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KENNETH ARROW'S FUNDAMENTAL
CRITIQUE OF NEOCLASSICAL
ECONOMICS.

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Kenneth Arrow's Fundamental Critique of Neoclassical Economics.

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Kenneth Arrow's Fundamental Critique of Neoclassical Economics

The paper presents Kenneth Arrow's interpretation of the competitive general equilibrium model, arguing he used it to articulate an ambitious critique of what he called the 'neoclassical theory.' Without arguing that Arrow's account of neoclassical theory was correct, I explore how Arrow was 'thinking with' this model, trying to reshape economic analysis. In particular, Arrow re-interpreted this model as a 'normative ideal' that should be used by contemplating the ways the world *differs* from it. I clarify this suggestion by showing how Arrow employed it to achieve three interrelated goals: (1) de-constructing the image of the self-regulating market (2) introducing new fundamental 'building blocks' for economic models, (3) providing an analytical reference point for a unified economic perspective. In the end, I explain why while 'Arrow's critique' genuinely aimed at deconstructing what Arrow identified as the orthodox view it did not suggest an alternative paradigm.

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(1) Introduction

Kenneth Arrow is widely recognized for his substantial contributions to general equilibrium theory. In a series of papers written during his early 30s, he introduced a set of formal results that would shape the post-war economic landscape: the two fundamental welfare theorems, the extension of general equilibrium to encompass uncertainty, and, in collaboration with Gérard Debreu, the existence proof (Arrow, 1951b, 1964; Arrow & Debreu, 1954). Together, these formal theorems asserted that, under specific conditions, a competitive general equilibrium exists and leads to a Pareto-efficient allocation, even in the presence of uncertainty.¹

Often regarded as the crown jewels of neoclassical economics, these results are sometimes seen as laying down the perspective that optimal allocations are most effectively attained through competitive markets (Blaug, 2007, p. 155). However, as I argue in this paper, Arrow's perspective on these results was quite the opposite. In fact, according to Arrow, general equilibrium theory served to challenge the validity of 'the neoclassical theory' by explicitly highlighting the implausibility, if not impossibility, of its implicit assumptions.

It is important to clarify at this point that I am using the term 'neoclassical theory' as Arrow did, without asserting his view as 'correct'. I will explain how Arrow understood the term 'neoclassical' in the next section of the paper. At this point, it suffices to observe that Arrow termed 'neoclassical' the approach that used

¹ The process which had led to the collaboration of Arrow and Debreu, as well as the story of its acceptance, received a throughout historical description in Düppe and Weintraub's book *Finding Equilibrium* (Düppe & Weintraub, 2014).

mathematical analysis, particularly calculus, while assuming the mutual adjustment of prices and quantities (Arrow, 1967, p. 735). Specifically, Arrow contended that the general equilibrium under uncertainty model unveils the foundational structure of the self-regulating market image, which, in his view, was tacitly presupposed in neoclassical economics (Arrow, 1987, pp. 207–209).

According to Arrow, when stated explicitly, it became clear that the assumptions generating this underlying structure could not hold in reality, a realization which carried profound implications for economic analysis (Arrow, 1974a, p. 269). Moreover, Arrow contended that understanding these implications suggested a new perspective on economic behavior, capable of giving rise to a novel framework for economic analysis. In this framework, general equilibrium still played a central analytical role—a role which Arrow termed a 'normative ideal':

In my own thinking, the model of general equilibrium under uncertainty is as much a normative ideal as an empirical description. *It is the way the actual world differs from the criteria of the model*, which suggests social policy to improve the efficiency with which risk bearing is allocated. (Arrow, 1974a, pp. 268–269, my emphasis)

This paragraph, featured in Arrow's Nobel Prize lecture, poses a puzzling question: what does it mean to engage with a model while considering the ways in which the world deviates from it?

The aim of my paper is to answer this question while reviewing Arrow's critique and discussing his methodological approach. The goal is *not* to argue that neoclassical theory was indeed refuted by Arrow or that the general equilibrium model revealed its underlying structure. Instead, my objective is to examine the way Arrow attempted to reshape economic analysis by reinterpreting the meaning of the competitive general equilibrium model.

While Arrow is widely acknowledged as a prominent pillar of post-war mathematical economics, previous research has primarily focused on his early works from the 1950s, addressing general equilibrium and social choice theory (Amadae, 2003; Duppe & Weintraub, 2014; Igersheim, 2019). However, Arrow remained a dominant figure in post-war economics up to the 21st century, making pioneering contributions to various topics central to modern economic analysis, from endogenous growth theory to health care economics. Previous historical research has explored Arrow's work on subjects such as environmental economics, labor market discrimination, and health economics (Berta, 2017; Chassonnery-Zaigouche, 2017; Rebelo, 2007). Furthermore, it has been noted that Arrow had a particular interest in the role of ethical considerations in economics (Fontaine, 2001, 2006). Nevertheless, this paper is the first to present Arrow's work as a comprehensive project with a critical aim.

Throughout the paper, my aim is to convey that Arrow's fundamental critique was a genuine critical project, intending to undermine the 'orthodoxy' as Arrow understood it. At the same time, Arrow's critique did not lead to the rejection of the analytical framework that forms the underlying structure of neoclassical analysis. On the contrary, the systematic analysis of this structure, as appeared in Arrow's work, demonstrated that the same 'building blocks' comprising the perfectly competitive market structure could be applied to analyze a broader array of economic institutions. In this manner, Arrow's critique aimed both to deconstruct the competitive general equilibrium model and to reconstruct it, leading to the expansion of its scope rather than limiting it.

The key insight at the heart of Arrow's critique is that the perfectly competitive market model assumes no uncertainty and, thus, allows market prices to encapsulate all the relevant information necessary for establishing an efficient incentive structure.

Thus, in Arrow's view, the most critical divergence between real-world markets and the model lies in the role of uncertainty in economic reality (Arrow, 1974a, pp. 5–6). Arrow did not refer to the Knight/Keynes type of uncertainty (Keynes, 1921; Knight, 1921). His notion of uncertainty was derived from the Rational Decision Under Uncertainty Theory developed around him (and by him) at Cowles during the 1950s. In particular, the framework presented by Leonard Savage in his *Foundations of Statistics* (Savage, 1954). In this framework, the agent chooses an action, while the outcome of the action depends on the state of the world. Uncertainty, in this context, simply means that the agent does not know what that state is (Arrow, 1959, p. 13). In other words, agents lack the information necessary to directly connect an action to a predetermined outcome. Consequently, when making decisions, they must depend on their beliefs concerning the likelihood of various states of the world (Arrow, 1959, p. 16).

The standard vision at Cowles was that in such cases, agents still maximize their expected utility, such as in Von Neumann and Morgenstern's theory but using subjective probabilities or 'beliefs' instead of 'objectively known' probabilities (Morgenstern & Von Neumann, 1944). In this setting, rational behavior involves agents relying on available information and consistently updating their beliefs using Bayes' law, known as 'Bayesian Rationality' (Harsanyi, 1967). Among post-war mathematical economists, any model using this Bayesian rationality approach was associated with 'uncertainty' (Diamond & Rothschild, 1978).

From our contemporary perspective, Subjective Expected Utility Theory is an inherent part of the rational choice approach that emerged within post-war neoclassical economics (Amadae, 2003; Herfeld, 2018). However, from Arrow's viewpoint, the capacity to formally analyze how information impacts economic behavior through

agents' beliefs suggested an entirely new perspective for economic theory, revising the understanding of economic behavior and market functioning.

According to Arrow, overlooking the interactions between market equilibrium, agents' beliefs, and the information prevailing in the system is a critical shortcoming of the perfectly competitive model. Thus, he rejected the pragmatic view that considered the this model as 'a simplified description of the economy' (Solow, 1967, p. 103).

Nevertheless, Arrow did not dismiss the general competitive equilibrium model as useless; quite the opposite. According to Arrow, this model is valuable precisely because it reflects the 'normative ideal' of the self-regulating market (Arrow, 1974a, p. 268). In essence, the model allows us to explore the 'conditions of possibility' for a self-regulating market by specifying the necessary assumptions underlies it.

I argue that this 'normative ideal' served Arrow in achieving three interrelated goals. First, it allowed him to present a 'critique of the ideology' of neoclassical economics by exposing the underlying assumptions that governed its logic. Specifically, it served him to challenge the notion of competitive markets as the optimal mechanism for resource allocation. Second, by delving into the underlying structure of the market model, it unveiled its 'true fundamental' building blocks, suggesting a new perspective for economic analysis. Third, it served as an analytical reference point, unifying new insights into a coherent framework.

After clarifying Arrow's interpretation of the term 'neoclassical economics' (section 2) and providing a brief overview of the general equilibrium model (section 3), the paper will explore each of Arrow's goals (sections 4-6).

Before delving into Arrow's perspective, it is important to note he was not alone in advocating for a theoretical shift in economics based on the new conceptualization of uncertainty and information. This viewpoint was shared by prominent Cowles

Commission members such as Tjalling Koopmans, Jacob Marschak, Leonid Hurwicz, Roy Radner, and Stanley Reiter, whose collective research laid the foundation for contemporary information economics (Mirowski & Nik-Khah, 2017, pp. 73–100).²

Arrow's role in the development of information economics presents a nuanced challenge to identify. While some argue that his theoretical contributions to this sub-discipline were limited (Mirowski & Nik-Khah, 2017, p. 93), I contend that Arrow played a crucial part in bridging the emerging perspective of the economics of information with the established framework of economic analysis. In doing so, he invested substantial effort in mediating this new approach, which employed sophisticated mathematical tools not widely familiar to the economic community. His aim was to disseminate these insights to a broader audience, including economists, scholars in other disciplines, and policymakers (Arrow, 1951a, 1957, 1959, 1966, 1969). Furthermore, he was distinctly focused on turning this new abstract framework into a practical and common tool to 'think-with' (Wise, 2021). As I will argue, the general equilibrium model played a pivotal role precisely in that pursuit.

While this paper centers on Arrow's work, its objective is not to delve into 'the thought of a great thinker.' Instead, I propose that what Arrow explicitly engaged in within his writings mirrors a broader phenomenon that unfolded in mainstream economics from the 1960s onward. This phenomenon can be observed in the undefined role that the perfectly competitive model plays in mainstream economics—widely deemed 'unrealistic' and often declared 'refuted,' yet still occupying a central, albeit not

² On the connection between their work and the socialist calculation debate, particularly Hayek's view of the price mechanism, see (Boldyrev & Ushakov, 2016; Caldwell, 2016; Mirowski & Nik-Khah, 2017).

precisely defined, position in economic analysis (Ackerman, 2002; Colander, 2018; Kirman, 1989).

Furthermore, while the scope of this paper does not allow me to elaborate on this point, I would like to suggest that the internal tensions that characterize the episode dealt with in the paper also appear, although not identically, in the more recent episode of the behavioral criticism of the neoclassical approach (Angner, 2019). I will touch upon this point in the conclusion of the paper.

(2) What was neoclassical economics in Arrow's view?

Defining neoclassical economics proves to be a challenging task, with no scholarly consensus on the matter (Colander, 2000; Mirowski & Hands, 2006; Weintraub, 1993). Fortunately, this paper does not aim to provide such definition. As stated in the introduction, my objective is not to inquire whether Arrow's critical project successfully 'undermined the neoclassical view' or even to assert that the target of Arrow's critique was, indeed, 'the neoclassical theory.' Instead, the focus is on understanding how Arrow aimed to reinterpret the general equilibrium model to advance economic analysis beyond the neoclassical perspective, *as he understood it*. Thus, this section aims only to clarify what Arrow 'had in mind' when using this term.

Unfortunately, elucidating Arrow's view of neoclassical economics is also a challenging task. Although he frequently employed this notion in many papers over several decades, attributing it to Marshall, Samuelson, and 'the Chicago School', he did not provide a clear definition of the term (Arrow, 1967, 1974b, 1987). This absence is particularly unfortunate for an economist who seemed to dislike conceptual vagueness (Arrow, 1987, p. 208).

Examining Arrow's works suggests he associated neoclassical theory with a group of key assumptions like individual rationality, competition, and market

completeness, emphasizing equilibrium analysis under the assumption of market clearing. (Arrow, 1986, pp. 386–387). Moreover, it appears that Arrow identified neoclassical economics with the view that markets basically work as in the perfectly competitive model (Arrow, 1993). Arrow firmly argued that the general competitive equilibrium is the most elaborated articulation of the neoclassical account of how markets work (Arrow, 1987, pp. 201, 207–208).

In particular, Arrow associated the neoclassical theory with the view that the competitive price mechanism provides an optimal incentive structure. Thus, above all else, the deconstructive part of his critique aimed at the argument that competitive prices are the best mechanism for resource allocation (Friedman & Friedman, 1990, pp. 14–20). According to Arrow, the most significant achievement of the two welfare theorems was explicitly stating in what sense the competitive equilibrium is optimal, emphasizing that optimality is limited to Pareto efficiency and depends on a specific set of assumptions (Arrow, 1969).³ Following that, in Arrow’s view, undermining the validity of the general competitive equilibrium was a way to criticize the perspective that equates competition with optimality.⁴

³ See Stiglitz (1991) for a similar analysis.

⁴ Of course, both Friedman and, for certain, Hayek would have rejected the claim that their view of the market is in accordance with the general equilibrium model. However, Arrow was likely right in saying that no other *formal model* in economics offered an alternative account of the efficiency of competitive markets. (Arrow, 1987, p. 232). The most elaborated attempt to develop an alternative formal model of competitive markets for the purpose of welfare analysis was done by Sugden after the 1990s (Sugden, 2004, 2018).

(3) The general equilibrium under uncertainty model

As explained in the previous section, Arrow argued that the general competitive equilibrium is the most complete account of the market model employed by neoclassical analysis. By explicitly examining the mutual clearing of all markets, it demands careful consideration of the connection between present and future markets (Arrow, 1987, pp. 207–208). Describing these connections without assuming that agents possess perfect foresight persists as a central challenge in the development of general equilibrium theory (Giocoli, 2003, p. 135). Arrow's solution, proposed during a conference in Paris in 1952, was as follows: Instead of assuming that agents trade present and future commodities, he suggested considering the trading of 'commodity options,' resembling agreements specifying what they would receive based on future states of the world (Arrow, 1964). This eliminated the need to assume that agents know what will happen in the future; instead, it is assumed that agents hold subjective beliefs about the likelihood of different future states, trading these 'commodity options,' to maximize their (subjective) expected utility.

In his paper, Arrow demonstrated that this mechanism, which he termed 'general equilibrium under uncertainty,' is equivalent to intertemporal general equilibrium, and generates a Pareto-efficient allocation. Although commodity options (sometimes referred to as 'state-dependent commodities' or 'contingent commodities') do not seem to exist, Arrow proved that a monetary mechanism of state-based securities can replace commodity options in the model, and suggested that, in reality, financial markets might play this role. This result, later generalized by Debreu (1959), had a broad impact on the development of economic analysis, spanning from finance to macroeconomics (Boldyrev, 2021; Mehrling, 2010).

Nevertheless, in the early 1960s, Arrow started to scrutinize the neat analogy he drew between the scenario of general equilibrium under uncertainty, where security markets are designed for efficient risk-bearing allocation, and the ordinary theory of resource allocation. This skepticism developed into a central theme in his writings from the 1960s onward. The various ways he developed this theme constitute what I term 'Arrow's fundamental critique.'

(4) De-constructing the image of the self-regulating markets: risk bearing and non-marketability.

In an unpublished work, titled 'The Allocation of Risk Bearing' and addressing the implication of rational decision under uncertainty to the theory of production, Arrow argued that 'the usual welfare economic identification between Pareto optima and competitive markets' face a specific difficulty when the decision regarding production involve uncertainty (Arrow, 1964). According to Arrow, this difficulty does not regard 'the formal validity of the conditions for optimal allocation but in their *applicability to the real world*' (ibid., my emphasis).

The central concern for Arrow in the paper lies with the 'indivisibility' assumption, which dictates that each commodity must be traded separately. In the general equilibrium under uncertainty, commodities are defined by their outcomes in all possible states. This implies, for example, that if two units of the same production factor differ in their probability of damage, they are treated as separate commodities in the model and should have different prices. However, calculating expected profit in such cases becomes highly cognitively demanding, rendering the assumption of indivisibility seemingly unrealistic.

This strict analogy between the model and the 'real world' may appear somewhat awkward. Indeed, this draft did not evolve into a published paper. Nevertheless, the

indivisibility assumption came to hold a central position in Arrow's attempt to deconstruct the image of the self-regulating market. This focus did not center on the complexity of calculating future expectations; rather, it addressed the challenge of knowing *the currently realized state* (Arrow, 1969, 1973). Following that, the critical issue with indivisibility did not concern the uncertain characteristics of physical commodities but rather *risk itself*, treated as a commodity, as observed in the context of insurance theory.⁵

The indivisibility of different types of risk, and its implication to welfare analysis appeared as the main topic in Arrow's well-known paper about the medical-care industry (Arrow, 1963). In this paper, Arrow introduced, for the first time, the notion of *non-marketability*, which implied that certain goods not only lack a market price but cannot be assigned one due to technological or institutional constraints (1963, p. 944-945).

In the paper, Arrow argued that the medical care industry encompasses various types of risk, inherently uninsurable or non-marketable due to the information asymmetry between physicians and patients, resulting in what is known as 'moral hazard.' While conventional understanding frames moral hazard as an incentive problem, Arrow redefined it as a challenge rooted in indivisibility. Agents, desiring to trade each type of risk independently, face the inability to distinguish between different

⁵ Arrow had early education in insurance theory which acquainted him with the concepts of

Moral hazard and *Adverse selection* (Arrow, 1984, p. 66).

states of the world. Thus, non-marketability stands instead of the technical phrase 'indivisibility.' (Arrow, 1963, p. 945).⁶

According to Arrow, this non-marketability, in fact, hinders competitive markets from functioning effectively in this setting. This observation provides an explanation for the emergence of 'non-market institutions' in this industry, particularly professional associations that incorporate a moral code. These institutions enable the industry to operate by removing the patient-physician relationship from the realm of profit maximization, which governs the market sphere, and placing them in the realm of ethical relationships, thus establishing *trust* (1963, p. 965-965).⁷

While the paper primarily addressed the medical-care industry and explored specific institutional arrangements within this sector, its methodological approach mirrored that employed by Arrow in the production functions paper. Arrow opened the paper by introducing the welfare theorems and explained their generalization to cases of uncertainty by treating 'risk-bearing' services as commodities, constructing this perfect image only to collapse it in the subsequent paragraph:

However, the variety of possible risks in the world is really staggering. The relevant commodities include, in effect, bets on all possible occurrences in the world which impinge upon utilities. In fact, many of these "commodities," i.e., desired protection against many risks, are simply not available. *Thus, a wide class*

⁶ In conventional fire insurance, the challenge of indivisibility arises from the insurance company's inability to differentiate among three types of fire risks: those resulting from natural forces, reckless behavior, and intentional fraud.

⁷ It is reasonable to argue that the spontaneous emergence of professional associations and moral codes should be viewed as inherent to the functioning of the market itself. However, Arrow's argument is that the competitive price mechanism cannot optimally coordinate behavior in these cases. Furthermore, in the specific context of medical care, he also contested the notion that licensing is merely a means to create a monopoly.

of commodities is nonmarketable, and a basic competitive precondition is not satisfied. (1963, p. 945-946, my emphasis)

As evident in this quotation, the main analytical argument in the paper, serving as the starting point for delineating the various ways in which these 'commodities' are absent, is stated in general terms. Arrow reiterated this argument in multiple future works, using it as the foundation to outline 'the limits of the market' (Arrow et al., 1976; Arrow, 1974c).

Arrow's central argument posits that the competitive price mechanism cannot always ensure optimal coordination and cooperation, leaving an 'optimality gap' that necessitates societal intervention, either through government or other institutions (Arrow, 1963, p. 947). Arrow used this reasoning to counter the perspective that the principle of profit maximization, coupled with market competition, is sufficient to guarantee optimal allocation aligned with societal goals (Friedman, 1970). According to Arrow, social responsibility and ethical relationships play an indispensable role in the functioning of the economic system (Arrow, 1973).

It is noteworthy that, in Arrow's perspective, among various types of market failures, informational market failures are the most destructive to the self-regulating market's image. According to Arrow, the issue of indivisibility ('non-marketability,' or in later terms, 'incomplete markets') is most critical in the context of uncertainty. In particular, this problem cannot be resolved by defining better property rights, as is suggested in the case of externalities. Contingent contracts can only be established on mutually observed events, while significant economic events are not mutually observed (Arrow, 1974a, pp. 268–269). Thus, the failure of future markets is not an empirical fact but an analytical problem in the model (Arrow, 1974b, p. 8). Arrow's conclusion was

that the ideal image of the self-regulating market necessitates an underlying structure that fundamentally cannot exist.

(5) The fundamental building blocks of economic analysis: information and the endogeneity of beliefs.

The next role that the general equilibrium under uncertainty model played in Arrow's thought was 'exposing' or, more accurately, re-imagining the underlying structure that governs the market model. Thus, the general equilibrium under uncertainty model suggested new fundamentals as the analytical building blocks of economic explanation.

In this model, agents do not trade *commodities* but *outcomes*. In particular, agents' welfare depends on the outcome of the allocation, which relies on both their actions—decisions regarding what to buy and sell—and the realized state of the world. Following that, that the agent's choice is directed not only by their preferences, defined over the outcomes, but also by their beliefs. These beliefs concern the likelihood of different states, signifying the probability that a specific action will lead to a particular outcome.

As discussed in the previous section, in this new setting, achieving Pareto efficiency requires agents to trade each outcome separately. However, in many cases, agents cannot definitively identify the realized state, hindering agreements on future trades. This leads us to the question: what they are doing instead?

The analysis of how the asymmetric spread of information affects market equilibrium began to emerge in the works of several scholars during the 1960s, resulting in a series of publications that have since become a central part of the economics canon (Akerlof, 1970; Spence, 1973; Stiglitz, 1975).

These new models introduced a novel methodological aspect: they had to incorporate an explicit assumption specifying how information shapes beliefs. Drawing

from Subjective Expected Utility Theory, these models posited that agents possess initial probability distributions (priors) that they consistently update, following Bayes Law, when confronted with new information. In a static model, this implies that in equilibrium, agents' beliefs must align with the information available within the realized state of the world (Arrow, 1973a, p. 10). Thus, unlike preferences, which are considered fixed in the model, beliefs are endogenous – meaning they are determined within the equilibrium.

Consequently, these new models introduced a new type of economic agent, which is not only a utility maximizer but also a small statistician (Arrow, 1973a, p. 6; Mirowski & Nik-Khah, 2017, p. 102). This new economic agent may consider things that appear irrelevant to the economic problem at first. Such non-economic variables, called signals, are valuable for their role in reducing the uncertainty the agent faces, but they do not directly influence the outcome's value (Spence, 1973; Arrow, 1973a, p.6). Furthermore, incorporating this insight into the framework of rational choice theory elucidates behaviors that would otherwise appear non-rational (Arrow, 1987, p. 231).⁸

Nevertheless, according to Arrow, the most profound methodological implication of treating our agents as statisticians lied elsewhere: let us refer to the factors determining how individuals rank different options as their 'attitudes' toward these options (Arrow, 1971, p. 10). In neoclassical theory, these attitudes are considered reflections of people's tastes or preferences. However, Arrow suggested that adopting the informational perspective implies these attitudes reflect the combination of people's

⁸ See Gilboa (2012, pp. 3–7). For instance, although rationality dictates that an agent should not alter their perception of a product based on its availability, in an uncertain environment, prices can function as signals (Akerlof, 1970). Similarly, 'framing effects' can also be regarded as a source of information (Gilboa & Wang, 2019).

preferences and beliefs. With beliefs explicitly analyzed in the model, this means that some part of the process governing personal attitudes is now endogenous.

Arrow developed this argument in an early version of his work on labor market discrimination (Arrow, 1971). In Arrow's model, known as 'statistical discrimination,' employers discriminate due to uncertainty, using employees' race as a 'signal' because they lack information about their ability.⁹ While acknowledging that the association between race and productivity may be false and prevail due to some cognitive biases, he also suggested that these beliefs may reflect a true gap in productivity that emerged from differences in investment in personal education between these two groups (Arrow, 1971, pp. 21–24).

However, by making this argument, Arrow did not intend to 'justify' discriminatory behavior. His explicit aim was to criticize Becker's 'taste-based' model, which posited that discriminatory behavior is uncompetitive because employers with discriminatory preferences are 'willing to pay' more to avoid hiring black workers (Becker, 2010). In contrast, Arrow argued that such behavior does not harm the employee, even if the employer's sole aim is to maximize profit. Specifically, Arrow contested Becker's view that, in the long run, competition is supposed to eliminate discrimination (Arrow, 1971, pp. 12–16).

Furthermore, Arrow argued that employers' attitudes towards blacks are not merely 'personal tastes.' These tastes may, in fact, align with their (white) group interest. In the long run, discrimination against blacks diminishes the incentive for them to invest in increasing productivity, thereby preserving the social hierarchy in favor of the white group (1971, pp. 24–25). Thus, his model provides an explanation consistent with the

⁹ This terminology aligns with Spence's version of a similar model (Spence, 1973).

idea that, over time, 'the values inherent in discrimination uphold a structure that is profitable to those holding those values' (p. 25). Moreover, while his formal analysis aligned with the economic tradition in its focus on purely individualistic terms, by examining how employers' beliefs were formed and sustained, Arrow's work suggested that discriminatory tastes, taken as given in Becker's theory, 'were themselves the mechanism by which discrimination profitable to whites was carried out' (p. 26).

Therefore, the primary focus of his paper was on 'economic theory itself, or the use and meaning of neoclassical price theory in the application to the allocation of resources' (1971, p. 1). In particular, he argued that assuming people's attitudes simply result from personal taste hinders neoclassical economics from explaining how attitudes are shaped in specific ways (p. 10). In this context, recognizing that people's choices are influenced by the information around them hints at how society may shape those attitudes (Arrow, 1994).

(6) General equilibrium as an analytical reference point and the dialectical nature of Arrow's critique.

In the preceding sections, I discussed how Arrow used the general competitive equilibrium model to challenge the notion of a self-regulating market and to re-conceptualized the fundamental components of the market model.

Given his critique of this model as unrealistic and the emergence of new models proposing alternative market structures based on information analysis, one might anticipate that Arrow would dismiss this model as non-useful. However, that was not the case. The general equilibrium under uncertainty model occupied a central position in Arrow's approach to economic analysis. Rather than outright rejecting the model, Arrow proposed a reinterpretation.

As mentioned in the introduction, in his Nobel Prize lecture, Arrow suggested considering the general equilibrium under uncertainty model as a ‘normative ideal’ that should be used for clarifying the way the actual world differ from it (Arrow, 1974a, p. 268). In this capacity, the model played a significant role in Arrow’s work, extending beyond the argument that it demonstrated why this ideal cannot hold in reality. The aim of this section is to elucidate this role.

Unlike heterodox critics of neoclassical theory, Arrow did not criticize its basic methodological commitments. He deeply valued structural mathematical models and saw no issue in assuming a self-interested Homo Economicus maximizing a utility function (Arrow, 1997). However, he emphasized that this maximization process should incorporate the agent's continuous efforts to understand the world.

From his standpoint, this seemingly minor alteration permitted a significant elaboration of the neoclassical image without discarding its mathematical rigor. It demonstrated that the same logical structure at the core of neoclassical economics could accommodate new arguments about economic behavior and lead to different conclusions regarding regulatory issues (Arrow, 1973a).

However, the new models of information economics had one shortcoming; they couldn’t generate a ‘grand’ theory that could be formalized in a similar manner to general equilibrium theory. They did not offer an answer to the question - how does *The Market* work? Rather, they suggested a group of ‘small-scale’ models describing different possible market mechanisms, each applicable in some cases.

If the mythical visitor from March were to approach economists and ask, 'How do you describe the functioning of the market?' To which models analyzing information should they direct this curious visitor—the market for lemons, signaling in the job market, or another?

In response, the general equilibrium under uncertainty still stands out as the most comprehensive portrayal of The Market. At least, this seems to be Arrow's position. Following that, he considered this model as an essential analytical reference point that provides a unified framework for comprehending the diverse insights proposed by small-scale models. Returning to our hypothetical visitor, Arrow's answer would be: 'consider the general equilibrium under uncertainty model as a starting point, but approach it with caution. Once you have delved into it, we can explore deeper and discuss why this image does not align with the operation of actual markets. However, this exploration will be undertaken after the establishment of a common language for our analysis.'

Indeed, it is evident that Arrow placed significant importance on conceptual unification. He devoted considerable effort to integrating different models within a shared analytical framework. In this context, the general competitive equilibrium served as the organizing foundation for a new typology of market structures, categorizing them based on the diverse ways they deviate from its assumptions.

As a result, we can clarify the logical relations between diverse models addressing various market structures. Contrasted with the structure of this model, which necessitates a separate market price for each outcome, we can conceptualize externalities as missing markets and informational market failures as problems of incomplete contracts.¹⁰ Thus, alongside his endeavor to deconstruct the image of the self-regulating market through a systematic review of the general competitive model's assumptions, Arrow employed the model to articulate new meanings for other concepts.

¹⁰ On Arrow and the New Institutional Economics, see (Williamson, 1987)

In fact, in many papers, Arrow presented the competitive general equilibrium model and developed his argument by analyzing its assumptions without even providing an alternative model. In that sense, the general equilibrium under uncertainty model served as the basis that 'opened' an explorative analytical realm, which centered around interpretation rather than idealization (Knuuttila & Morgan, 2019).¹¹

For Arrow, this new typology was most significant in welfare and policy analysis. By clarifying in which 'economic environment' the assumptions of the general competitive model fail, it helps to identify scenarios in which the competitive price mechanism would not work, providing a valuable guide for policymakers (Arrow et al., 1976; Arrow, 1969). Using this model as a normative ideal, or 'benchmark,' did not suggest that policy should 'fix' markets to make them more 'perfect'. Instead, it provided an explanation for the necessity of social policy, highlighting why markets alone could not 'solve' certain problems.

As we have seen, Arrow employed his approach to think not only about non-perfect market structures, but also about 'non-market' institutions. In particular, Arrow was dedicated to explain the necessity of social norms in the economy, by suggesting to think about them as the 'reactions of society to compensate for market failures' (Arrow, 1969, p. 14). In a similar manner, he emphasized the importance of ethical codes, which 'serve as an alternative to equal information,' and suggested considering trust as an externality (Arrow, 1973a, p. 27; 1974c, p. 23).

¹¹ We can compare that to contemporary argument that advantage of formal models lies in clarifying the relationship between assumptions and conclusions. (Gilboa et al., 2014; Rodrik, 2015).

Before moving to the conclusion of the paper, I want to briefly problematize this aspect of Arrow's approach and emphasize that this suggestion should be approached with caution.

By reconceptualizing the market as a mechanism for allocating risk and emphasizing information as a crucial factor in economic behavior, Arrow proposed a new ontological structure capable of encompassing a broader range of social phenomena. For instance, trust can be seen as an externality, carrying value in risk-bearing allocation, while stereotype-based discrimination can be conceptualized as an adverse selection problem. This integration of new phenomena into the existing paradigm marks significant progress in economic theory.

However, we should note that these arguments are coherent only within the analytical framework governed by the general competitive equilibrium model. In this framework, markets hold *analytical primacy* over other phenomena, suggesting that market imperfections can 'account for' the necessity of social norms. Nevertheless, employing historical, sociological, or anthropological perspectives may reject a view that regards social norms as second-order to the market.

While Arrow's arguments may not be apt for explaining the historical origins of social norms, they provided an economic perspective on their significance. They clarified their functionality in terms of economic efficiency by demonstrating the specific functions they undertake instead of the ideal market mechanism (Guala, 2016). Nevertheless, even within this expanded framework, we grapple with the persistent normative structure, funneling all aspects of policy analysis, excluding distributional concerns, towards questions of efficiency.¹²

¹² On Arrow's approach and economic imperialism, see Chassonnery-Zaïgouche (2017).

Indeed, Arrow's effort to 'translate' his critical views into the prevailing framework carried certain tensions, specifically regarded normative perspective on policy analysis. For example, while Arrow's analysis of belief-based discrimination was presented with a critical, even radical interpretation, it has paradoxically been construed as a justification for discrimination (Schwab, 1986). This interpretation aligns with the conventional approach to normative analysis, where rational and efficiency-preserving behaviors are deemed acceptable. Similarly, attributing the need for public health care to informational gaps may suggest that increased access to genetic information could resolve the issue. Moreover, if ethical codes and trust serve as substitutes for information, perhaps improved monitoring technology could diminish their significance.

One can always label these tensions as 'ethical dilemmas' (Arrow, 1995). However, they can also be viewed as a valuable source of information. These tensions may suggest that when we perceive social reality as a realm of risk-bearing allocation, other fundamental forces, beyond individual optimization and the transmission of information, may emerge as meaningful — from power relations to care. Indeed, a meaningful exploration of these alternative fundamentals could not only result in a distinct normative framework but also in a different account of the way 'The Market' operates.

(7) Concluding remarks

This paper aimed to present Arrow's fundamental critique of neoclassical theory (as he perceived it), highlighting its dual nature of deconstruction and reconstruction. While undermining the validity of the general competitive equilibrium as a representation of real markets, Arrow proposed to reinterpret it as a 'normative ideal.' I suggested that this normative ideal served Arrow for various interrelated goals, all

bearing some 'fundamental' aspects. First, he used this model to explain why the image of the self-regulating market is logically problematic. Second, he use this model to reconceptualize the underlying structure of the market model as a mechanism for risk-bearing allocation governed by agents' preferences and beliefs. Third, he employed the exploration of the 'conditions of possibility' of an ideal market, as reflected in the assumptions of the competitive general equilibrium model, as a unifying principle for a broader economic analysis framework.

At the end, I argued that while Arrow's critique was a genuine critical project, it did not offer an alternative paradigm because it did not suggest a novel perspective regarding the fundamental forces that operate in economic reality. Instead, it showed that some phenomena which seemed related to such forces can be 'translated' into the existing framework, using the new perspective of information.

Thus, Arrow's legacy is inherently 'dialectical' in the sense that it moves between what appear as conflicting tensions. As a key figure in mathematical economics, he played a pivotal role in constructing the mathematical underpinnings of neoclassical economics, but he also harnessed them to criticize this very approach. As a critical theorist, he sought to deconstruct the image of the self-regulating market while extending its logical framework to encompass a broader spectrum of phenomena.

This dialectical nature is a broader characteristic of the development of post-war neoclassical economics, where conflicting views and methodological principles were nurtured under the same umbrella of 'neoclassical theory' (Mirowski & Hands, 2006). These internal tensions became more apparent with the increasing dominance of the behavioral approach, presenting itself as a departure from neoclassical theory by challenging the fundamental notion of 'rationality' (Angner, 2019). However, as may have become apparent throughout the paper, there are notions of continuity between the

behavioral perspective and the economics of information, at least within some traditions of the former (Stiglitz, 2017).

While the highly empirical commitment of behavioral economics is a critical methodological difference separates these two 'revolutions' in economic analysis, they share a curious methodological similarity: In both cases, a tension arises as the paradigmatic model is criticized for its descriptive capacity yet simultaneously serves as a reference point for welfare analysis.

Thus, while behavioral findings have challenged the validity of the image of perfectly rational agents portrayed by theories such as Subjective Expected Utility, they continue to wield significant analytical influence. Other theories are conceptualized as deviations from them, and welfare analysis still refer to their requirements, such as internal consistency (Infante et al., 2016). In that sense, the dual role of the perfectly rational agent mirrors the role of the perfectly competitive equilibrium outlined in this paper.

The perfectly competitive market serves as the foundation for analyzing imperfect markets, much like the perfectly rational agent guides our analysis of non-perfect agents. In both instances, we employ new insights to undermine the structure suggested by the original model. Imperfect information "distorts" competitive markets, while behavioral effects "distort" rational choice. However, it remains unclear how to construct normative evaluations without referencing the neoclassical normative ideal.

Using the structure of the normative ideal, whether the perfectly competitive market or the perfectly rational agent, to reveal its shortcomings is a potent critical tool. Nevertheless, we must remember that these normative ideals are theoretical constructs, valuable only as long as they serve a purpose. Perhaps it is time to move beyond the normative idols inherited from our neoclassical predecessors and develop novel

normative frameworks that more seamlessly align with our evolving understanding of economic behavior and institutions.

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