

Summary of the Philosophy of Causality in Economics: Causal Inferences and Policy Proposals

PhD thesis prepared under the supervision of prof.
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The List of Contents

Abstract	3
Chapter 1: The purpose of the project and research methods	4
Chapter 2: Empirical regularities	6
Chapter 3: Probabilistic dependencies	7
Chapter 4: Counterfactual dependencies.....	9
Chapter 5: Mechanistic reasoning	11
Chapter 6: Discovering intervention-neutrality.....	12
Chapter 7: Concluding Remarks	15

Abstract

The primary purpose of *The Philosophy of Causality in Economics* is to address the questions of [1] what are the methods of causal inference employed in contemporary economics; [2] what are the views of economists on the meaning of causality; [3] what are the philosophical presuppositions on causality implicitly accepted by economists; and [4] what are the implications of the answers for economic policymaking. In order to address these exploratory questions, I proceed with in-depth case studies of contemporary economic research. Aiming at representativeness of contemporary economics, the case studies have been chosen on the ground of a systematic literature review of three most influential economics journals (*American Economic Review*, *Journal of Political Economy*, and *Quarterly Journal of Economics*) published from 2005 until 2015 (see Maziarz 2018). The book considers five key causal approaches: the regularity approach, probabilistic theories, counterfactual theories, mechanisms, and interventions, and manipulability. Each chapter opens with a summary of the literature on the relevant approach and discusses its reception among economists. The text details case studies, and goes on to examine papers which have adopted the approach in order to highlight the methods of causal inference used in contemporary economics. It analyzes the meaning of the causal claim put forward, and finally reconstructs the philosophical presuppositions accepted implicitly by economists. The strengths and limitations of each method of causal inference are also considered in the context of using the results as evidence for policymaking. The book advances economic methodology by arguing that economists are moderate causal pluralists and exploring the implications of this stance on economic policy-making. The summary proceeds with synopses of the seven chapters.

Chapter 1: The purpose of the project and research methods

The purpose of the first chapter is to introduce the reader into the philosophy of causality, put forward research questions, define the purpose of the book, and describe the method of inquiry.

A brief look at the chronological development of the philosophical debates on causality shows that there currently are several opposing views on what causality is (ontology) and how causal relations can be uncovered (epistemology). In this chapter, I claim that we lack systematic research on causal inference in economics and elaborate on my research methods. The questions of how economists define causality and what philosophical presuppositions they accept can be addressed by analyzing the types of relations that can be uncovered and represented by research methods. Despite causal talk in economics regaining in popularity nowadays (Hoover 2004), methodology of economics lacks a systematic study of the methods of causal inference. The majority of methodologists interested in causal inferences attempt at guiding economists and conduct normative analyses. The hitherto descriptive research on the topic is fragmentary. Four different approaches can be distinguished. First, some analyses focus on discussing the points of view on causation presented by philosophers of economics. Second, studies focus on the historical development of a chosen method or analyze the approach to causal inference practiced by a famous economist. Third, some philosophers attempt to review the philosophy of causality literature and making it relevant to economic research. Finally, a few notable studies focus on analyzing chosen cases of causal economic research with a view to uncovering the meaning of causality presupposed by economists. However, because of a limited sample, they do not deliver a systematic knowledge of causal inferences in economics. Francois Claveau and Luis Mireles-Flores studied the meaning of causal generalizations employing referentialist (2014) and inferentialist (2016) semantics using an OECD report on unemployment as an example. On the grounds of a few case studies, Tobias Henschen (2018) supported a manipulationist definition of causality as adequate to macroeconomics what has lead to an exchange of arguments with Maziarz and Mróz (2019).

Today, some questions connected to causal inferences in economics stay open. On what grounds causal conclusions are put forward, what ‘causality’ means for economists, what philosophical assumptions underlie the methods used for causal inference, and what are the

implications for economic policy-making are the problems I address in the book. My research aims at developing our understanding of causal research in economics and helping policymakers understand the limitations of employing causal conclusions to intervening in the world of economy. My approach to addressing the research questions is based on the view that the use of causal label by economists implicates that either economists interpret their study as delivering evidence for the presence of this type of relation or use this name with a view to underline the importance of conclusions and their application to policymaking. In either case, the question of what ‘causality’ means arises. The use of specific research methods can give a hint of which of the five approaches of causality is implicitly presupposed by economists. Alternatively, my analysis focusing on studying the research methods used by economists to draw causal conclusions aims at uncovering the meaning of causal conclusions that can justifiably be drawn from each method of causal inference employed by economists. This allows for putting forward economic policymaking implications.

At a previous stage of my research, I have systematized and described research methods employed by economists to put forth causal conclusions employing systematic literature review of the research published by three top economic journals (*American Economic Review*, *Quarterly Journal of Economics*, and *Journal of Political Economy*) between 2005 and 2015 (Maziarz 2018). I have chosen the studies including *explicitly* causal conclusions and described statistically the prevalence of research methods (Maziarz under review). In the book, given the exploratory nature of the research questions, I exemplify the most common methods of causal inference with in-depth case studies chosen from the sample and deliver (brief) examples of those methods that are not popular today. Each case study proceeds as follows. First, I briefly review the context of the study that specifies empirical and theoretical research on the topic under consideration. Second, I analyze the research method employed by the authors of the article under consideration. Third, I study the types of causal relations that can be discovered by used methods. Fourth, I consider what the economic world would have to be like for the conclusions to be justified and reconstruct the presuppositions implicitly accepted by the use of each research method. Finally, I discuss types of policy interventions justified by evidence and their limitations.

Chapter 2: Empirical regularities

Chapter 2 focuses on the regularity theories of causality and research methods grounded in this understanding of causality. In the first part, I briefly review the development of the regularity view on causality. Four different types of regularity theories can be distinguished. First, causality can be understood as two events being constantly conjoined; i.e., appearing at the same time and space. Second, causal relations can be defined as empirical regularities instantiating ‘necessary connection,’ i.e., regularities produced by a law of nature. Third, causes are, in some cases, defined as difference-making factors, or the INUS conditions. Fourth, according to the logical-positivist reductionism, there is nothing beyond appearances in laws of nature (the regularity view of laws, or RVL). David Hume, who defined causality in terms of constant event conjunctions, is the father of this reductionist position. Due to criticism, John Stuart Mill added the requirement of necessary connections between conjoined events. In the first half of the twentieth century, logical positivists revived the reductionist view. The regularity approach was further developed by defining causes as difference-making factors, or INUS conditions. I also discuss philosophical views of econometricians from the Cowles Commission.

In Section 2.2, I focus on case studies of research methods employed by economists. The main research methods aimed at uncovering constant event regularities are structural equation modeling (SEM), theory-driven econometrics, and two cliometric studies of economic history (an analysis employing narrative records and statistical analysis). Economists infer causal claims employing research methods that are capable of discovering constant event conjunctions or law-like regularities present in the economy. Three main approaches can be distinguished. First, theory-driven econometric research aims at uncovering empirical regularities instantiating Mill’s necessary-connection requirement (or its contemporary counterpart; i.e., a realist view on scientific laws). I instantiate this approach with the case study of analysis conducted by Nicholas Bloom et al. (2012). Their method can be labeled as theory-driven econometrics, whereby the causal structure is identified using aprioristic modeling, and the strength of considered relation is

estimated with econometric techniques from observational data. I also consider structural equation modeling that, despite being rarely used today, is of historical importance, and instantiate this method with the study of Artuc et al. (2010). Second, I analyze cliometric methods aimed at establishing the causal generalization in line with the constant-event-conjunctions view. Cerra and Saxena (2008) employ narrative records and quantitative techniques to analyze the relationship between economic crises and subsequent economic development. Third, I use the study of Reinhart and Rogoff (2010) a cliometric study presupposing the regularity view of laws.

In Section 2.3, I discuss how evidence delivered by the research methods can be employed to policymaking. I differentiate between theory-driven and data-driven regularities, and discuss why such evidence does not warrant causal claims to be invariant under intervention and its heavy reliance on theory. I argue that while cliometric methods are unable to assert the relations to be invariant under intervention, theory-driven econometrics delivers evidence, which reliability depends strongly on the accuracy of theory. Also, I introduce the notion of translating the meaning of causal claims for policy purposes. I summarize the chapter by differentiating between the two types of interventions and argue that only those policy actions that do not rely on ‘translating’ causal claims into the manipulationist view are vindicated.

Chapter 3: Probabilistic dependencies

Chapter 3 discusses the probabilistic approach to causality that reduces causal relations to changes in conditional probability. In the theoretical part, I summarize the criticism of the regularity views and discuss the developments of Wiener (1956), Suppes (1970), Good (1959), and Cartwright (1979). In general, the probabilistic theories of causality are prevalent in defining the relation in the following way: C causes E if and only if (1) C and E are spatiotemporally connected, and (2) the occurrence of cause C raises the probability that effect E will occur: $P(E|C) > P(E)$ I also review philosophical issues in the debate on econometrics: the views of

Hicks (1979), and Granger's (e.g., 1969) development of Wiener's definition of causality as a change in predictability that gave birth to the project of atheoretical econometrics.

The discussion of case studies covers an exercise in vector-autoregressive modeling as a conventional example of atheoretical econometrics and a cross-sectional model. The latter example shows that also regressions usually interpreted as pieces of theory-driven econometrics can be practiced in an atheoretical way; i.e., without establishing causal structure on aprioristic grounds. Generally speaking, the probabilistic approach to causality won the hearts of the quantitatively oriented economists. All methods of causal inference share in common use of the knowledge about time precedence to establish the direction of causality between correlated variables. The Granger-causality tests, directly employing one of the probabilistic definitions, are an obvious example. In contemporary economics, the tests are rarely employed as an exclusive method of causal inference. In Section 3.2.1, I discuss the analysis of Jaeger and Paserman (2008) that studied the Israeli-Palestinian conflict by means of testing for Granger causality in a vector-autoregressive framework. The case is a prime example of drawing causal conclusions from time-series data. However, economists also arrive at causal conclusions understood in agreement with a version of the probabilistic definitions by studying cross-sectional data. In the case of datasets that do not consist of time-indexed variables, the atheoretical grounds for distinguishing between causes preceding effects in time are less obvious. In general, economists use knowledge of how data were generated. In Section 3.2.2, I analyze Stock et al.'s (2006) study of the causes of dropouts from Ph.D. programs in economics that instantiate such an approach and establish the direction of causality on the factual knowledge on the time precedence of phenomena represented by the variables included into the analysis.

In Section 3.3, I focus on the use of atheoretical econometric studies as evidence for policymaking. My main concern is that such results are susceptible to the common-cause fallacy, or spurious correlations. To offer a practical solution to this problem, I distinguish between policy actions that do and do not break the causal structure and exemplify these two types of

interventions with examples. I argue that policymakers in principle cannot exclude the possibility that causal claims based on the probabilistic evidence result from the common-cause fallacy and therefore are not invariant under interventions (when the system is kicked out from its usual state). Hence, such evidence can only be employed in support of policymaking actions that do not interfere with the causal structure producing phenomena of interest. My argument is of inductive nature. Lutkepohl's (1982) deductive result establishes that the presence of Granger causality in a two-dimensional model does not generalize into a three-dimensional model, including another causally relevant variable. Sims' (1972, 1992) empirical results suggest that the change from a three-dimensional model into a five-dimensional model can result in detecting that the three-dimensional model excluding other relevant variables establishes a spurious causal relationship. Given that any economic policymaking takes place in the economy rather than in an experimental setting, excluding factors not present in the econometric model being evidence for that claim, the policymaker intervenes on a more-dimensional process than the one modeled econometrically.

Chapter 4: Counterfactual dependencies

Chapter 4 focuses on the counterfactual theories of causality. Economists employ counterfactual causal claims of the form 'if C did not happen, then E would not happen' to establish singular (token-level) causal claims. It is useful to divide counterfactual claims into the manipulationist and Galilean counterfactuals. I analyze the philosophical literature developing Hume's second definition of causality and studying how can we deliver evidence in favor of a counterfactual claim. First, I review the main philosophical theories of counterfactual causality and discuss a few significant problems with the counterfactual approach and responses to these problems. Later, I review the discussions from the methodology of economics literature that are relevant to the counterfactual view on science. In particular, I review the theories put forward by Lewis, Mackie, and other counterfactual formulations of the necessary condition. Furthermore, I consider the views of philosophers on the use of counterfactuals in research practice (voiced by

Cartwright and Reiss (2008), and Cook, Campbell, and Shadish (2002)) and philosophical discussion on the methods of case-study analysis.

The second part focuses on the methods of causal inference aimed at justifying counterfactual claims: drawing counterfactual claims from a previously established calibrated model and a case study. First, singular causal claims can deductively depend on (results from) a model depicting type-level causal relations. Second, they can result from a detailed study of a particular instance. In section 4.2., I instantiate these two main approaches to supporting singular causal claims with two types of causal claims. Mian and Amir Sufi (2012) put forward a counterfactual causal claim on the grounds of their econometric model (Section 4.2.1) aimed at analyzing the influence of fiscal stimulus ('cash for clunkers') on economic development. The counterfactual analysis assessed the effects of the stimulus package by comparing car purchases in cities most and least affected by the program. Heidi Williams (2013) conjectured about the influence of intellectual property rights on the innovation of the human genome project, establishing the token-level causal claim on the grounds of a case study.

In Section 4.3, I comment on the distinction between Galilean and manipulationist counterfactuals. The latter type of counterfactual claims does not warrant that an intervention on a cause will result in a change in its effect. This undermines some (but not all) types of interventions. I consider how policymakers can deal with this problem and conclude by discussing the vices and virtues of the counterfactual evidence. I argue that academic economists put forward Galilean counterfactuals. Employing the 'causes as necessary conditions' definition has serious policy implications. Given that effects usually result from a few (more than one) necessary conditions, policymakers willing to employ such evidence need to establish that all relevant factors present in the research setting also operate in the policy setting. Even though the manipulationist counterfactuals directly support the policies they describe, the evidence required to establish them is challenging to gather, what I exemplify with the case of the discussion of the effectiveness of Troubled Assets Relief Program.

Chapter 5: Mechanistic reasoning

Chapter 5 discusses the mechanistic approach to causality. As usual, in the first section, I focus on discussing mechanistic theories of causality with the view to distinguish between ontic and epistemic views. The mechanistic approach to causality identifies causal relations with mechanisms underlying or producing effects. The notion of mechanism is employed “to refer to a variety of systems or processes that produce phenomena in virtue of the arrangement and interaction of a number of parts” (Glennan 2012, p. 315). Ontologically, causal relations are identified with mechanisms constituted by causes that produce effects. Epistemically, accepting this approach leads to accepting only such inferences about causal relations that deliver mechanistic evidence. The two notions seem to be interrelated in the research practice of economists. I also review various definitions of ‘mechanism’ and consider the concept of economic mechanism put forth by Marchionni (2017). Furthermore, I discuss the mainstream methodology of economics discussions regarding theoretical modeling that interprets theoretical models as models of mechanisms.

In section 5.2., three methods of causal inference aimed at uncovering theoretical mechanisms are exemplified with in-depth case studies: inferring causal claims on a ground of a nonempirical theoretical model, calibrated theoretical model, and its special case, DSGE (dynamic stochastic general equilibrium) model. I argue that economists use theoretical, axiomatic models to represent either possible or actual mechanisms and that the causal claims based on such evidence presuppose a version of the mechanistic view on causality. I distinguish between purely theoretical models that are not based on any empirical input and calibrated models that employ statistical data to amend axioms and choose the values of parameters. The former group of models represents possible mechanisms, while the latter group stands for actual mechanisms. Highly abstract, axiomatic models (such as Schelling’s checkerboard model considered previously) are purely theoretical (nonempirical); i.e., do not use data in any formalized way. The whole input to such models are axioms chosen by modelers. On the

contrary, calibrated models base the values of some parameters on ‘calibration.’ First, I consider Kotchen’s (2006) game-theoretic model of a market mechanism for green goods having features of both public and private goods (4.2.1). Second, I discuss Parry and Small’s (2009) calibrated model of a mechanism underlying the relationship between public transport subsidies and transport efficiency in agglomerations. Third, I study Christiano et al.’s (2011) DSGE model devoted to studying government spending multiplier.

In Section 5.3, I discuss the use of theoretical models of mechanisms for economic policymaking. First, I argue that highly abstract, purely theoretical models can only represent possible mechanisms, and the move from a possibility claim to the actuality claim requires extensive empirical work. Furthermore, this empirical research is likely to suffice for establishing a causal claim on its own. I refer to this problem using the notion of ‘mechanist’s circle’. Second, I consider whether knowledge of an actual mechanism is sufficient for conducting effective interventions. I disagree, and argue that since theoretical models represent single mechanisms, then it is in principle possible that its work will be influenced by other mechanisms operating at the same time and place. Given that mechanistic evidence does not allow for predicting the effects of interventions reliably, translating a conclusion from a mechanistic into the manipulationist understanding of causality is not justified. Finally, I find the role of mechanistic evidence in planning and introducing institutional changes that promote an expected outcome but do not warrant it.

Chapter 6: Discovering intervention-neutrality

Chapter 6 focuses on the last of the ‘big five’ approaches to causality. The first section starts by reviewing the manipulationist theories of causality and analyzing why they are usually considered as most adequate by philosophers interested in policymaking-oriented sciences. The label ‘manipulationist approach to causality’ covers two distinct views. On the one hand, agency theories define causality in terms of free (human) action influencing an effect. On the other, the

notion of manipulability is considered theoretically and includes all possible interventions. Roughly speaking, both groups of theories accept the identification of causality with manipulability: X causes Y if and only if a possible or actual change in X causes a change in Y . I argue that James Woodward's interventionist theory can only be interpreted ontologically because it uses the notion of ideal intervention that is too strict to be implemented in research practice. Furthermore, I consider the manipulationist reading of econometric modeling and discuss philosophical views on experimental and quasi-experimental research designs.

Section 6.1. covers also the recent debate on the meaning of causality in macroeconomics. Recently, Henschen (2018) has supported a version of the manipulationist definition of causality as a concept adequate to macroeconomics. In response, I and Mróz (Maziarz and Mróz 2019; Maziarz and Mróz 2020) argued that while it is adequate to some macroeconomic models, other macroeconomic models (VAR models standing for probabilistic dependencies and DSGE models representing mechanisms) can be considered to be causal only if one accepts other definitions of causality. Given that economists refer to such models as causal models and their direct application to macroeconomic policymaking, a version of moderate causal pluralism seems to be an adequate view on causal relations represented by macroeconomic causal models. Henschen (2020) responded that his manipulationist definition is normative in nature, and therefore, it should serve the purpose of differentiating between causal and noncausal models. While I agree in this book that having evidence that a relation under study is invariant under intervention is superior to other types of evidence, I do not think that other notions of causality (or types of evidence presupposing these different notions) should be excluded from economics.

The second part of the chapter focuses on the growing number of studies employing various experimental approaches to causal inference. I analyze four case studies of research methods that allow for uncovering relations invariant under interventions. The number of economic studies that use experimental or quasi-experimental research design (design-based econometrics) is rapidly growing (Hamermesh 2013; Meyer 1995). The following two studies

exemplify quasi-experimental research design. Doyle's (2007) study of the influence of foster care on children's wellbeing and income uses instrumental-variable design to construct quasi-experiment (Section 6.2.1). Pop-Eleches' (2006) analysis of the introduction of abortion ban in Romania employs regression-discontinuity design to study its influence on children's socioeconomic wellbeing. The latter two studies instantiate two experimental approaches. Hussam et al. (2008) conducted a laboratory financial market experiment to study how the experience of market participants influences the emergence of bubbles. Finally, I analyze the case of the gold standard of causal evidence. Dupas and Robinson (2013) conducted randomized field experiment to address the question of why saving propensity among the poor is low.

The third, policy-oriented, section focuses on the use of experimental and quasi-experimental evidence for policymaking. I differentiate between two types of extrapolation, and argue that the extrapolator's circle can be solved by conducting contextualized experiments that address policy questions. I interpret experimental and quasi-experimental research designs (field and laboratory experiment, instrumental variable estimation, and regression-discontinuity design) as presupposing the definition of causality in agreement with the agency theory of Menzies and Price (1993). Furthermore, I approach the problem of extrapolation (external validity). I differentiate between 'populational extrapolation' and 'extra-populational extrapolation' and argue that the philosophical discussion on the problem of extrapolation focuses on the latter notion, while the former (i.e., taking results of a study of a population's sample as evidence for policy targeting that population) is relatively unproblematic. However, inferring relations invariant under interventions does not imply that they can be employed in all types of policymaking. Causal claims based on the experimental and quasi-experimental research designs hold only at the level of populations. At the singular level, interventions only modify the probability that an effect will follow, but do not allow for concluding that a causal claim is deterministically true for each case. Therefore, translating manipulationist causal claims into the counterfactual notion may lead to unexpected policy outcomes.

Chapter 7: Concluding Remarks

Chapter 7, which plays the role of a summary, summarizes the responses to the research questions delivered throughout the book. I argue in favor of a thesis that economists as a group are conceptual pluralists: they use various methods of causal inference that allow for formulating causal conclusions understood in line with different notions of this relationship. Otherwise, if one did not ascribe to causal pluralism, then some relations deemed causal in contemporary economic research published by top economic journals would not deserve the causal label. These different types of evidence support causal claims based on different notions of causality, and therefore having different policy implications. Policymaking on the basis of insufficient evidence may lead to undertaking careless actions or obtaining unexpected outcomes. Given the framework of referentialist semantics and the focus on reconstructing the meaning of causal claims, I use the notion of ‘translation’ to denote taking a causal claim and using it in disagreement with what is implied by the evidence behind that claim. For instance, if causal evidence suffices only to put forward a causal claim that is in agreement with the probabilistic view, but a policymaker decides to intervene by changing the relata of causal claims, then they commit themselves to translating the causal claim from the probabilistic understanding into the manipulationist notion. The translation, without additional empirical support, is unjustified.

What follows, not each kind of causal evidence can justify interventions understood in line with the manipulationist definition of causality. In other words, I argue that translating causal claims into the manipulationist notion is not justified, and may lead to unexpected policy outcomes or failed interventions. I develop my argument that causal claims that are based on a research method for uncovering relations understood in some way (in line with one of the philosophical approaches to causality) cannot be translated into other meanings without additional evidence. The unjustified translation of causal claims leads to unsuccessful policy interventions. However, more questions are waiting to be addressed at the intersection of philosophy of causality and causal inference in economics. In concluding, I indicate the questions regarding causal inference in economics that wait to be addressed.

In the PhD thesis, I have contributed to the contemporary methodological and philosophical debates on causal inference in economics. In particular, I have offered the first systematic study of the meaning of causal claims put forward by economists and the

reconstruction of philosophical presuppositions. Moreover, I have analyzed the epistemic justification for using different types of causal conclusions as evidence for decision-making regarding economic policy.

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