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How Could Models in Economics Possibly Provide 'How-Actually' Explanations?

Dinçer Çevik

Muğla Sıtkı Koçman University, Turkey
dincercevik@mu.edu.tr
ORCID https://orcid.org/0000-0001-5897-7381
https://ror.org/05n2cz176

Abstract. Much of the debate about model-based explanations in economics revolves around *How-Possibly Explanations* (HPEs). HPEs propose a potential way in which something could occur. I argue that these debates often occur without adequately considering the various ways in which economic models can provide *How-Actually Explanations* (HAEs). HAEs concentrate on what actually happens, providing explanations based on real-world events. I suggest that adopting a pluralistic and pragmatic approach is among the most effective methods for exploring the potential of HAEs in economics. To support my argument, I will use two case studies from microeconomics and macroeconomics. I contend that these case studies provide grounds to believe that a pluralist and pragmatist perspective could clarify how models in economics might offer HAEs.
Keywords: How-possibly explanations, how-actually explanations, model-based explanations in economics, perfectly competitive model, core-periphery model.

Kaip ekonomikos modeliai galėtų suteikti paaiškinimus „kaip yra iš tikrųjų"?

Santrauka. Didelė dalis diskusijų apie modeliais paremtus aiškinimus ekonomikoje susijusios su aiškinimais „kaip yra galima". Tokie aiškinimai nurodo potencialų būdą, kuriuo kažkas galėtų įvykti. Aš teigiu, kad tokie ginčai dažnai vyksta adekvačiai neapsvarsčius įvairių būdų, kuriais ekonominiai modeliai galėtų pateikti „kaip yra iš tikrųjų" paaiškinimus (KIP). KIP sutelkia dėmesį į tai, kas iš tikrųjų vyksta, siūlydami aiškinimus, pagrįstus realaus pasaulio įvykiais. Teigiu, kad pliuralistinės ir pragmatinės prieigos priėmimas yra vienas efektyviausių metodų tyrinėti KIP potencialą ekonomikoje. Paremdamas savo argumentą, pasitelkiu dvi atvejo analizes – vieną iš mikroekonomikos, o kitą – iš makroekonomikos srities. Straipsnyje parodau, kad šios dvi atvejo analizės suteikia pagrindą tikėti, kad pliuralistinė ir pragmatinė perspektyva galėtų paaiškinti, kaip ekonomikos modeliai gali suteikti „kaip iš tikrųjų" paaiškinimus.
Pagrindiniai žodžiai: paaiškinimai „kaip yra galima", paaiškinimai „kaip yra iš tikrųjų", modeliu paremti aiškinimai ekonomikoje, idealiai konkurencingas modelis, centro-periferijos modelis

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Introduction

One perspective, supported by proponents who argue that economic models provide explanations, suggests that these models offer *How-Possibly Explanations* (HPEs) (Aydınonat and Köksal 2019; Grüne-Yanoff 2013a, 2013b; Verreault-Julien 2017, 2019; Ylikoski and Aydınonat 2014). The dominant view in these studies is that model-based explanations in economics are largely of the HPE type. Broadly, HPEs suggest a possible way that something could happen in principle. *How-Actually Explanations* (HAEs), on the other hand, focus on what truly occurs, offering explanations grounded in actual events[1]. I contend that these debates often overlook the various ways in which economic models can provide HAEs. Some of the recent approaches put forward regarding HPEs and HAEs (Verreault-Julien 2019; Bokulich 2014) emphasize the structural similarity between these two types of explanations but argue that they differ in how the targeted phenomenon actually occurs. Based on this, the claim in this paper aims to clarify how certain models *actually* explain[2] specific phenomena. To this end, I argue that adopting a pluralistic and pragmatic approach is one of the most effective ways to explore the potential for HAEs in model-based explanations in economics.

The paper is organized as follows. In Section 1, I closely analyze a standard supply-demand model from elementary microeconomics. In Section 2, I examine the Nobel Prize-winning *Core-Periphery model* from macroeconomics (Krugman 1991). In Section 3, I will use these models to argue that, by adopting a pragmatist and pluralist perspective, it is possible to show how certain models actually explain specific phenomena. Section 4 concludes the paper[3].

1. Microeconomics Case Study

The first case analyzed involves microeconomic explanations for decreases seen in personal computer prices during the 1980s (Carbaugh 2015, 104).

When *IBM* launched the first *Personal Computer* (PC) in 1981, they faced very little competition, allowing IBM to set high prices (around US$7,000 per PC) with substantial profit realization. Recognizing the profit potential, other companies, such as *Compaq* and *Dell*, quickly began producing PCs of a similar quality. Upon their entering the market, the overall volume supply of PCs increased dramatically, resulting in a lowering of prices and decreased profits for most suppliers. Hence, declining prices in the PC market in the 1980s constitutes an explanatory part. From this, an explanation for the decrease in PC prices (EPC) can be summarized as follows:

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[1] There is vast literature on the nature of HPEs and HAEs, as well as their similarities and differences. However, due to space constraints, I cannot delve into these discussions here.

[2] It should be noted that scientific explanations take various forms, including mathematical (non-causal), probability-based, and others. Throughout the article, I use the term 'explanations' in reference to causal explanations, which are based on reasons within explanatory relations.

[3] This article is derived from the fourth chapter of my doctoral dissertation titled *Between Overrated Pessimism and Underrated Optimism: A Study on the Model-Based Explanations in Economics,* which I defended in 2019.

1. A perfectly competitive market existed, characterized by pure competition.
2. Assumption that ideal conditions existed (such as the presence or absence of general deflation, government intervention, etc.).
3. The occasion of what is termed 'market entry', a complex issue related to the specific characteristics of an industry and the details of how the entry took place.
4. The level of competition within the industry (which can vary significantly and can be interpreted in different ways).

These idealizations are assumptions that, in one way or another, misrepresent the target system since they relate to the presence of at least some falsehoods, omissions, or distortions.

Proposition (1) presents an idealized market whose assumptions do not correspond to any real-world system. Proposition (2) depicts background conditions to a partial level, whereas Proposition (3) delivers a factual assertion. Hence, it is not conceivably possible that all four propositions cover all the relevant factors in explaining the decline in the PC prices of the 1980s. However, I argue that, when taken together, they still fulfill an *actual* explanatory role.

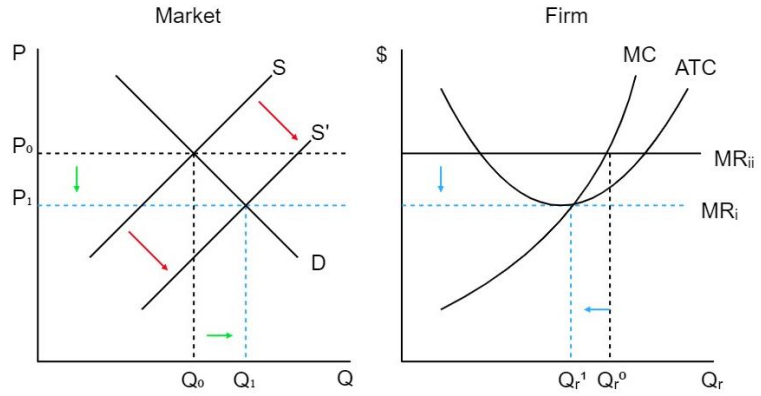

Figure 1. Typical model explaining price decreases for products from a real company using the model of a perfectly competitive industry and firm

Figure 1 is a representation of the model utilized to arrive at **EPC**[4], where MC = marginal cost, MR = marginal revenue, ATC = average total cost, S = supply, and D = demand. The model represents a perfectly competitive market for a specific goods type (i.e., PCs) and a typical firm within that market. It illustrates that when new firms enter the industry or the market (e.g., Compaq, Dell, etc.), the supply of particular goods in question increases (shifting from S to S'), leading to a decrease in the market price (shifting from P_0 to P_1). In this competitive market, prices are determined by the market itself, and therefore a typical firm (i.e., IBM) will face lower prices and *Marginal Revenue* (MR), which, in turn,

[4] Although D. Wade Hands (2018) analyzed this model in a broader perspective, the current case study examines how a basic supply-demand model could be applied to understand price differences in the 1981 PC market.

reduces their profit-maximizing output. However, while each individual firm produces less, the total market output increases due to the presence of more firms. To explain the reduction in PC prices, it is not logically possible to know if the market meets all the assumptions of perfect competition. Certain idealizing assumptions are therefore made to exclude factors considered irrelevant for the purposes of producing an explanation.

The model is highly unrealistic[5]. Economists are aware that the model depicted in **Figure 1** represents highly simplified structures that are unlikely to be found in reality. In order to analyze the target system, the model is required to make idealizations so as to obtain explanatory relevant information. One of the fundamental assumptions within the model is the presence of barriers to entry into the market or the industry. Additionally, the model assumes that there are no substitute goods, which is another idealization built into the model's core mechanisms. However, these conditions are merely approximations. As a result, the model significantly misrepresents and distracts from the complexities of real-world markets and industries. Furthermore, the model relies on *ceteris paribus* assumptions, such as the absence of market interventions.

Yet, as it exists in nearly every elementary microeconomics textbook, the model in question here is one of the theoretical cornerstones of economics. Economists use these models to explain how changes in fundamental supply-demand factors impact outputs, prices, and other variables. These models are employed under specific idealizations, such as the assumption that wholesalers do not stockpile excess production to avoid price reductions, and the presence of certain expectations and similar conditions.

I argue that one reason why some philosophers of economics suggest that economic models provide only HPEs or serve as heuristics is due to a conflation of singular and generic explanations[6]. For example, it may be argued that these models merely explain general phenomena and are thus generic. However, I maintain that, even for singular explanations, economists would employ the models analyzed here, with the model I examined being extensively used in economic practice. The satisfaction of economists with more detailed explanations depends on the specifics of the target being analyzed. The issue centers on the amount of detail required or the differences in the specific target being explained. Elliot Sober made a similar point, by stating that,

> *Explanations come with different levels of detail.* When someone tells you more than you want to hear, this does not mean that what is said fails to be an explanation. *There is a difference between explaining too much and not explaining at all* (emphasis added in Sober 1999, 547).

[5] The unrealistic nature of scientific models stems from the idealizations they incorporate. Although there is an extensive body of literature on the nature and roles of idealizations, space limitations prevent me from exploring these discussions in detail. In this context, the following sources, among others, can be examined; (Mäki 2020; Rice 2024). Also, on this issue, Verreault-Julien's (2024) article on the explanatory power of highly unrealistic toy models contains highly significant insights.

[6] Model-based explanations differ based on the structure of the explananda. While some models explain singular events, i.e., a forensic scientist explains why a particular bridge collapsed by analyzing the specific structural weaknesses and environmental conditions, others account for general phenomena, i.e., a physicist explains why objects fall by referring to Newton's law of universal gravitation. Both Marchionni (2017, 610–614) and Aydınonat (2024, 189) highlight the distinction between singular and generic explanations in the context of model-based explanations in economics.

In a similar vein, in order to explain singular cases of price reduction in competitive markets, economists would require more detailed information, such as knowledge of updated foreign exchange rates, etc. Still, economists employ the standard model in order to explain **EPC**'s singular occurrences (that is, **EPC**). So, although differences may exist in explaining why prices fell for the output of a specific firm and price reductions in general, this is not due to the models behind the explanation and because **EPC** provide HPEs, but rather due to the level of information detail and abstraction needed to produce a viable explanation. Therefore, stating that economic models occasionally offer HPEs does not mean that they are incapable of providing HAEs.

I argue that the explanation for declining prices in the PC market is an *actual* one within its context. The explanation provided here is accurate in that it does not detail how Dell's and Compaq's entry into the PC market specifically led to a lowering of prices. Instead, the model, though highly idealized, effectively and *actually* clarifies how the arrival of Dell and Compaq contributed to price reductions across the PC market.

2. Macroeconomics Case Study

Another case study that could support my claim regarding how model-based explanations in economics can provide HAEs can be drawn from one of the key models in macroeconomics.

The *Core-Periphery* (CP) model is a general equilibrium model used to explain regional inequalities by concentrating on certain forces pertaining to economic activities (Marchionni 2006, 430). More specifically, the model is manipulated in order to explain why economic activity agglomerates at certain pivotal points[7].

The model operates based on three effects. First, there is the 'market access effect', which describes how monopolistic firms tend to locate their production in large markets. Second, the 'cost of living effect' links a firm's location choices to the local cost of living, by noting that goods often become cheaper in areas with more industry due to a more limited range of imported products. As consumers often reside in areas where there are more industrial firms, goods in the marketplace generally become cheaper since the range of products imported is generally more limited. Third, the 'market crowding effect' suggests that firms facing imperfect competition prefer to set up shop in regions where there are fewer competitors. Centripetal forces, associated with pecuniary externalities, are characterized by decreased average costs resulting from an increased total output across the industry (Marchionni 2006, 431). In contrast, centrifugal forces include market competition, thus rising input prices, and congestion-related costs (Mäki and Marchionni 2009, 189). By virtue of being centripetal forces, pecuniary externalities function as forces that promote the concentration of economic activity, whereas centrifugal forces such

[7] With this model, the 2008 Nobel Prize for Economics was awarded to Paul Krugman for his contributions to 'new economic geography' (Kuorikoski et al. 2010, 553).

as immobile factors, congestion, and similar elements drive its dispersion (Marchionni 2006, 431).

The tension between these two sets of factors is decisive for the occurrence of cumulation. Hence, as Caterina Marchionni described, the CP model can be characterized by the presence of multiple equilibria: the occurrence and location of agglomeration dependent on the relative strength of various forces and initial conditions, such as prior locational choices (Marchionni 2006, 431). Various idealizations conducive to the CP model are used to explain concentration of economic activity within particular zones.

Uskali Mäki and Caterina Marchionni (2009, 188) outlined the following assumptions that underpin the CP model:

(1) There are two identical locations: n_1 and n_2.
(2) There are two sectors, A and M.
(3) A is tied to a location and produces a homogeneous good, G_A, under constant returns to scale. M is a monopolistic competitive sector: there are a large number of firms producing, under increasing returns to scale, differentiated products, g_{m1}, g_{m2}, ..., g_{mn}.
(4) Each sector employs a specific factor of production: L_A and L_M.
(5) L_M moves across locations in response to changes of its price; L_A is immobile between locations.
(6) The good produced by M is subject to transportation costs, $1/T$.
(7) The typical individual in the economy demands both G_A and G_M. The typical individual not only prefers more goods to less, but also prefers a larger range of g_{m1}, g_{m2}, …, g_{mn}.
(8) M is evenly distributed between n_1 and n_2 under conditions C_1 and is agglomerated in either n_1 or n_2 under conditions C_2 (which amounts to identifying the break point, the conditions under which agglomeration becomes possible, and the sustain point, the conditions under which agglomeration is sustainable). In particular, M agglomerates for a low level of transportation costs.

Points (1) to (7) are explicitly simplifying assumptions that serve as premises, while point (8) is derived as a result based on them (Mäki and Marchionni 2009, 188). The way the CP model works can be put as follows:

> Replace n_1 and n_2 with types (or tokens) of locations (between which labor can move, such as zones within metropolitan areas, regions within a country, or regions involving more than one country, characterized by free mobility of workers, such as the European Union). Replace A and M with types (or tokens) of sectors (agricultural, manufacturing, service). Replace L_A and L_M with types of labor specific to each sector (agricultural labor, manufacturing labor, skilled or unskilled labor). Replace C_1 and C_2 with expressions that relate the main parameters to the distribution of economic activity: the share of the mobile factor, the level of transportation costs, the preference for variety (Mäki and Marchionni 2009, 188).

Based on three main forces or mechanisms, which function across different spatial scales, the CP model illustrates how agglomeration can emerge and persist. In the same

context, Kuorikoski et al. (2010)[8] stated that the distribution of the manufacturing sector between two locations is determined by the balance between centripetal and centrifugal forces. Centripetal forces arise from a positive feedback loop: as more firms and workers concentrate in a region, it becomes increasingly attractive to additional firms and workers due to the market-size effect. Economies of scale and transportation costs encourage firms to establish themselves in larger markets to minimize transportation costs, while workers and consumers prefer proximity to manufacturers as a means to reducing their living expenses and increased access to a wider variety of goods (since each firm produces a unique product). On the other hand, centrifugal forces arise from the necessity to cater to the immobile factor, which is uniformly spread across both regions, and from competitive pressures, as firms in larger regions encounter more competition and increased input costs. In Figure 2, a schematic representation depicts the model provided by Kuorikoski et al. (2010, 555).

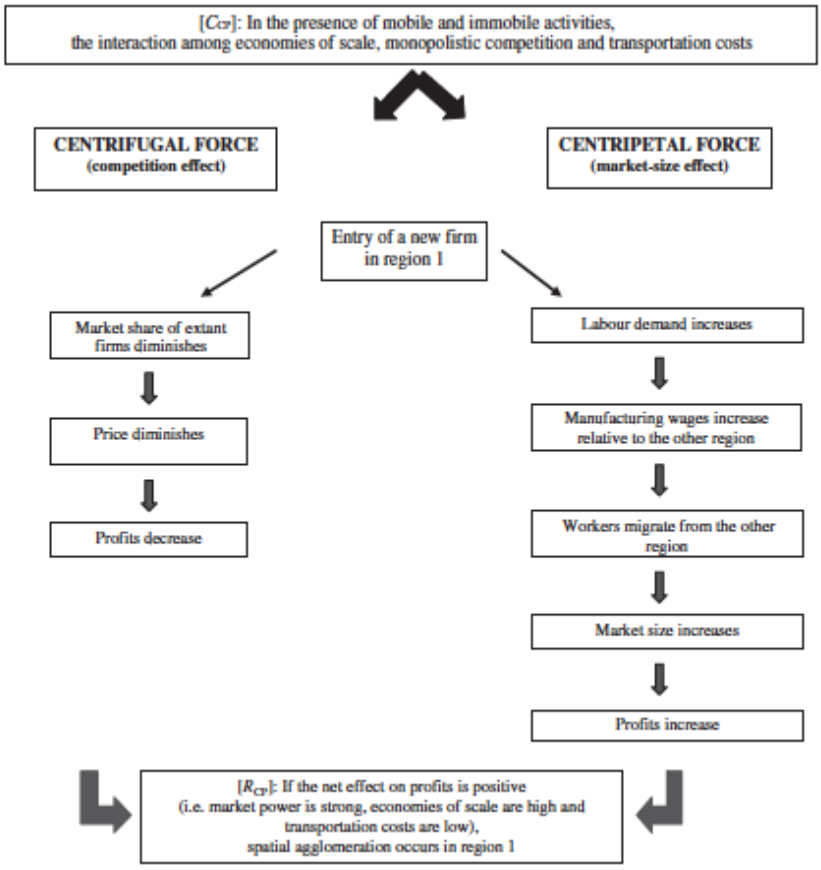

Figure 2. Core-Periphery Model (Kuorikoski et al. 2010, 555)

[8] Kuorikoski et al. (2010) considered the CP model in the context of robustness analysis.

The CP model offers the following explanation: *ceteris paribus*, spatial agglomeration happens when economies of scale are significant, market power is robust, and transportation costs are low; in other words, when centripetal forces outweigh centrifugal forces (Kuorikoski et al. 2010, 556). Thus, according to the model, the effects of market crowding are balanced by another set of effects: lower transportation costs, strong market influence, and substantial economies of scale (Kuorikoski et al. 2010, 556).

This brief analysis is intended to highlight the main forces involved in the CP model. By means of a set of idealizations together with two counteracting forces, namely, centripetal and centrifugal effects, the CP model *actually* contributes to the emergence and persistence of agglomeration behavior. Having remarked on the ways this model works, the following examines criticisms raised against the CP model.

The CP model's description is not of anything real. Analyzing some of the criticisms that have arisen against the explanatory power of the CP model is useful in order to assess its explanatory strength. Some of the arguments advanced by those who have expressed doubt regarding the explanatory power of the CP model have stated that the explanatory power of the CP model fails when it comes to explaining particular cases of agglomeration behavior (Marchionni 2006, 436). Much of the critique of the CP model's explanatory power has followed a similar pattern. Typically, they share a common structure where the CP model is perceived as inadequate for addressing why and where agglomeration occurs in certain locations but not in others. The recurring criticism appears to be that the CP model cannot answer these specific questions since it requires a different set of explanatory factors that, while related to, are not included in the CP model.

I would argue that explaining specific places of agglomeration could hardly be a plausible demand, given that such specific explanations and predictions are also hardly possible for exact sciences such as physics. For example, Nancy Cartwright noted that a physicist would not be able to predict a $1,000 bill's exact landing spot in St. Stephen's Square (1999, 27). Cartwright (1999, 27) cites Otto Neurath's example of a one thousand dollar bill that floats down from the leaning tower, and notes that its exact resting location in St. Stephen's Square cannot be predicted by a physicist. According to Cartwright, the successes of mechanics in accurately modeled situations do not prove its universal validity, but only its truth within its specific domain (Cartwright 1999, 27). The point is that not only economic models but also models in physics should sometimes face trade-offs between generality and specificity. Some models may serve well for some certain domains and the context of inquiry while others may fail to do so. Perhaps most of the details may not even be relevant from the point of view of the modeler. That is, in providing explanations, the interest of the modeler determines which questions are asked and which model(s) is/are being deployed, and this, in turn, decides contrast classes that ultimately lead to the specification of the explanandum.

Caterina Marchionni (2006, 436) argued along similar lines, by stating that questions about why clustering occurs in certain spots and not others may require an answer that involves a different set of explanations than those employed in the CP model, even though the new set could include certain elements of the CP model. However, she maintained that

this does not imply that the CP model is entirely devoid of explanatory value. Although the CP model may not entirely explain why clustering happens in some locations and not others, it can still provide an explanation as to why spatial clustering occurs rather than spatial dispersion (Marchionni 2006, 436).

From a philosophical perspective, one way to assess the explanatory power of the CP model is through contrastive approaches to explanations. While economics often includes extensive lists of causal factors, not every explanation examines all of these factors. Assessing causal factors in economics in relation to certain explanatory objectives seems an effective approach. Analyzing causal relationships within an economic model can be framed through the lens of contrastive explanations. Philosophers, such as Alan Garfinkel (1981, 28–41), Bas van Fraassen (1980, 126–129), and Peter Lipton (1990, 249–250; 1991), have highlighted and examined the role of contextual factors within explanatory practices. The key idea behind contrastive explanations involves contrast classes (Garfinkel 1981). Petri Ylikoski (2001) and later together with Jaakko Kuorikoski (2010) underscored the importance of contrastive methods in explanations more broadly. Referring to (Ylikoski 2001, 19), Marchionni rightly underlined that

> Notice that the contrastive approach to explanation is neither about what the explainee has in mind when asking for an explanation nor about what the explainer means when giving the explanation, but instead it is about what a given explanation can *actually* explain (original emphasis, as used in Marchionni 2006, 427).

These observations help clarify how economics uses causal factors to provide actual explanations of economic phenomena. It is accepted that economic explanations are connected to specific research interests, and that this determination aligns with contemporary economic practices. By identifying the implicit contrastive structure of the explanandum, we can pinpoint relevant explanatory factors within the broader causal network of the phenomena. In economics, these causal networks are often intricate, and not all factors involved are pertinent to the explanation. Questions related to contrastive accounts are generally framed as "Why *f* rather than *c*?", where *f* is the fact in need of explanation, and *c* represents an alternative to it (Garfinkel 1981, 21–22; Ylikoski 2001, 24). In cases where *c* consists of multiple alternatives, it is considered to be a contrast class (Ylikoski 2001, 24). Formulating explanation-seeking questions in contrastive terms can help clarify the goals of the explanation and facilitate its evaluation (Ylikoski and Kuorikoski 2010, 205). As Ylikoski and Kuorikoski (2010, 204–205) suggested, the contrastive structure helps to sharpen questions such as, "Are we explaining a specific event, or a broader phenomenon or regularity? What is the appropriate level of detail: micro-level specifics or macro-level patterns?".

Marchionni's distinctions are useful for comprehending the explanatory power of the CP model, differentiating between three dimensions of an explanation (2006, 429). *Explanatory variety* pertains to the range of contrastive questions a model can answer regarding the phenomenon being studied. Meanwhile, *explanatory depth* involves the extent and variety of detailed causal connections that the model can provide. In contrast,

explanatory scope pertains to the range of phenomena a model is capable of explaining (Marchionni 2006, 429). I find these distinctions particularly valuable since explanations cannot be fully understood from just one perspective. In order to appreciate how models provide explanations, they should be evaluated according to their various strengths, which are often spread across different dimensions. Martin King made a similar observation about examining different aspects of modeling, by emphasizing the following:

> Sometimes the aim of the modeler is to generate a maximally simple model, or to capture the large-scale structure of quite different systems <…> *Simple models will lose out on accuracy, but many models could have the accuracy added back in, at least in principle* (emphasis added, King 2016, 34).

The above quote captures the core idea of the CP model. Marchionni (2006) applied the contrastive approach to assess its explanatory power, and stated that although the CP model's ability to address contrastive questions is somewhat limited, it can effectively explain why economic activity tends to cluster rather than spread out across different scales (2006, 438). However, as noted by King (2016), and based on Marchionni (2006, 438), there is potential for the model's explanatory variety to expand with further extensions and modifications. Consequently, I concur with Marchionni's assessment that the CP model has both substantial explanatory scope and depth (2004, 438). While its explanatory variety may be limited, the model demonstrates significant explanatory scope and depth. The limited range of contrastive questions is expected, given that, in economics, as well as in other specialized sciences, few causal factors or mechanisms are isolated. This limitation does not necessarily imply that the overall explanatory power is restricted, as this would require case-specific analysis (Marchionni 2006, 438). While some general economic models might initially appear to offer only abstract causal mechanisms suitable for HPEs, the relative nature of models with related contrast classes suggests that limited contrastive explanations do not necessarily preclude the possibility of providing actual explanations.

Focusing on a segment of the causal network brings specific causal factors into sharper focus. Contrastive analysis of explanations appears to be an effective method for exploring the potential for HAEs offered by economic models. I believe that clarifying the explanation-seeking questions and the explanandum is crucial in assessing whether the explanations given by economic models are HPEs or HAEs. Additionally, I do not intend to favor any particular theory of explanation; I remain neutral regarding different explanatory frameworks. I posit that the modeler's interest is key in shaping the contrast classes and defining the explanandum. However, determining the contrast class does not render the resulting explanation subjective. Once the contrast class has been established, evaluating whether explanations address the explanandum becomes an objective matter. The value of the contrastive approach lies in grasping the intimate relationship between the explanation and the explanandum. Take the CP model, for example. In this model, it is essential that the explanatory factors continuously operate, and their relative strength compared to other forces is critical in the emergence of clustering behavior (Marchionni 2006, 437). The model's core causal mechanism involves economies of scale, imperfect competition, transportation

costs, and mobile versus immobile activities, and the way how these factors interact is central. The balance between centrifugal and centripetal forces, resulting from the interactions of these components, is crucial for determining whether or not agglomeration occurs (Kuorikoski et al. 2010, 557). As Marchionni noted (2013, 334–335), among the available philosophical theories of explanation, James Woodward's approach is widely accepted by both philosophers and scientists as it aligns with many scientists' intuitions regarding what constitutes an explanation (Woodward 2003; Ylikoski and Kuorikoski 2010). I argue that the model's explanatory strength can also be understood through Woodward's framework of causal explanation. Woodward's (2003) approach to explanation through intervention relies on counterfactual reasoning. In his account, counterfactuals are crucial because the explanation is connected to hypothetical scenarios that might change the explanandum. The assessment of explanatory power, according to Woodward (2003), revolves around the number of 'what-if' questions ('w-questions') that can be addressed through explanatory factors, while considering a specific set of background knowledge.

The forces represented by the CP model are appropriate for Woodward-inspired intervention, meaning that, in principle, one can manipulate them and explore possible scenarios through counterfactual dependencies. Although the CP model aims to explain agglomeration and may sometimes fall short in explaining specific occurrences, this does not necessarily mean that it fails to explain general patterns. The model's capacity to explain specific or general events may sometimes be restricted, but this does not rule out its potential to contribute to HAEs.

Depending on the context and the modeler's interests regarding the appropriate contrast class, the CP model might still contribute to HAEs by providing causally significant information that distinguishes between the explanandum and its contrasts. Thus, even with relatively limited contrastive explanations, the CP model can still offer *actual* explanations.

3. Recapitulation

I believe that, in order to understand how economic models offer actual explanations, certain key points should be taken into consideration.

Before addressing these issues, I want to clarify a few points. I argue that economic models are intended to only partially represent phenomena. This is the case because scientific representation is necessarily a version of reality that is incomplete, distorted, or idealized[9]. However, this does not imply that they are incapable of offering HAEs. The goals of the modeler, along with the specific interests and context of the investigation, play a crucial role in determining the information included in the explanation. Even though economics frequently involves comprehensive lists of causal factors in its explanations, not every factor is examined in every explanation. The choice to exclude certain details

[9] In this context, I should note that, in terms of the nature of scientific representation, I do not necessarily adopt any of the constructivist-isolationist positions. For details on the related discussion, see the following two articles and the references they contain (Knuuttila 2009; Mroz and Hardt 2020).

should be guided by the particular problem and the explanandum being addressed. The CP model illustrates how effectively this approach can be applied in providing explanations in economics. If the propositions are developed from contrastive class questions using 'what-if' scenarios that adequately reflect the empirical propositions, then we obtain partial – yet *actual* – explanations of the phenomena being analyzed.

Certain fundamental explanatory questions necessitate basic models, as demonstrated by the case of price reductions in the personal computer market during the 1980s. It should be noted that models addressing price reductions within competitive markets are contextually explanatory, often limited to a specific time and place, such as the PC market in the United States in the 1980s. Background conditions are crucial for the explanations and models used, but this does not mean that they only provide HPEs. For certain purposes and contexts, these models can offer *actual* explanations, as demonstrated by the case of personal computers. While the explanatory depth and scope of these models may be questioned, they are not merely theoretical exercises. I argue that if we take the argument from complexity seriously, we should adopt a pluralistic and pragmatic approach to explanations in economics. Indeed, it is a fact that economics is a causally pluralistic discipline (Maziarz 2020; Maziarz and Mroz 2020)[10]. The challenges associated with model-based economic explanations arise from both the 'phenomenon-side' and the 'model-side' (Herfeld 2018, 191, 193; Mäki 2013, 89). Concerns about economic models suggest that they are limited both ontologically and pragmatically (Mäki 2013; Herfeld 2018). The ontological issue pertains to the resemblance between the model and the real world, while the pragmatic concern relates to how the model functions, particularly in terms of prediction and explanation (Herfeld 2018, 191). These concerns raise difficulties in justifying the models (Mäki 2013, 89). Adopting a pluralist and pragmatic approach to economic explanations offers a way to address these challenges in model-based explanations.

Economic explanations should be evaluated with respect to related perspectives. As Carl G. Hempel noted (1965, 421–423), instead of providing complete explanations of events, we focus on explaining specific aspects of them. Ylikoski and Kuorikoski (2010, 204) made similar points. This focus on aspects indicates that explanations are inherently partial. Although this might reasonably seem somewhat frustrating, it relates closely to the essence of scientific practice. The fact that scientific explanations are not concerned with the whole, but only with a part of the phenomenon to be explained is common to economics and the exact sciences (Hempel 1965, 417). Economic explanations, like those found in other disciplines, are dependent upon specific interests and contexts, and contrastive explanations therefore help us examine these variations. While it is sometimes sufficient to accept that certain explanations are better due to their superior detail, more detailed explanations are rarely seen in economics. In many cases, modelers seek general patterns rather than micro-level details. In other words, the accuracy of an explanation is determined by the task at hand.

[10] For details on the causal pluralist position in economics, Mariusz Maziarz's (2020) book and the articles he co-authored with Robert Mróz in the same year (2020) can be reviewed.

Van Fraassen's (1980) perspective on the pragmatics of explanation provides a framework for understanding explanations in economics. He argues that explanations should not be viewed simply as a two-term relationship between theory and fact. Instead, van Fraassen proposed that explanations should be considered as a three-term relationship involving theory, fact, and context (1980, 153). The questions considered relevant to the explanation and which explanation is appropriate for the phenomenon to be explained are closely related to the context of the inquiry itself and the interest of the researcher. For example, in analyzing the IBM case and its market entry results, the model used might initially appear designed to explore the general relationship between the market entry and the price reduction rather than explaining the specific price drop of a particular firm. However, it effectively explains why IBM could not maintain its high profits after Dell and Compaq entered the PC market. The model, in its current form, outlines a space of possibilities with what-if scenarios. By incorporating relevant details on specific interests and applying them to the context of the PC market in the 1980s, the model *actually* explains how IBM's profits declined due to market entry. As Marchionni (2013, 335) explained, there is a distinction between evaluating how a specific explanatory strategy performs in terms of particular dimensions of explanatory power and determining the best explanation for a phenomenon. Explanations are characterized by factors such as their level of precision, abstraction, and whether they address a singular event or a broader pattern. These factors influence the type and extent of causally relevant information included (Marchionni 2013, 335). While some of these dimensions can be traded off against each other, "actual scientific explanations *may perform well on one dimension while performing poorly on others*" (emphasis added; Marchionni 2013, 335). In economics, there can be fundamental models that not only offer HPEs but also HAEs. Some models may be used to propose HPEs without considering their potential as HAEs. However, as demonstrated in previous sections, certain microeconomic supply-demand models and macroeconomic models can provide HAEs.

Before concluding, some clarifications are necessary. The question of whether a model that aids in explanation is true differs from whether the model is applicable in a specific case[11]. Determining whether a model is true is the focus of robustness tests which assess the truth of the explanans by examining the truth conditions of the model's conditional part, and this involves reasoning *about* models. On the other hand, applicability concerns whether the antecedent of the model is met in the situation at hand, which involves reasoning *with* models.

4. Conclusion

In this paper, I argued for a pluralist and pragmatist perspective on understanding the way in which economic models can provide *actual* explanations. A combination of Wood-

[11] I want to mean models that contain conditional propositions, and not every model since some models may not consist of propositions.

ward-inspired framework and contrastive explanations may be employed for an accurate assessment of the nature of HAEs obtained through certain economic models. From the pluralist and pragmatist perspective, another theory of explanation could be considered, so long as it recognizes the existence of multiple aspects of explanatory power. Approaching scientific explanations and their components, the explanans and explanandum, in the way suggested by the pluralist and pragmatist methodology, allows us to see that model-based explanations in economics can at least sometimes provide HAEs, and that these explanations can vary in strength and weakness across different dimensions.

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