



Turun yliopisto
University of Turku



ESSAYS ON SYNTHETIC
COUNTERFACTUALS IN
APPLIED ECONOMETRICS

Erik Mäkelä



Turun yliopisto
University of Turku

ESSAYS ON SYNTHETIC COUNTERFACTUALS IN APPLIED ECONOMETRICS

Erik Mäkelä

University of Turku

Turku School of Economics
Department of Economics
Subject - Economics
Doctoral Programme of Turku School of Economics

Supervised by

Professor Heikki Kauppi
University of Turku
Finland

Professor Matti Viren
University of Turku
Finland

Reviewed by

Professor Pekka Ilmakunnas
Aalto University
Finland

Professor Karsten Staehr
Tallinn University of Technology
Estonia

Custos

Professor Heikki Kauppi
University of Turku
Finland

Opponent

Professor Karsten Staehr
Tallinn University of Technology
Estonia

The originality of this thesis has been checked in accordance with the University of Turku quality assurance system using the Turnitin OriginalityCheck service.

ISBN 978-951-29-6934-0 (PRINT)
ISBN 978-951-29-6935-7 (PDF)
ISSN 2343-3159 (Painettu/Print)
ISSN 2343-3167 (Verkkajulkaisu/Online)
Painosalama Oy - Turku, Finland 2017

ABSTRACT

This dissertation consists an introductory chapter and three empirical essays on the method of synthetic counterfactuals in applied econometrics. The method is applied in two distinguish themes. The first and second essays examine the effects of monetary unification on financial markets and fiscal policies. Third essay focuses on impacts of large scale labor supply shock on labor market outcomes.

Compared to the previous research on the analyzed topics, the main advantages of the applied methodological approach is that it relaxes the parallel trend assumption and it combines qualitative and quantitative techniques in comparative case studies. In addition, this dissertation extends the applicability of the traditional synthetic control method in different analytical settings.

The first two essays create counterfactual scenarios for the Eurozone countries and address question: what would have been the development in a country if the country had not adopted the single currency? The first essay analyzes the effect of the euro on long maturity government bond yields. The results suggest that before the latest financial crisis former high inflation countries benefitted whereas other countries faced costs from the membership. Since the crisis period, all member countries experienced significant adverse effects in terms of government borrowing costs.

The second essay examines the effects of the euro on sovereign risk from the viewpoint of fiscal sustainability. It is studied whether the membership in the monetary union affects government expenditures. The essay finds that the average government expenditures have been clearly higher compared to the counterfactual scenario with own currency, which also gives rationale for the finding that investors seem to perceive the monetary union as a factor that increases country's sovereign risk.

The third essay studies a question that has been a long-lasting concern in empirical labor economics; how labor supply shocks, especially immigration, affect labor market conditions. The third essay provides a reappraisal of the evidence from the influx that has been unique in the recent European history, the flood of more than half million returnees from Mozambique and Angola to Portugal in the mid-1970s. The objective of this essay is to study the impacts of large supply shock on labor market outcomes. In contrast to the previous evidence, this article finds that the influx had a significant adverse effect on labor market outcomes. The results suggest that the Portuguese labor market responded precisely the same way as the standard textbook model predicts: an increase in the number of workers lowered average labor productivity and wages.

Keywords: Synthetic control method, Treatment effect, Policy evaluation, Monetary union, Sovereign risk, Fiscal policy, Labor supply, Immigration

TIIVISTELMÄ

Tämä väitöskirja koostuu johdantoluvusta sekä kolme empiirisestä esseestä jotka käsittelevät synteettisen kontrollin menetelmää soveltavassa ekonometriassa. Menetelmää sovelletaan taloudellisten vaikutusten arviointiin kahdessa erillisessä aihepiirissä. Kaksi ensimmäistä esseettä käsittelevät rahaliiton vaikutuksia rahoitusmarkkinoilla sekä finanssipolitiikassa. Kolmannessa esseessä analysoidaan maahanmuutosta aiheutuneen työvoiman kasvun vaikutuksia työmarkkinoilla.

Verrattuna aiempiin tutkimuksiin edellä mainituista teemoista, väitöskirjassa sovelletun menetelmän etuna on että se ei vaadi oletusta yhdenmukaisista trendeistä analysoidun maan ja kontrollimaiden välillä. Tämän lisäksi menetelmä mahdollistaa sekä kvalitatiivisten että kvantitatiivisten lähestymistapojen hyödyntämisen vertailevassa tapaustutkimuksessa. Väitöskirja pyrkii laajentamaan synteettisten kontrollien menetelmää sekä sen käyttömahdollisuuksia erilaisissa sovelluskohteissa.

Kahdessa ensimmäisessä esseessä euromaille luodaan kontrafaktuaalisia kehityskulkuja, joiden avulla pyritään vastaamaan kysymykseen: miten maalle olisi käynyt jos se ei olisi liittynyt euroalueeseen? Ensimmäinen essee tutkii yhteisvaluutan vaikutuksia pitkän maturiteetin valtionlainojen korkoihin. Tutkimustulosten mukaan viimeisintä finanssikriisiä edeltäneenä aikana maat, joiden inflaatio oli korkea ennen rahaliittoa, hyötyivät rahaliitosta, kun taas muissa euromaissa rahaliitto nosti valtionlainojen korkoja. Finanssikriisin jälkeen euron vaikutus valtionlainojen korkoihin on ollut positiivinen kaikissa jäsenmaissa.

Toinen essee tarkastelee euron vaikutuksia maariskiin finanssipolitiikan kestävyuden näkökulmasta. Esseessä tutkitaan kuinka rahaliitto on vaikuttanut valtion menoihin. Tutkimuksessa havaitaan että euromaiden valtion menot ovat olleet selvästi korkeammat verrattuna kontrafaktuaaliseen skenaarioon, jossa maat olisivat jääneet yhteisvaluutan ulkopuolelle. Tämä tulos on linjassa ensimmäisen esseen johtopäätöksen kanssa, jonka mukaan sijoittajat arvioivat rahaliittoon kuulumisen maariskiiä kohottavana tekijänä.

Kolmas essee käsittelee kysymystä, joka on ollut pitkään empiirisen työn taloustieteen mielenkiinnon kohteena; kuinka työvoiman tarjonnan muutokset vaikuttavat työmarkkinoiden lopputulemiin? Essee analysoi maahanmuuttoshokkia, joka on ainutlaatuinen Euroopan lähihistoriassa; yli puolen miljoonan ihmisen paluumuuttoa Angolasta ja Mosambikista Portugaliin 1970-luvun puolivälissä. Tutkimuksen tavoitteena on arvioida kyseisen maahanmuuttoshokin vaikutuksia Portugalin työmarkkinoilla. Toisin kuin aiemmassa Portugalin tapausta käsittelevässä tutkimuksessa, maahanmuuttoshokilla havaitaan olleen merkittävä negatiivinen vaikutus työmarkkinoiden lopputulemiin. Tutkimustulosten mukaan Portugalin työmarkkinat reagoivat työvoiman tarjonnan kasvuun oppikirjaesimerkin mukaisesti; työntekijöiden määrän lisääntyminen alensi keskimääräistä työn tuottavuutta sekä palkkatasoa.

Avainsanat: Synteettinen kontrolli, politiikka-arviointi, rahaliitto, maariski, finanssipolitiikka, työvoiman tarjonta, maahanmuutto

ACKNOWLEDGEMENTS

First, I would like to express my special appreciation and thanks to my both supervisors, Professor Matti Viren and Professor Heikki Kauppi. You have enormously contributed to my development as an economist. During my master's studies Professor Viren's practical and policy oriented approach on economics inspired me to continue to the path towards this doctoral dissertation. Professor Kauppi's extensive knowledge of econometrics and attentive attitude have certainly increased the quality of my research. You both have always found time to discuss my research and I have learnt much from these discussions. I am grateful for that.

I would like to thank the pre-examiners, Professor Pekka Ilmakunnas of Aalto University and Professor Karsten Staehr of Tallinn University of Technology for reading my dissertation and providing valuable and insightful comments. Moreover, I would like to thank Professor Staehr for accepting the invitation to act as an opponent for this dissertation.

I have been privileged to work at the Department of Economics at the University of Turku where I have received helpful comments from various people. Especially, I would like to thank Professor Kaisa Kotakorpi and Professor Petri Böckerman for valuable comments which have improved my research. I would also like to thank Jouni Jokinen and Henna Mäki for your support and help with the practical issues.

During my doctoral studies I have learnt to know many fellow doctoral students who I am happy to call my friends. Thank you Joonas, Oskari, Kim, Tomi, Johannes, Henri, Sakari, Matti, Susmita and Jenni for all your help and peer support. I would also like to thank my friends outside economics and fellow students from the earlier phases of my studies for fruitful discussions and bringing fun into my life.

I am grateful for the financial support that I have received from Yrjö Jahnsson Foundation, Employee's Foundation and Turku School of Economics Association.

Behind every accomplishment, there is the family. I would like to thank my parents Maritta and Kari, grandmothers Seija and Vuokko and Sister Vilma. I have never lacked support from you. I want to thank you Sanna that you have been there for me and unconditionally supported me during these years. My gratitude is beyond the words. Finally, thank you Aatos for all the joy and happiness you have brought into our lives.

Erik Mäkelä, June 2017

TABLE OF CONTENTS

ABSTRACT

TIIVISTELMÄ

ACKNOWLEDGEMENTS

1	INTRODUCTION	9
1.1	Causality and policy evaluation in applied econometrics	10
1.2	Synthetic control method.....	14
1.3	Recent developments and extensions of the traditional synthetic control method.....	18
1.4	Summary of Essays	20
1.4.1	The Price of the Euro – Evidence from Sovereign Debt Markets	20
1.4.2	EMU and the Size of the Public Sector	22
1.4.3	The Effect of Mass Influx on Labor Markets: Portuguese 1974 Evidence Revisited	23
1.5	References	26
2	ESSAY 1: THE PRICE OF THE EURO: EVIDENCE FROM SOVEREIGN DEBT MARKETS.....	29
2.1	Introduction	31
2.2	Sovereign risk and the EMU	33
2.3	Synthetic control method.....	35
2.4	Estimating the effect of the Euro on government bond yields	38
2.4.1	Data and Sample.....	38
2.4.2	Synthetic counterfactuals for the Eurozone.....	39
2.4.3	Baseline results	41
2.4.4	Inference	44
2.4.5	Robustness checks	47
2.4.6	The effect of the European sovereign debt crisis revised.....	49

2.5	Conclusions	52
2.6	References	53
3	ESSAY 2: EMU AND THE SIZE OF THE PUBLIC SECTOR	55
3.1	Introduction	57
3.2	Theoretical motivation and related literature	58
3.3	Estimating the effect.....	62
3.3.1	Empirical strategy.....	62
3.3.2	Constructing a synthetic counterfactual for the average Eurozone country.....	66
3.3.3	The average effect of the EMU membership.....	71
3.3.4	Treatment period revised.....	72
3.3.5	Placebo tests.....	73
3.3.6	Robustness checks	75
3.3.7	Alternative fiscal policy measures.....	77
3.3.8	Evidence from Sweden and Denmark	80
3.3.9	Results for the individual member countries.....	82
3.3.10	Which country characteristics explain the heterogeneity of the estimated effects?	83
3.4	Conclusions	85
3.5	References	87
3.6	Appendix	90
4	ESSAY 3: THE EFFECT OF MASS INFLUX ON LABOR MARKETS: PORTUGUESE 1974 EVIDENCE REVISITED	93
4.1	Introduction	95
4.2	Related literature.....	97
4.3	Background.....	99
4.4	Evidence from international comparison.....	101
4.4.1	Constructing synthetic counterfactuals for Portugal	104
4.4.2	Comparison between post-1974 institutional developments in Portugal, Spain and Greece	108
4.4.3	Results.....	110
4.4.4	Robustness checks	113
4.5	Evidence from regional comparisons	117
4.5.1	Estimation strategy	119
4.5.2	Data and descriptive statistics.....	121

4.5.3	Results	124
4.5.4	Alternative estimation techniques	126
4.5.5	The effect of nationalization revised	128
4.5.6	Discussions	130
4.6	Conclusions	131
4.7	References	132
4.8	Appendix	136

1 INTRODUCTION

This dissertation comprises three empirical essays on treatment effect evaluation with aggregate data. The methodological cornerstone of this dissertation is the synthetic counterfactual approach for causal inference in comparative case studies. The essays concentrate on highly policy relevant, topical and debated questions related to the economic impacts of monetary unification and labor supply shock. This dissertation contributes to the existing literature by offering new insights into analyzed themes and the applicability of the synthetic control method in different analytical settings. Compared to the previous research on the analyzed topics, the main advantages of the applied methodological approach is that it relaxes the parallel trend assumption and it combines qualitative and quantitative techniques in comparative case studies.

The first essay analyzes how the Economic and Monetary Union in Europe (EMU) has affected its member's long-term government bond yields. The first essay is complemented with the second essay that examines the effect of the EMU on fiscal policies and sovereign risk. More precisely, the second essay studies how the introduction of the Euro has affected the government expenditure in the Eurozone countries. These articles find that the euro has not benefitted its members in sovereign debt markets and that the monetary unification has enforced lax tendency in fiscal policies. Moreover, investors seem to perceive the monetary union as a factor that increases country's sovereign risk.

The third essay provides a reappraisal of the evidence from the influx that has been unique in the recent European history, the flood of more than half million returnees from Mozambique and Angola to Portugal in the mid-1970s. The objective of this essay is to study the impacts of large supply shock on labor market outcomes. In contrast to the previous evidence, this article finds that the influx had a significant adverse effect on labor market outcomes. The results suggest that the Portuguese labor market responded precisely the same way as the standard textbook model predicts: an increase in the number of workers lowered average labor productivity and wages.

When I started my dissertation project the synthetic control method was a recent technique with small number of applications. During the last couple of years, the method has become increasingly popular and it has been applied to diverse set of topics. This dissertation contributes to the applied economics literature by providing three new applications for the traditional synthetic control method. In addition, extensions to the traditional synthetic control method

are proposed. The first and second essays deal with the method in a case with multiple treated units and propose techniques for statistical inference and analysis of heterogeneous effects. The third essay provides a novel approach how to utilize synthetic counterfactuals with non-binary treatment and in the absence of untreated control group.

This introductory chapter proceeds as follows. The first section provides a general framework for causality and treatment effect evaluation in applied econometrics literature. Section 1.2 briefly introduces the synthetic control method and section 1.3 discusses the recent developments and extensions of the method. The last section summarizes the key findings and contributions of the individual essays and put them into context of the previous studies.

1.1 Causality and policy evaluation in applied econometrics

The title of Adam Smith's foundational work, *An Inquiry into the Nature and Causes of the Wealth of Nation* (1776), illustrates the central role of causality, the relation of cause and effect, in economics. According to Hoover (2006) economists inherited from the 18th century philosopher David Hume the sense that economics was essentially a causal science. On the other hand, Hume doubted whether we could ever know the essential nature of causation "in the objects". Since Hume, there has been a tension between the epistemological status of causal relations and their role in practical policy through the history of economic analysis. Hoover (2006) classifies the approaches to causation in economics into four types; the approaches that emphasize structure and those that emphasize process, the other dimension of the classification being a distinction between approaches that adopt a priori reasoning and those that seek to infer causation from the evidence provided by data.

Nowadays, empirical research in economics has two main paradigms: structural and reduced-form approaches. The latter is also referred to design based or treatment effect approach. The structural approach specifies complete models of economic behavior, calibrates the parameters of such models and then simulates the effects of changes in policies and the economic environment on behavior. The reduced-form branch of applied work estimates statistical relationships, giving priority on identification of causal effects using research designs that exploit quasi-experimental variation (Chetty 2009). This dissertation builds on the reduced-form approach.

The most challenging empirical questions in economics involve "what if" statements about counterfactual outcomes (Angrist & Krueger, 1999). The randomized controlled experiment has often been considered as the ideal situation for drawing causal inferences about the effect of a policy. In this kind setup the

unbiased estimate of the average causal effect is simply the difference between the sample average outcome for treated units and control units. Unfortunately, large scale experiments are not often feasible in practice. Due to lack of randomized controlled experiments, a major share of empirical research in economics relies on observational data. Studies that aim to analyze the effects from some treatment with observational data face substantial challenges in causal inference. Typically these challenges arise from the possibility that the treatment is endogenous (for example treated units might be self-elected to the treatment).

For example if we consider the impacts of immigration shock on regional labor markets, the simple correlations between the magnitude of the influx and wage developments after the influx provide naïve estimate for the impact of the shock. If the immigrants are able to choose their location, the naïve estimate would confuse correlation with causality. It could be the case for example, that the wage levels were increasing most sharply in the low wage districts, whereas the immigrants are more interested in actual wage level than the expected wage growth and settle to the high wage districts. In this kind of setup the naïve estimate suggests that there are negative relationship between immigration and developments in wages. However, it impossible to know to what extent the immigration affects to the wages.

During the last decades experimental research designs have become increasingly popular in treatment and policy evaluations studies especially in the fields of labor and public economics. It can be argued that the essential role of identification separates the empirical economics from other social sciences. In the econometrics literature on policy evaluations the focus is on internal validity, issues surrounding correlation from causality, in observational studies (Authey & Imbens, 2016). This branch of literature has spawned several empirical strategies for identifying causal effects with non-experimental data. The four most common approaches to identification are control for confounding variables, fixed-effects and differences-in-differences, instrumental variables, and regression discontinuity methods (Angrist & Krueger, 1999).

In econometric literature on treatment effects, the causal problems are typically analyzed with potential outcome approach. In this framework, there is a potential outcome $Y_i(t)$, that describes the level of the outcome under treatment level t for each unit i . In addition, each unit has a vector of characteristics denoted by X_i . In this framework, the causal effects are comparisons of pairs of potential outcomes for the same unit (the difference between $Y_i(t') - Y_i(t)$). Because a given unit can only receive one level of the treatment ($Y_i^{obs} = Y_i(T_i)$), the causal effect cannot be directly observed. For this reason, the estimates of causal effects are ultimately based on comparisons of different units with different levels of the treatment (Imbens 2004).

The majority of treatment effect literature has focused on estimating average treatment effects in a binary treatment setting under the unconfoundedness assumption.

$$(Y_i(0), Y_i(1)) \perp T_i | X_i \quad (1)$$

If this assumption holds, the difference between $\mathbb{E}[Y_i^{obs} | T_i = 1, X_i = x] - \mathbb{E}[Y_i^{obs} | T_i = 0, X_i = x]$ has a causal interpretation for the average treatment effect ($\mathbb{E}[Y_i(1) - Y_i(0) | X_i = x]$).

In order to illustrate the link between standard exogeneity and unconfoundedness assumptions, suppose that the treatment effect is constant, $\alpha = Y_i(1) - Y_i(0)$, for all i . Furthermore, suppose that the control outcome is linear in X_i :

$$Y_i(0) = c + X_i\beta + \varepsilon_i \quad (2)$$

If the error term is orthogonal in covariates, $\varepsilon_i \perp X_i$, then the outcome for i can be written as:

$$Y_i = c + \alpha T_i + X_i\beta + \varepsilon_i \quad (3)$$

When the assumption of constant treatment effect holds, unconfoundedness is equivalent to independence of T_i and ε_i conditional on X_i , which would also capture the idea that T_i is exogenous. The literature on estimating average treatment effects under unconfoundedness is a mature branch of literature, with a number of alternative methods and applications (Authey & Imbens, 2016). Typically these estimators utilize matching methods, weighting or involve the propensity score, the conditional probability of receiving the treatment given the covariates.

Identification strategies based on instrumental variables can be thought of as a scheme for using exogenous variation to approximate randomized trials. Instrumental variable methods eliminate a bias that arises from the possibility that a treatment is not randomly assigned. In practice, researcher tries to find an instrumental variable that is correlated with treatment, but is otherwise independent of potential outcomes.

Regression discontinuity strategy can be used in a setting when allocation to a treatment is based on a forcing variable, such as location or time being above or below some threshold. The identifying assumption is that the characteristics of individuals, who fall on a side of the threshold for treatment, lack the discrete changes. If that assumptions hold, the relationship between outcomes and the forcing variable can be modeled, and deviations from the predicted relationship at the treatment assignment boundary can be attributed to the treatment.

Differences-in-differences strategies are panel-data methods applied to sets of group means in cases when certain groups are exposed to a treatment and others are not. This approach has been widely used for example to estimate the effect of sharp changes in the economic environment or changes in government policy (Angrist & Krueger, 1999). One of the seminal papers that combines quasi-experimental approach and differences-in-differences strategy is Card's (1990) study on a sudden large-scale migration from Cuba to Miami, so called Mariel boatlift, in 1980. Card analyzes whether the Cuban immigration, reduced the employment or wages of non-immigrant groups. The main component of his identification strategy is the selection of comparison cities that are similar to Miami and did not experience large scale immigration. These appropriate control cities are used to estimate what would have happened in the Miami labor market without the immigration shock.

Although randomized trials have been considered as the "gold standard" in evidence (Banerjee 2007) and the adoption of experimental methods has led to a "credibility revolution" in economics (Angrist & Pischke 2010), reduced form approach has been subject to various criticisms. Typically the bulk of empirical literature with experimental design deals with microdata and engages in partial equilibrium comparisons. Acemoglu (2010) argues that partial equilibrium analyses that ignore responses from general equilibrium and political economy channels will not give appropriate answer to counterfactual exercises. For example general equilibrium interactions can offset or reverse partial equilibrium conclusions. In addition, the debate concerns about the external validity of the obtained evidence for the treatment effect, i.e. limitations of the extent to which such an effect is informative outside of the sample population in question (see e.g. Rodrik 2008 and Deaton 2010).

Next section presents the methodological cornerstone of this dissertation, the synthetic control method for causal inference in comparative case studies. According to Athey and Imbens (2016) the method is the most important innovation in the evaluation literature in the last fifteen years. The method builds on difference-in-differences estimation and matching. When I started my dissertation project the number of applications was quite small. During the project, the method has become increasingly popular and it has been developed further. I discuss about the general properties of the method and what kind of complementarities it provides to the previous treatment effect estimation techniques.

1.2 Synthetic control method

Methodologically this dissertation is based on the method of synthetic counterfactual developed in Abadie and Gardeazabal (2003) and Abadie, Diamond, and Hainmueller (2010). The synthetic control method aims to estimate the effects of interventions, which are implemented at an aggregate level affecting a small number of large units (such as cities, regions, or countries), on a specific aggregate outcome of interest. The main idea of this method is to construct a synthetic match for treated unit by using the untreated units in the control group in such a way that the synthetic counterfactual has similar behavior to the actual treated unit before the event of interest. The synthetic control is the weighted average of the available control units. It makes explicit the contribution of each control unit to the counterfactual based on the similarities with the unit affected by the event in terms of pre-intervention outcomes. The synthetic control method is based on the idea that a combination of unaffected units often provides a more appropriate comparison than any single unaffected unit alone.

The method originates from calls for the development and use of quantitative methods that complement and facilitate qualitative analysis in comparative studies in social sciences. Moreover, a strand of the quantitative literature (like Mill's Method of Difference) is advocating for research designs that carefully select comparison units to reduce biases in observational studies.

The synthetic control approach has three benefits in comparative case studies. First, it precludes the researcher from making arbitrary decisions about what the proper control should be. Second, the weights attached to the potential donor unit can be based on several economic characteristics. Third, a common critique of the cross-country literature is the presence of unmeasurable time varying omitted variables, such as the quality of the institutions that affect both economic outcomes and the likelihood of the treatment (Bove, Elia & Smith, 2016). Billmeier and Nannicini (2013) point out that while traditional panel models control only confounding factors that are time invariant (fixed effect) or share a common trend (difference-in-differences), the synthetic control method allows the effect of unobservable confounding factors to vary with time.

Given the widespread availability of aggregate data and the fact that many policy interventions and events of interest in the social sciences take place at an aggregate level, comparative case study research has broad potential (Abadie, Diamond, and Hainmueller 2010). One of the main advantages in aggregate level analysis is that it enables to consider the equilibrium effects of the treatment. Moreover, microdata based comparative case studies employ inferential techniques that measure only uncertainty about the aggregate values of the data in the population. Abadie, Diamond, and Hainmueller (2010) point out that uncertainty about the values of aggregate variables can be eliminated completely

if aggregate data is available. However, even if the analysis is based on aggregate data there is still uncertainty about the ability of the control group to reproduce the counterfactual outcome trajectory.

King and Zeng (2006) show that traditional regression techniques are based on model dependent extrapolation. Traditional fixed effect models for panel data assume that an unweighted average of all units acts as a valid counterfactual for each state. Due to fact that the weights in synthetic control are restricted to be positive and sum to one, the synthetic control method provides a safeguard against extrapolation from outside of the support of the data. Moreover the method allows researchers to use both quantitative and qualitative techniques to analyze similarities and differences between the treated unit and it's synthetic control.

Next I discuss the formal aspects of the method. Suppose that there is a sample of $J + 1$ units indexed by j , among whom unit $j = 1$ is the case of interest and units $j = 2$ to $j = J + 1$ are potential comparisons. The unit treated, $j = 1$, is the unit exposed to the event or intervention of interest, while units $j = 2$ to $j = J + 1$ constitute the donor pool (potential comparison countries). Because comparison units are meant to approximate the counterfactual of the case of interest without the intervention, the donor pool should be restricted to units with outcomes that are thought to be driven by the same structural process as the unit representing the case of interest and that were not subject to structural shocks to the outcome variable during the sample period of the study.

Assume that the sample is a balanced panel data set where all units are observed at the same time periods, $t = 1, \dots, T$. Assume also that the sample includes a positive number of pre-intervention periods, T_0 , as well as a positive number of post-intervention periods, T_1 , with $T = T_0 + T_1$. The goal of the study is to measure the effect of the event of interest on some post-intervention outcome. A synthetic control is defined as a weighted average of the units in the donor pool. That is, a synthetic control can be represented by a $(J \times 1)$ vector of weights $W = (w_2, \dots, w_{J+1})'$, with $0 \leq w_j \leq 1$ for $j = 2, \dots, J$ and $w_2 + \dots + w_{J+1} = 1$. These conditions guarantee the non-extrapolation outside the support of the data. Choosing a particular value for W is equivalent to choosing a synthetic control.

The value of W is selected so that the characteristics of the treated unit are best resembled by the characteristics of the synthetic control. X_1 is a $(k \times 1)$ vector containing the values of the pre-intervention characteristics of the treated unit that is aimed to match as closely as possible and X_0 is the $k \times J$ matrix collecting the values of the same variables for the units in the donor pool. The differences between the pre-intervention characteristics of the treated unit and a synthetic control is given by the vector $X_1 - X_0 W$. Synthetic control, W^* , is selected so that it minimizes the size of this difference. This can be done in the

following manner. For $m=1, \dots, k$, X_{1m} is the value of the m -th variable for the treated unit and X_{0m} is a $(I \times J)$ vector containing the values of the m -th variable for the units in the donor pool. W^* is chosen as the value of W that minimizes:

$$\sum_{m=1}^k v_m (X_{1m} - X_{0m}W)^2 \quad (4)$$

where v_m is a weight that gives the relative importance that is assigned to the m -th variable when measuring the deviance between X_1 and X_0W . The usability of the method depends on that synthetic controls closely reproduce the values that variables with a large predictive power on the outcome of interest take for the unit affected by the intervention. Those variables should be assigned large weights.

The choice of v_m influences the mean square error of the estimator. An optimal choice of v_m assigns weights to linear combinations of the variables in X_{0m} and X_{1m} to minimize the mean square error of the synthetic control estimator. The predictor weights can be determined in a first step exploratory analysis using regression to determine the relative predictive power of the variables. Another way to select v_m is to choose the set of values for that produce the best pre-treatment fit. This can be implemented by solving a nested optimization problem where v_m is chosen so that w_j minimizes the mean square prediction error over a pre-specified set of pre-intervention periods. Usually the regression-based weights produce considerably worse fit, compared to using the optimal weights from nested optimization.

Y_{jt} is the outcome of unit j at time t . In addition, Y_1 is a $(T_1 \times 1)$ vector collecting the post-intervention values of the outcome for the treated unit ($Y_1 = (Y_{1T_0+1}, \dots, Y_{1T})'$). Similarly, Y_0 is a $(T_1 \times J)$ matrix, where column j contains the post-intervention values of the outcome for unit $j + 1$. The synthetic control estimator of the treatment effect is given by the comparison of post-intervention outcomes between the treated unit, which is exposed to the intervention, and the synthetic control, which is not exposed to the intervention, $Y_1 - Y_0W^*$. That is, for a post-intervention period t (with $t \geq T_0$) the synthetic control estimator of the effect of the treatment is given by the comparison between the outcome for the treated unit and the outcome for the synthetic control at that period:

$$Y_{1t} - \sum_{j=2}^{J+1} W_j^* Y_{jt} \quad (5)$$

The main weakness of the synthetic control method is that the use of traditional statistical inference is difficult due to small sample nature of the data, the absence of randomization, and because of the fact that probabilistic sampling is not employed to select sample units. However, the synthetic control method enables to conduct falsification exercises, which are called

placebo studies. These exercises study the possibility that the obtained results for the treatment effect could be driven entirely by chance. Like in permutation tests, the synthetic control method can be applied to every potential control in the sample. This allows the researcher to assess whether the effect estimated by the synthetic control for the country affected by the intervention is large relative to the effect estimated for a region chosen at random. This method is referred to as the unit-placebo. Another possible falsification exercise is called in-time-placebo, where the synthetic control method is applied to dates when the intervention did not occur.

Abadie, Diamond and Hainmueller (2010) motivate the synthetic control method with a general factor model. The model implies the usual assumption of no interference between units which means that outcomes of the untreated units are not affected by the intervention implemented in the treated unit. In addition, the model assumes that the intervention has no effect on the outcome before the implementation period. When these assumptions hold, there is still remaining limitations for causal inference. For example, the method does not include control variables which implies that the established effects may be affected by factors that are unrelated to the treatment. Moreover, Billmeir and Nannicini (2013) point out that although the synthetic control method allows the effect of unobservable confounding factors to vary with time, a remaining limitation is that economic and political reforms might be triggered by, for example, the anticipation of future growth prospects thus leading to endogeneity from reverse causation.

Qualitative techniques have an important role in the synthetic control method. In order to avoid interpolation biases and overfitting, Abadie, Diamond and Hainmueller (2014) suggest that it is important to restrict the donor pool to units with characteristics similar to the treated unit. Moreover, donors that have large idiosyncratic shocks to the outcome of interest during the study period should be excluded if such shocks would have not affected the treated unit in the absence of the treatment. In practice the difficulty lies in finding a donor group that is large enough and, at the same time, informative. If the pre-treatment development of treated unit is somewhat exceptional, it might be impossible to construct a credible counterfactual from a convex combination of untreated units. Moreover, in some applications there might be a trade-off between qualitative plausibility of the control and bias of the estimate since more similar and closely connected control units may be more exposed to the spill-over effects of the treatment.

1.3 Recent developments and extensions of the traditional synthetic control method

Since 1990's difference-in-differences has become one of the most commonly used empirical designs in economics. The identifying assumptions for difference-in-differences include the parallel trends assumption, which states that in the absence of the treatment the average outcomes of treated and control units would have followed parallel paths. However, in many applications, parallel pre-treatment trends are not supported by data or the parallel trends assumption is likely to fail in the post-treatment period (Xu 2016). Because the synthetic control method relaxes the parallel trends assumption, it has been increasingly popular alternative especially for difference-in-differences in policy evaluations during the recent years.

There are ongoing debates regarding to different methodological approaches in treatment effect literature. For example, in the field of labor economics, Borjas (2016) contributes to these debates by revising Card's (1990) difference-in-differences based evidence from the Mariel supply shock. He studied what happened to the wage of high school dropouts in Miami before and after Mariel by utilizing the synthetic control approach. His results suggest that drop in the low-skill wage between 1979 and 1985 was substantial, perhaps as much as 30 percent, which is in contrast to Card's (1990) findings.

Originally the synthetic control method was proposed to address counterfactual questions involving only one treated unit and a few control units. As in the majority of treatment effect studies, the treatment was considered as binary variable. The seminal paper of Abadie and Gardeazabal (2003) investigate what would have been the level of GDP per capita in the Basque country in Spain if it had not experienced terrorism. After that, Abadie, Diamond and Hainmueller (2010) extended the method and presented two further examples: "What would have been cigarette consumption in California without the Proposition 99?" and "What would have been the GDP per capita of West Germany without reunification?" (2014). After Abadie, Diamond and Hainmueller (2010) the method has been applied to diverse set of topics, see e.g. Lee (2011) (inflation targeting), Billmeier and Nannicini (2013) (trade liberalization), Cavallo et al. (2013) (natural disasters), Ribeiro et al. (2013) (political reform), Campos, Coricelli and Moretti (2014) (economic growth benefits of the EU), Acemoglu et al. (2014) (political connections), Gobillon and Magnac (2016) (enterprise zones) and Kreif et al. (2016) (health policy).

Recently, the synthetic control method has been considered for settings with multiple treated units and alternative approaches have been proposed (see e.g. Dube and Zipperer, 2013; Acemoglu et al., 2014; Xu, 2016; Kreif et al 2016). Differences between approaches relate to the aggregation of estimated treatment

effects and statistical inference. For evaluations where there is more than one treated unit, Abadie, Diamond and Hainmueller (2010) originally suggest aggregating the treated units into a single treated unit. Billmeier and Nannicini (2013) investigate the effects of 30 country-level episodes of trade liberalization on their GDP. They study each case and report estimates separately, i.e. the obtained results are not aggregated and statistical inference for the estimates is not drawn. Also Campos, Coricelli and Moretti (2014) follow similar approach when studying the growth benefits of the EU. However, they report t-tests for the effects of individual countries (these tests study the equality of pre- and post-EU difference between actual and synthetic GDP of a country in question).

Dube and Zipperer (2013) study the effects of 29 state level minimum wage increases on teen employment and wages. They propose a method for pooling synthetic control estimates in a setting with recurring treatment and variable treatment intensity. This application converts the estimates to elasticities by scaling them by the size of the minimum wage changes, and then aggregate these elasticities across minimum wage reforms. They show that the mean of the percentile ranks of the effects in the treated states vis-à-vis donor states can be used to judge the statistical significance for the pooled point estimate.

Kreif et al. (2016) analyze health policy reform in 24 hospitals that locate in a same region. They construct the synthetic control region by directly weighting the 132 control hospitals to match the average pre-treatment outcomes of the hospitals in the treated region. Acemoglu et al. (2014) suggest that the average effect of intervention on the treatment group should be weighted average formula, with greater weight given to units with better pre-intervention fit. They argue that the difference between actual and synthetic development should contain more information about the intervention when there are better predictions of the developments during the estimation window. For statistical inference, they suggest bootstrapping approach for placebo study. In order to construct the confidence intervals, they randomly draw 5,000 placebo treatment groups from the control group—with each group having the same size as the real treatment group. By using these placebo groups, they construct the confidence intervals for hypothesis testing of whether the estimated treatment effect is significantly different from zero.

Xu (2016) proposes a generalized synthetic control method that unifies the synthetic control method with linear fixed effects models and generalizes the synthetic control method to cases of multiple treated units. First, the method estimates an interactive fixed effect model using only the control group data, obtaining a fixed number of latent factors. Second it estimates factor loadings for each treated unit by linearly projecting pre-treatment treated outcomes onto the space spanned by these factors. Last, it imputes treated counterfactuals based on the estimated factors and factor loadings. The method is in the spirit of the

synthetic control method in the sense that by essence it is a reweighting scheme that takes pre-treatment treated outcomes as benchmarks when choosing weights for control units and uses cross-sectional correlations between treated and control units to predict treated counterfactuals. Due to fact that it combines the synthetic control method and interactive fixed effect models, the method allows extrapolation which may lead to erroneous conclusions. On the other hand, it is less sensitive to the idiosyncrasies of a small number of observations compared to the traditional synthetic control method.

1.4 Summary of Essays

1.4.1 The Price of the Euro – Evidence from Sovereign Debt Markets

Fifteen years after it was established, the costs and benefits of the Economic and Monetary Union in Europe (EMU) continue to be debated. Existing literature studying the effects of unification on international trade and capital market integration (see e.g. survey studies Baldwin 2006 and Lane 2006) suggests that the Euro countries have gained in these fields. After the outbreak of the Eurozone crises, political and academic debates on the costs and benefits of the monetary union have activated. De Grauwe and Ji (2013) claim that during the current crisis many sovereign borrowers in the Eurozone, especially the peripheral ones, have paid significant risk premiums that cannot be justified by fiscal or macroeconomic fundamentals. They suggest that the excess premiums in the Eurozone reflect the flaws in the union's structural architecture such as weak fiscal discipline and uncertainty over the joint bailouts.

Unfortunately, the previous studies do not offer much empirical evidence on the role and actual magnitude of monetary unification for sovereign risk premiums and government's borrowing costs. This article aims to fill this gap by studying comprehensively the effect from EMU-membership during the both pre- and post-crisis periods. The methodological contributions of this article are twofold. First, this article is likely the first one that illustrates the applicability of the synthetic control method with fixed income time series. In this application synthetic counterfactuals offer fairly intuitive portfolio interpretation for each government bond. Second, this article extends synthetic control method to the case with multiple treated units. The treatment effects are estimated for both average and individual country level. Moreover, statistical inference for these effects are provided.

Billmeier and Nannicini (2013) point out that the synthetic control method does not allow assessing the significance of the results using large-sample

inferential techniques, because the number of observations in the control pool and the number of periods covered by the sample are usually quite small in comparative case studies. In this article the number of observation is large enough to implement a simple yet novel solution to this drawback. The difference-in-differences estimation is conducted for the difference between actual and the synthetic series for the EMU-countries and donor pool countries (which synthetic series are produced in unit placebo studies). This shores up statements about the statistical significance of the effect of EMU membership on government bond yields, before and after, relative to the donor pool countries.

For the period before the European sovereign debt crisis, the synthetic control analysis provides evidence for a positive and economically significant effect from EMU-membership on 10-year government bonds for Austria, Belgium, Finland, France, and the Netherlands. In these countries the estimated pre-crisis effect varies from 44 to 24 basis points. Moreover, the obtained results support the general understanding that the monetary unification lowered the yields in former high inflation, high yield Southern-European countries (Italy, Portugal and Spain), where the estimated effects are about -20 basis points.

Together with Lane's (2006) conclusion that the investors treated the euro area as a single entity, the heterogeneous treatment effects for the pre-crisis period indicates that the Northern- and Central-European countries subsidized the government borrowing costs in the Southern-European countries. In addition, the analysis suggests that the adoption of the single currency did not lead to lower average 10-year government bond yield in the Eurozone compared to the counterfactual outcome during the early and mid-2000's. After the outbreak of the most recent financial crisis, the EMU-effect has become positive in all the member countries that were analyzed. The effect during the crisis period is substantial in all other countries except in Germany where the effect decreased from 61 basis (2001) to 13 basis points (2011). The average point estimate in 2011 for the Eurozone being about 240 basis points. During the whole sample period (May 1998-December 2011) the average 10-year government yields have been 35 basis points higher compared to the situation without the single currency. This estimate indicates about 9 percent point higher borrowing costs for the governments in the long-term maturities.

This article claims that the euro has not benefitted its members in sovereign debt markets. Investors perceive monetary union as a factor that increases sovereign risk. A positive EMU-effect has been imposed on the majority of member countries since the adoption of a single currency, but clearly before the current Eurozone crisis.

1.4.2 EMU and the Size of the Public Sector

The current sovereign debt crisis has sparked active debates on the sustainability of the fiscal policy and the level of government spending in the Eurozone countries, where relatively large public sectors have generated excessive deficits during the past two decades. An important question is whether the monetary union itself boosts government spending and exposes its member countries to a greater risk of falling into debt problems.

Some theoretical studies suggest that the EMU may enforce political incentives to increase spending by creating a common pool problem, where the costs that arise from individual member country's lax fiscal policy are shared with all member countries (see e.g. survey article by Beetsma and Giuliadori, 2010). On the other hand, the Maastricht Treaty and the Stability and Growth Pact were signed to discipline the fiscal policy. While the predictions of theoretical literature on the combined effect of monetary union is ambiguous, also empirical studies that examine the effects of monetary unification on fiscal policy outcomes (typically deficits) produce mixed evidence (see e.g. Gali and Perotti, 2003; Wyplosz, 2006; Candelon et al., 2009; Weichenrieder and Zimmer, 2014).

The objective of this essay is to ascertain how the monetary unification has affected government spending in the countries that were the first to adopt the euro in 1999 and 2001. In contrast to the previous studies, this article utilizes synthetic controls to create counterfactual outcomes for the member countries in the absence of monetary unification. Moreover, the primary focus is on the government spending. Compared to debt and deficits, government outlays/GDP is less affected by accounting tricks and the decisions on how the expenditures are financed. In this sense, the relative size of government expenditure describes better how the monetary union has affected the discretionary part of fiscal policy (Fatás and Mihov, 2003). Although the main focus of this paper is on the relative size of the public sector, for comparability with previous studies, the effects on debt levels and deficits are also examined.

The main finding is that the aggregate size of the public sector is higher in the EMU countries than what it would have been without the single currency. The magnitude of the estimated average effect for the period from 1999 to 2008 is about 1.8 percent of the gross domestic product (GDP). This effect seems to be persistent and gradually increasing. Before the latest financial crisis, the average effect was already about 3.6 percent of the GDP. In addition, evidence from debt-to-GDP ratios and deficit supports the finding that the monetary unification has enforced lax tendency in fiscal policies.

Qualitatively the results of this essay seem plausible in a light of the findings of the first essay which suggests that investors seem to perceive the monetary

union as a factor that increases country's sovereign risk. This essay provides a rationale for this finding; the monetary unification has increased government expenditures and hence weakened the fiscal sustainability of the Eurozone countries.

From the methodological viewpoint this essay illustrates that when more than one unit is treated, synthetic control method enables not only the estimation of the average treatment but also the analysis of heterogeneous treatment effects. I propose simple framework to examine potential mechanisms that affect to the magnitude of the treatment effect and improve the external validity of the obtained evidence in comparative case studies. This framework is based on the statistical analysis for the relationship between estimated treatment effect and pre-determined country characteristics.

The magnitude of the estimated effect is positive in most analyzed countries. The analysis for individual member countries reveals that the EMU-effect on the relative size of the public sector is highest in countries which have had the most unstable governments and stiffest political competition. These countries are Greece, Portugal, France and Italy. This finding supports Beetsma's and Giuliodori's (2010) hypothesis that political distortions caused by short-sighted behavior, which already produce excessive deficits under monetary autonomy, may be worsened by the move to monetary union.

The policy implications that can be derived from my results are twofold. First, in order to emerge from the current sovereign debt crisis and prevent similar situations in the future, the most crucial issue is to find credible means to weaken the political incentives that encourage national politicians to increase government spending and take higher risks in fiscal policy from the viewpoint of long term solvency. Second implication relates to the discussion on optimal currency area. My analysis suggests that the extent to which a country exploits the (financial market) common pool resource in the monetary union might depend on its political culture and stability. In this sense, large differences in the level of political short-sightedness among the member countries may enforce the common pool problem in the monetary union. This article concludes that the EMU might have some undesirable features, which increases the fragility of the public finance by encouraging national politicians to increase the size of the public sector.

1.4.3 The Effect of Mass Influx on Labor Markets: Portuguese 1974 Evidence Revisited

The study of how labor supply shocks, especially immigration, affect labor market conditions has been a long-lasting concern in empirical labor economics.

The textbook model of a competitive labor market suggests that, at least in the short run, high levels of immigration should lower the wage of competing workers and increase the wage of complementary workers (Borjas, 2013). Despite the common sense intuition behind these theoretical predictions, empirical literature offers contradictory evidence (see e.g., Borjas, 2003; Card, 2005; Ottaviano and Peri, 2012).

This article provides a reappraisal of the evidence from the influx that has been unique in the recent European history, the flood of more than half million returnees from Mozambique and Angola to Portugal in the mid-1970s. The objective of this article is to study the impacts of large supply shock on aggregate labor productivity, wages and unemployment. Following the line of Carrington and De Lima (1996), this article provides evidence from both international and intra-Portugal comparisons. The international comparison analyzes the effects of the Portuguese total labor supply shock (immigration and repatriating soldiers) on aggregate measures whereas the regional comparison focuses to the effects of the immigration part of the shock on wages in agriculture and construction industries.

The synthetic control analysis offers new evidence and some of the obtained results are in contrast to the previous conclusions that has been made from the Portuguese case. The main finding of this article is that the influx had a significant adverse effect on the Portuguese aggregate labor productivity and wages. The analysis suggests that in the short run, the 15 percent increase in the labor force decreased labor productivity by about 26 percent, the long run effect being even larger. In low-skilled professions (in agriculture and construction), the average wage impact of the returnees in Portuguese regions was -12 to -30 percent during the 1974-1977 period. The short run effect on aggregate wages seems to be smaller but still clearly negative. Compared to the construction sector, the adverse effect is clearly larger in the agriculture. One potential explanation for this difference might be that, in contrast to the construction sector, agriculture was not covered by the minimum wage law during the analyzed period.

The main advantage of country level analysis is that the equilibrium effects in the Portuguese labor market can be examined. In addition, the results from international comparisons are not affected by internal migration that might be caused by the supply shock. In this analysis, it should be assumed that the reference countries are not severely idiosyncratic in other dimensions during the post-influx period. However, this possibility cannot be completely ruled out due to complex institutional developments, which are hard to quantify. In this sense, the identification is probably weaker compared to the regional comparison, which abstracts from Portugal specific phenomena.

Synthetic control method has typically been applied in case studies with dichotomous definitions of the treatments and control groups. However, in

many cases it is hard to find control group that is unaffected and still informative. As a methodological contribution, this paper presents a novel approach on how to utilize synthetic counterfactuals when all available units are somewhat treated but the intensity of the treatment varies across the units. This approach has been utilized in the regional comparisons to construct counterfactual scenarios for all Portuguese regions and ascertain how wages would have developed in each region if the immigration shock had been different. In order to identify the effect of the influx in aggregate level, this article highlights the importance of qualitative judgements of the institutional developments in treated and donor countries during the post-treatment period.

Due to the aggregate nature of the available data, this article does not separate the effects between native and immigrant workers. However, the estimated adverse effects for aggregate wages and labor productivity are so large that it is not reasonable to expect that the natives remained unaffected. On the other hand, this article does not rule out the possibility of positive wage effects, for example in some high-skilled professions. Due to the Portuguese peculiar economic and institutional structures in the 1970s and the 1980s, the lessons from this case study has limited applicability for example on the immigration policies in today's Europe. The returnees were fairly well-educated and native Portuguese speakers, which made them reasonable substitutes for average non-returnee workers. This is in contrast to the characteristics of migrants and refugees in the current migration crisis in Europe. Notwithstanding, the results support the predictions of the standard textbook model for competitive labor markets; an increase in the number of workers lowered average labor productivity and wages.

This article concludes that replications and reappraisals serve an extremely useful role in empirical economics. Due to fairly small number of appropriate events which enables the quasi-experiment design, new perspectives and methods suggested by recent economic literature should be applied also to some old data. The reexamination of old studies might offer new insights that challenge the prevailing views.

1.5 References

- Abadie, A., Diamond, A., Hainmueller, J., 2014. Comparative Politics and the Synthetic Control Method. *American Journal of Political Science* 59(2), 495–510.
- Abadie, A., Diamond, A., Hainmueller, J., 2010. Synthetic Control Methods for Comparative Case Studies: Estimating the Effect of California’s Tobacco Control Program. *Journal of American Statistical Association*. 105, 493–505.
- Abadie, A., Gardeazabal, J., 2003. The Economic Costs of Conflict: A Case Study of the Basque Country. *American Economic Review* 93, 113–132.
- Acemoglu, D., 2010. Theory, general equilibrium, and political economy in development economics *Journal of Economic Perspectives*, 24 (3) (2010), pp. 17–32
- Acemoglu, D., Johnson, S. Kermani, A., Kwak, J., Mitton, T., 2014. The Value of Connections In Turbulent Times: Evidence from the United States, MIT mimeo.
- Angrist, J., Pischke J., 2010. The credibility revolution in empirical economics: How better research design is taking the con out of econometrics. *Journal of Economic Perspectives* 24(2), 3–30.
- Angrist, J., Krueger, A., 1999. Empirical strategies in labor economics. In: *Handbook of Labor Economics*, O. Ashenfelter and D. Card, eds., Volume 3A, Chapter 23, New York: Elsevier.
- Athey, S. ja Imbens, G. (2016), “The State of Applied Econometrics: Causality and Policy Evaluation” arXiv:1607.00699
- Baldwin, R., (2006). "The euro’s trade effects," Working Paper Series 0594, European Central Bank.
- Banerjee, A. V. (2007). *Making aid work*. Cambridge(MA): MIT Press
- Beetsma, R., Giuliodori, M., 2010. The Macroeconomic Costs and Benefits of the EMU and Other Monetary Unions: An Overview of Recent Research, *Journal of Economic Literature* 48(3), 603-41.
- Billmeier, A., Nannicini, T., 2013. Assessing Economic Liberalization Episodes: A Synthetic Control Approach, *Review of Economics and Statistics* 95, 983-1001.
- Borjas, G., 2016. The wage impact of the Marielitos: A reappraisal, *Industrial and Labor Relations Review*, forthcoming
- Borjas, G., 2013. The analytics of the wage effect of immigration, *IZA Journal of Migration*, 2:22.
- Borjas, G., 2003. The labor demand curve is downward sloping: reexamining the impact of immigration on the labor market, *Quarterly Journal of Economics*, 118, 1335–1374.

- Bove, V., Elia, L., Smith, R., 2016. On the heterogenous consequences of civil war. *Oxford Economic Papers*, forthcoming
- Campos, N., Corricelli, F., Moretti, L., 2014. Economic Growth and Political Integration: Estimating the Benefits from Membership in the European Union Using the Synthetic Counterfactuals Method, *IZA Discussion Paper No. 8162*.
- Candelon, B., Muysken, J., Vermeulen, R., 2009. Fiscal policy and monetary integration in Europe: an update. *Oxford Economic Papers* 62, 323–349.
- Card, D., 2005. Is the new immigration really so bad?. *The Economic Journal* 115(4)
- Card, D., 1990. The impact of the Mariel Boatlift on the Miami labor market. *Industrial and Labor Relations Review* 43(2), 245–257.
- Carrington, W., De Lima P., 1996. The impact of 1970s repatriates from Africa on the Portuguese labor market. *Industrial and Labor Relations Review*. 49, 330.
- Cavallo, E., Galiani, S., Noy, I., and Pantano, J., 2013. Catastrophic natural disasters and economic growth. *Review of Economics and Statistics*, 95, 1549–1561.
- Chetty, R., 2009. Sufficient statistics for welfare analysis: a bridge between structural and reduced-form methods. *Annual Review of Economics* 1:451-488.
- De Grauwe, P., Ji, Y., (2013). "Self-fulfilling crises in the Eurozone: an empirical test?" *Journal of International Money and Finance* 34. 15-36.
- Deaton, A. (2010). Instruments, randomization, and learning about development. *Journal of Economic Literature* 48(2), 424–455.
- Dube, A., Zipperer, B., 2013. Pooled synthetic control estimates for recurring treatment: an application to minimum wage studies, University of Massachusetts. Amherst Working Paper
- Fatás, A., Mihov, I., 2003. The Case for Restricting Fiscal Policy Discretion, *The Quarterly Journal of Economics* 118(4), 1419-1447.
- Gali, J., Perotti, R., 2003. Fiscal policy and monetary integration in Europe. *Economic Policy* 18 (37), 533–572.
- Gobillon, L., Magnac, T., 2016. Regional Policy Evaluation: Interactive Fixed Effects and Synthetic Controls, *The Review of Economics and Statistics* 98(3), 535-551.
- Hoover, K., 2006. Causality in Economics and Econometrics, An Entry for the *New Palgrave Dictionary of Economics*.
- Imbens, G., 2004. Nonparametric estimation of average treatment effects under exogeneity: a review *Review of Economics and Statistics*, 86 (2004), pp. 4–30

- King, G., Zeng, L., 2006. "The Dangers of Extreme Counterfactuals." *Political Analysis* 14(2): 131–59.
- Kreif, N., Grieve, R., Hangartner, D., Turner, A., Nikolova, S., Sutton, M., 2016. Examination of the Synthetic Control Method for Evaluating Health Policies with Multiple Treated Units, *Health Economics*, 25: 1514–1528
- Lane, P., 2006. The Real Effects of EMU", CEPR Discussion Paper No. 5536
- Lee, W., 2011. Comparative case studies of the effects of inflation targeting in emerging economies. *Oxford Economic Papers*, 63, 375–397.
- Ottaviano, G., Peri, G., 2012. Rethinking the effect of immigration on wages. *Journal of European Economic Association*. 10(1), 152–197.
- Ribeiro, F., Stein, G., Kang, T., 2013. The Cuban Experiment: Measuring the Role of the 1959 Revolution on Economic Performance using Synthetic Control
- Rodrik, D., 2008. The new development economics: We shall experiment, but how shall we learn? Harvard Kennedy School Working Paper RWP08-055
- Weichenrieder, A., Zimmer, J., 2014. Euro membership and fiscal reaction functions, *International Tax and Public Finance* 21(4), 598-613.
- Wyplosz, C., 2006. European Monetary Union: the dark side of a major success. *Economic Policy* 21, 208–261.
- Xu, Y., 2016. Generalized Synthetic Control Method: Causal Inference with Interactive Fixed Effects Models. *Political Analysis* (forthcoming).

Annales Universitatis Turkuensis



Turun yliopisto
University of Turku

ISBN 978-951-29-6934-0 (PRINT)

ISBN 978-951-29-6935-7 (PDF)

ISSN 2343-3159 (Painettu/Print) | ISSN 2343-3167 (Verkkajulkaisu/Online)