y and z, he prefers y. Since he also knows that he prefers x over z, when confronted with the choice between x and z, then R is transitive. Therefore, we can write x ≻ y ≻ z. This is the only array of alternatives that fits the requirements for the verification of transitivity. Notice that I did not simply say that Primus prefers x to y, though this is how students usually learn these things. I said that he knows that he prefers x over y when facing the choice between alternatives x and y. This is how x ≻ y should be understood and this is extremely important.

Primus is then fully aware of the best alternative forsaken when he chooses x, *within the restricted set of choices he is aware of*. The value he accrues to y is his opportunity cost of choosing x. The presence of z in the chain x ≻ y ≻ z is not irrelevant. Indeed, remember the cyclic preference structure we discussed above. There we also had x ≻ y, but this is not sufficient to allow us to say that Primus is aware of his opportunity cost, because, through what he knows about his choice between z and either of the other alternatives, Primus also knows that y ≻ x. The only case in which any third alternative is irrelevant for choice is the case X = {x,y} and R = {(x,y)}.

Something has to be said about w. Primus knows that w is an alternative. However, he does not know that he does not know that the choice between w and x is possible. If he at least knew that he did not know, he would have thought about it and would then realize he had to come to a decision[16] between x and w, in which case he would complete his ordering R by adding either w ≻ x or x ≻ w. Since R does not say anything about the choice between w and x, then R is not complete. Epistemically, the meaning of the mathematical definition of completeness is that Primus simply does not satisfy Kripke's axiom (5) of the S5 system. Primus is not a homo cartesianus. He does not have perfect knowledge about the possible choices, even though he has perfect knowledge about the possible alternatives. Roughly speaking, Primus has never thought the he would eventually face the choice between w and x, even though he knew about w. This is not uncommon in real life. Primus knows that the government can decide to levy unbearable taxes on his product, so high that he and everybody else would even be expelled from the market. The price of his product oscilates around, say, $40, with mild dispersion. Excise taxes in general have oscilate from $1 to about $20 per unit. So far so good. Primus also knows that, if things go really crazy (say, a socialist revolution), the government could levy a $1,000 excise tax on his product, something so absurd that Primus did not even think about what to do in such situation. To him, such a choice is not possible, even though he is aware of the alternatives. Knowledge about alternatives are one thing, knowledge about choices is another. If reality eventually throw the choice between w and w onto Primus's face, then he will have to modify his ordering to include the choice between them.

[16] We can use here a variation of the same evolutionary argument used before.

The lesson to be drawn from this second remark is that rationality does not imply perfect knowledge, because transitivity does not require completeness of preference orderings. It follows that homo oeconomicus and homo cartesianus are not identical. Economic Theory deals with the former, not with the later.

I took this long turn on postulate (6) only to highlight the relevance of postulates (1) through (5), which are the ones I suggest to be the correct way to characterize the homo oeconomicus, the true persona in the stage of microeconomic reasoning, and not to confound it with the homo cartesianus, which is the persona of formal mathematical microeconomic model. The homo oeconomicus is not supposed to be rational, as Robbins clearly reminded us. Indeed, Economics "makes no pretence, as has been alleged so often, that action is necessarily rational in the sense that ends pursued are not mutually inconsistent" [Robbins (1932), pp. 140-141]. As Alchian and Allen (1983, p. 40) suggest, assevering that people "act in accordance with some fundamental propositions" is not the same thing as saying that "people refer to those propositions for guidance in choosing their behavior". The former statement contains no implications about thought processes. People, sicut homo oeconimicus, can be as unaware of the principia actionis as they are about the rules of sexual attraction that govern their sexual lives. Not only they do not need to think about it, they do not even know that they do not think about it neither. The later quotattion, on the contrary, suggests that people make mental calculations. This is true of homo cartesianus, not of homo oeconomicus. Homo cartesianus is the one with perfect knowledge about consequences, impecable rationality, and computer-like mind, not homo oeconomicus. Nevertheless, it does not matter, for the validity of theoretical economic propositions, which one we work with.

4. Applying the postulates

Let us now see illustrations of how to derive theoretical propositions (generalizations, in the sense of Robbins) of the homo cartesianus from the principia actionis of the homo oeconomicus. We start with the axiom of convexity of preferences (or quasi-concavity of the utility function).

Given two goods, X and Y, desired by Primus, consider three bundles A, B and C, and assume that Primus is indifferent between B and C:
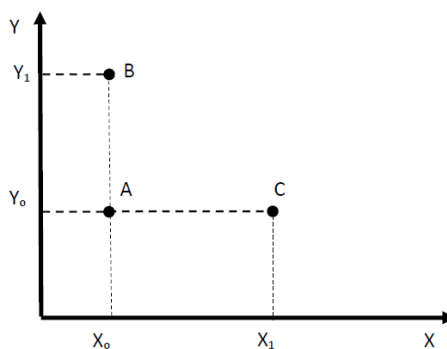
In terms of preference relations, clearly, by postulates (1) and (2), $B \succ A$, since bundle B contains more of one good than A, for the same quantity of the other. Anagously, $C \succ A$. Given B and C, which are assumed to be indifferent, that is, $B \sim C$, consider the choice of getting an extra amount ΔX of good X in bundle B as compared to the same increment in bundle C. By postulate (3), in both bundles, Primus is willing

to forsake some amount of good Y for the same incremental quantum of good X. By postulate (4), since in the bundle C good Y is scarcer with respect to good X than it is in B, Primus will be willing to forsake a smaller quantum $|\Delta Y|_C$ of good Y at C than the quantum $|\Delta Y|_B$ of good Y at B. Therefore, the following configuration of the indifference curve holds:
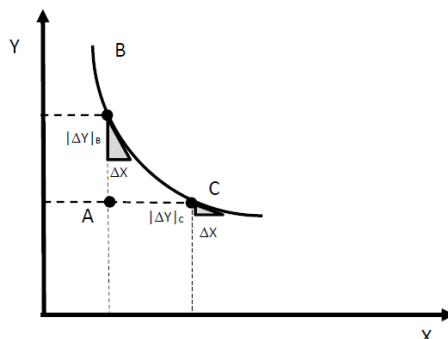
If his choice is mediated by a price system, and if the relative prices of goods X and Y are given by P_x/P_y, then as long as $|\Delta Y|/\Delta X$ does not equal P_x/P_y, Primus will find in his advantage to pursue further exchanges. If the money value of the chosen bundle does not exceed Primus' income for the time of consumption, then axioms (1), (2) and (5) still allow for further trades. Therefore, the optimal bundle (X^*,Y^*) (or Marshallian demand) is characterized by two equations: $|\Delta Y|/\Delta X = P_x/P_y$ and $P_xX^*+P_yY^* = r$, where r > 0 is his income and $|\Delta Y|/\Delta X$ is evaluated at (X^*,Y^*). There is no need to explain this any further, since it is the most basic kind of reasoning in the education of any economist.

The point to be born in mind resides elsewhere. If we start not from the *principia actionis* of the *homo oeconomicus*, but from the axioms of the utility-maximization model, which I refer as the model of *homo cartesianus*, then we get the well-known condition that the marginal rate of substitution, *MRS*, be equal to relative prices, $|MRS| = P_x/P_y$, where $MRS = \dfrac{\partial U/\partial X}{\partial U/\partial Y}$ and U(X,Y) is a utility function. Given the indifference level, say $\overline{u}$, and reasonable differentiability conditions, the implicit function theorem assures that $\dfrac{dY}{dX} = -\dfrac{\partial U/\partial X}{\partial U/\partial Y}$. Given the budgetary restriction, at any interior solution (X^*,Y^*) we must have $P_xX^*+P_yY^* = r$ and:

$$\text{homo cartesianus}$$
$$\Uparrow$$
$$\left|\frac{dY}{dX}\right| = \frac{P_x}{P_y} = MRS$$
$$\Downarrow$$
$$\text{homo oeconomius}$$

evaluated, of course, at (X^*,Y^*).

The utility-maximizing approach of the homo cartesianus is nothing more than an alternative formal framework to derive the same theoretical propositions already derived from the principia actionis of homo oeconomicus. However, nowhere Economic Theory presupposes that Primus is a homo cartesianus. Besides, the economic concept

truly relevant for analysis is not the marginal rate of substitution $\frac{\partial U/\partial X}{\partial U/\partial Y}$, but the ratio of consumption substitution, $\frac{dY}{dX} \approx \frac{\Delta Y}{\Delta X}$, if we express it in infinitesimal form.

From the point of view of the criticizer who only sees homo cartesianus as the very foundation of microeconomic theory and who is unaware of the forementioned principia actionis of homo oeconomicus, the axiom of convexity of preferences may seem to be an arbitrary mathematical imposition on economic behavior. Incapable of understanding that the axiom of convexity is just a formal counterpart of the true fundamental principles of economic action, and whose negation, as we saw, contradicts scarcity of means to conflicting ends as one of the most elementary facts of life, the criticizer misdirects his attacks on neoclassical Economics. Nothing more far from truth than the accusation that *homo oeconomicus* is a pleasure computing machine, an automaton with a utility function in his head. Robbins (1932, p. 87) unburdens his heart by writing about the "absurdity of the belief that the world contemplated by the economist is peopled only by egoists or pleasure machines (…)", and then reminds us of the basics: "that the fundamental concept of economic analysis is the idea of scales of relative valuations". At the time Robbins wrote his magnificent essay, the term *homo oeconomicus* was already attached to the idea of man as a pleasure computing machine, rationality was identified with perfect knowledge and computatroid mind. He then says, "[i]f it were generally realized that Economic Man is only an expository device (..), it is improbable that he would be such a universal bogey (…). And it is for this reason that he is so furiously attacked (…). Unfortunatley this belief rests upon complete misapprehension" (Robbins, 1932, p. 90). If we could give Robbins a better term for the fictitious character behind the complete misapprehension he talked about, that would be *homo cartesianus*.

One thing is the modus cogitandi of the microeconomist. It is based on the ability to use the principia actionis to study economic phenomena. Another thing is the formal mathematical model. In this alternative framework, the agent maximizes a utility function under budget constraints, with whatever mathematical properties the functions and sets involved might have.
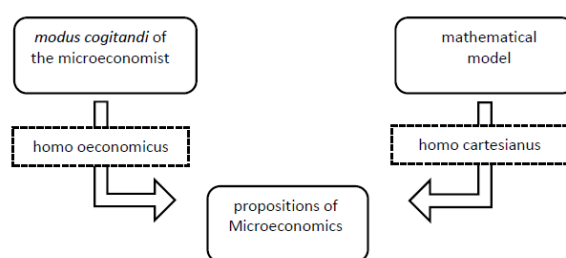
In the formal mathematical model, the analytical results derived from the modus cogitandi of the microeconomist are equivalently derived by means of an auxiliary language built on optimization. However, none of the elements of the mathematical model are imposed upon the common man's mind.

The second example, Lindahl's taxes, is of intermediary level. It is well known that the optimality condition for the provision of public goods is given by the equality between social marginal cost of production of the public good with the algebraic sum of marginal rates of substitution (between private and public good) among consumers. Lindahl's taxes fit this condition too. This sum is how social marginal benefit expresses

itself in an economy with non-rival and non-excludent goods (or public goods). The formula comes from the basic mathematical model of public goods provision, as we can see in any textbook. Think of it as derived by the powerful mind of homo cartesianus.

Consider again Primus and Secundus. The government wants to produce the first unit of public good. Its marginal social cost is $90. In other words, the value accrued by society to the resources displaced from the economy to the production of this first unit is $90. Primus has to pay for this unit, he has to forsake the consumption of private goods in order to get that unit of the public good. Assume he is willing to forsake $60 of private goods. Since his consumption does not diminish the unit available, Secundus is also willing to sacrifice consumption of private goods for that same unit. Say he is willing to forsake $50. The social marginal benefit is $110, which exceeds the social marginal cost by $20, so it is worth producing it.

Is it worth to produce the second unit? Suppose the social marginal cost of the second unit is $100. This is the value society accrues to the resources displaced from the economy to the production of the second unit. This value is higher than before because the displaced resources became scarcer relatively to other resources from the point of view of the owners of these resources, so by postulates (1), (2), (3) and (4), their opportunity costs are higher. This is why, under the absence of externalities, the array of marginal costs is nothing but the specular reflection of the marginal valuations of the resources from the point of view of their private owners. For the second unit, Primus is willing to forsake $55, which is less than in the first step. Again, this follows from the postulates. Secundus, say, is willing to sacrifice $48. Then social marginal benefit is $103, which exceeds social marginal cost by $3, hence the second unit is worth producing.

Regarding the third unit, suppose social marginal cost is $120, that Primus is willing to pay $49 and Secundus $45. Social marginal benefit is $94, less than social marginal cost, hence production stops at the second unit. Lindahl's taxes are $49 and $45, to a first order approximation.

If goods were arbitrarily divisible, then, from the principia actionis, the proposition follows. The optimality condition for the provision of public goods, within the framework of the formal model, is that the sum of marginal rates of substitution equals social marginal cost. It was not necessary to get the result *ex homine cartesiano* only. The expression in terms of marginal rates of substitution belongs to the realm of homo cartesianus. To the *homo oeconomicus*, the marginal consumption-substitution rate suffices.

Once the economist knows how to master the principia actionis, he can obviously forsee the microeconomic proposition that will result from the model.

Consider, for instance, a formal model in which it is assumed a *continuum* [0,1] of consumers distributed according to the probability distribution μ satisfying $d\mu(i) = f(i)d\lambda(i)$, in which λ is the Lebesgue measure on [0,1] and *f* is a real-valued function assumed to be continuous everywhere. This means that the measure μ is absolutely continuous with respect to the Lebesgue measure λ and that *f* is the corresponding Radon-Nikodym derivative, $f = \frac{d\mu}{d\lambda}$.

For each unit of the public good, a mass λ(*di*) (which is the antient – and more intuitive – notation for $d\lambda(i)$) of consumers (around some particular *i*, with obvious abuse of notation, but no loss of generality) consumes the quantum *dx* of the public good with probability π(*i,dx*). One can argue that it is an impure public good, since the unit consumed is not homogeneous among consumers. Perhaps there are transaction costs

inherent to the process of allocation of each unit of the public good to consumers. Assume that the price of private good is \$1 and that there are two goods only, the private one and the impure public good.

At the socially optimal quantity x of public good, social marginal benefit equals social marginal cost, $SB'(x) = SC'(x)$.[17] The social marginal benefit is given by the sum total of money taxes that consumers are willing to pay in order to get that marginal (and last) unit, as we already deduced from the principia actionis.

A mass $\mu(i)$ of consumers around i is willing to sacrifice the amount $\frac{dY}{dX} \approx \frac{\Delta Y}{\Delta X}$ of consumption of the private good in order to get the amount $\pi(i,dx)$ of the last marginal unit of the public good, which in modern notation is written as $d\pi(i,x)$. Therefore the money value accrued by this infinitesimal mass of consumers to the amount of public good they acquire is $\frac{dY}{dX} d\pi(i, x) d\mu(i)$. The sum total of payments of these payment is, by definition, the social marginal benefit, that is, $SB'(x) = \int_0^1 \frac{dY}{dX} d\pi(i, x) d\mu(i)$. We know that $d\mu(i) = f(i)d\lambda(i)$.

If we start from the formal utility-maximizing model, in which $\frac{dY}{dX}$ is replaced by the marginal rate of substitution $TMS^i(x, y)$, then the socially optimal quantity of public good with personalized Lindahl taxes must satisfy the condition:

$$\int_0^1 |TMS^i(x, y)| f(i) d\pi(i, x) d\lambda(i) = SC'(x)$$

The economist already knows what the optimality condition is, since this is where the principia actionis took him to. All he has to do now is to translate the economic proposition into the mathematical language. It was not necessary to depart from the utility maximization model in the first place[18]. But if he does, the formula above is what he will obtain. The other equation is clearly the feasibility constraint. This variation of the Lindahl's model of public goods does not exist in textbooks and, to my knowledge, neither in papers. It is a mere theoretical exercise though. The point, however, should be clear. Both *homines, alius oeconomicus alius cartesianus,* derive the same propositions through different ways.

5. Concluding remarks

I hope to have made a clear distinction between homo oeconomicus and homo cartesianus. When economic theory analyzes economic behavior by means of formal mathematical models, it does not impinge upon people the computational power of homo cartesianus. Its only purpose is to facilitate the obtainment of theoretical propositions that can also be attained through solid economic thinking grounded on the principia actionis. The modus cogitandi of the economist relies on the principia actionis. This is what should be understood by homo economicus. He is not a pleasure machine, he does not have perfect knowledge, and he definitely does not have a utility function in his mind. Though Robbins, Alchian and many others have already been emphatic on this so long

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[17] The prime sign stands for derivative.
[18] Of course the economist will have to assume some mathematical properties about the functions in order to allow for commutation of the derivative and integral operators. He may assume that the functions to be integrated satisfy, for instance, uniform integrability and are defined over compact sets.

ago, it is still necessary to bring that back to light, given the never ending confusion about who the homo oeconomicus is.

What then is the purpose of the mathematical formal model of the *homo cartesianus*? The formal model reproduces, in an elegant way, the same propositions we get through the principia actionis of the homo oeconomicus. By elegant way I mean mathematical. This is obviously a matter of choice. The other reason for the use of the mathematical model is given by what Schumpeter (1954) called *tooled knowledge*. The economists who developed the utility-maximizing approach did so, to some extent, independently from each other and more or less during the same epoch. It was just how things happened. The artifice of utility maximization in particular, and of mathematical modelling of economic phenomena in general, is a powerful tool to derive economic propositions. It is not, however, a description of homo oeconomicus.

Who, then, is the homo cartesianus? Even logicians have questioned the plausibility of homo cartesianus. Indeed, according to Girle (2000, pp. 158-159), whoever reasons according to the S5 system is but an omniscient god, an angel of the highest level in the celestial hierarchy. The discomfort of criticizers who mistakenly throw their arrows onto homo cartesianus, thinking to be aiming at homo oeconomicus instead, is not a privilege of economists.

My position, however, is not that radical. Just like being or τὸ ὄν is said in diverse ways, so taught us Aristotle, also cartesianity can be said in diverse modes. In fact, the totality Ω, the universe of discourse, depends on context. When economists who master the mathematical tools of economic analysis discuss economic problems in a brownbag seminar, they all know that everybody else knows what they are talking about. *They* are the homines cartesiani *in that context*. If a politician ever participates in their discussion, without any clue whatsoever about Economics, then he may sometimes not know that he does not know what they are talking about, specially if the others speak in the mathematical language. Notwithstanding the politician's ignorance *in that context*, it is not true that the economists in the debate do not comply with Kripke's S5 system *in that context*. Of course I am not considering the possibility that the politician just pretends not to know what economists are talking about. Cartesianity only loses plausibility when totality is too large. By *too-large* I mean exactly what Savage (1954) meant by large world.

The homo oeconomicus, on the other hand, is much simpler and much closer to the real man than criticizers tend to believe. I invite the reader to try to refute once again, on logical grounds, the postulates of the principia actionis stated by Alchian and Allen. The logical negation of any one of the postulates implies the negation of scarcity in the realm of economic phenomena, which is absurd, it would be the very negation of whole economic theory.

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