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An empirical study into the welfare effects of the euro

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1 Introduction

Implementing the euro was part of the ambition of the European Union for further European integration (Europa, n.d.). Recent times however, have seen increasing conflicts over the structure of the eurozone, especially worsened by the eurozone crisis (Lehner & Wasserfallen, 2019). Political rhetoric in The Netherlands has also become more critical towards the European Union. The Dutch Socialist Party argued for a separation of the Euro into a southern and northern currency in the most recent campaign, and a complete Nexit is supported by 25 out of 150 seats of Dutch parliament in the PVV and FvD. Italy has also seen debates on the European Union, with three out of four current coalition parties being anti-European populists (Gadd, 2021). The common perception is that Northern Europe has mainly benefited from EU membership, which has sparked calls for a stronger transfer union so that Southern European countries can also reap some of the benefits (Reuters, 2019).

Theoretical literature has established criteria under which it would be optimal for countries or regions to form a common currency together, making it an optimum currency area. A large collection of research has studied whether these criteria apply to the eurozone. The general conclusion is that the eurozone only meets some criteria, making it an imperfect currency area. Empirical literature has mainly studied how this has affected GDP per capita in the eurozone countries (see e.g., Fernández & Garcia-Perea, 2015; Gabriel & Pessoa, 2020; Žúdel & Melioris, 2016). My research adds to this literature by studying the broader welfare effects of introducing the euro, rather than only focusing on GDP per capita. Having a broad overview of the effects of a certain policy is essential for policy makers to evaluate that policy, and the euro is no different in this regard. The findings of this research can therefore influence both the public opinion of the euro project and future policies in relation to the euro.

In this thesis, I use the synthetic control method to assess how the euro has affected the countries of the eurozone. In particular, I investigate what the effects of euro introduction have been on material welfare in Italy and The Netherlands.

My analysis for each country is split into two parts. Firstly, I study what has happened to average indicators of material welfare. These include adjusted net national income per capita, households and NPISHs final consumption expenditure per capita, and household financial net worth. After that, I look at distributional indicators of material welfare, which include the disposable income Gini index, average pre-tax national income of the top 10% and average pre-tax national income of the bottom 50%. I chose these indicators based on the recommendations made by Stiglitz et al. (2009) in a report on measuring economic performance and social progress. They give a comprehensive view of material welfare, which is an important part of social welfare.

To construct a synthetic control, I use OECD countries who did not adopt the euro as donor countries. Multiple predictor variables and outcome lags are used for each indicator in order to form a reliable synthetic control. After my main analysis, I restrict my donor pool to non-European countries in order to rule out spillover effects. I also perform an in-time placebo test, which allows me to test whether there are anticipation effects present and to check how robust my results are.

For Italy, I find significant negative material welfare effects. Both adjusted net national income per capita and households and NPISHs final consumption expenditure per capita show a sharp decline for Italy when compared to its synthetic counterfactual. These losses are sizable, with a loss of one third in annual income and one quarter in annual consumption at the end of the data period when compared to the counterfactual outcome of the euro not being introduced. The effect for household financial net worth is positive at first, but becomes negative after about ten years. The effect amounts to approximately one fifth of household net worth, although these findings are less reliable due to a short pre-intervention period. For the distributional measures, I find an initial decrease in the disposable income Gini index followed by an increase after around a decade. Average pre-tax national income in both the top 10% and bottom 50% decrease after the euro is introduced, but the effect is only statistically significant for the top 10%. The effect for this group is a loss of more than one quarter of income in the final years when compared to the scenario where the euro would not have been introduced. My robustness checks indicate that spillover effects are not an issue, and confirm my findings of negative effects for income, consumption and income of the top 10%.

My analysis for The Netherlands shows no significant effect of euro introduction on adjusted net national income per capita, household financial net worth or any of my distributional indicators. Households and NPISHs final consumption expenditure per capita initially increases but lags behind its synthetic counterfactual after five years. My robustness checks, however, are unable to validate these findings. I therefore find no clear effects of introducing the euro on material welfare in The Netherlands.

The following chapter first establishes a theoretical framework where I discuss how to assess common currencies, look deeper at previous studies on the effects of adopting the euro and examine how to measure welfare. After that, I shape my empirical model and discuss the data that I use. This is followed by the presentation of the results of my main analysis and robustness checks. Next, I present a discussion of my findings, which is followed by the conclusion.

2 Theoretical framework

This chapter provides both a theoretical and empirical background to the topic of common currencies, and the euro in particular. Section 2.1 discusses the literature on optimum currency areas,

which is a theoretical structure establishing certain criteria by which to judge a common currency. In section 2.2, I examine current literature's findings on how well these criteria apply to the euro. This literature provides an indication of where the euro is insufficient as a common currency and how this affects the welfare of citizens of the eurozone, which allows me to formulate hypotheses on the effects I expect to find. In section 2.3 I explore the literature which empirically investigates what effects euro adoption has had, to see how well this corresponds with the theoretical expectations and to see how my research can add to the current scientific literature. Finally, in section 2.4 I discuss how economists generally approach policy evaluations and what approach I use in this research.

2.1 Theoretical literature on common currencies

As mentioned in the introduction, assessing a common currency can be done by considering the framework provided by the literature on optimum currency areas. Mundell (1961) was the first to discuss when it would be optimal for a particular region to have a single currency, which would make it an optimum currency area (OCA from this point forward). Since then, a vast range of literature has built upon his work and developed criteria for a region to be an OCA. An OCA is defined as the optimal geographic domain of a single currency, or of multiple currencies, whose exchange rates are permanently fixed with respect to each other. Most of these criteria have to do with how a country can respond to an asymmetric shock.[1] Mongelli (2002) summarizes these criteria, or properties, as follows:

i) *Price and wage flexibility.* When prices and wages are flexible within and between countries, a shock can be accounted for through changes in these prices and wages (Friedman, 1953). Compared to the case with inflexible prices and wages, the transition after a shock is then less likely to create unemployment and/or inflation, especially in the short run (Mongelli, 2002).

ii) *Production factor mobility.* High mobility of production factors, such as capital and labor, allows for a more efficient allocation of resources and therefore enhances the welfare of the countries of interest (Mongelli, 2002). A flexible exchange rate against other areas can work when factor mobility is high within an area and low internationally (Mundell, 1961). It is therefore optimal to have a currency area within which factor mobility is high.

iii) *Financial market integration.* When financial markets are highly integrated between countries, a trade deficit can be responded to with capital flows between these countries rather than through exchange rate adjustments (Kawai, 1991).

[1] For further reading I refer the reader to Mundell (1961), who provides a clear example to illustrate what happens when such an asymmetric shock occurs.

iv) *High degree of economic openness.* Economic openness can be indicated by the ratio of tradable to non-tradable goods, the ratio of exports and imports to gross output and/or the marginal propensity to import (Kawai, 1991). McKinnon (1963) argued that flexible exchange rates are less effective in maintaining an equilibrium in the balance of payments and cause more internal price instability, the more open an economy is. An area with a high degree of economic openness would therefore benefit from a common currency within the area.

v) *High diversification in production and consumption.* When countries produce and consume a diverse range of products, their exports will also be diverse. Any shock in demand for a particular good will then have a smaller impact on the country as a whole, and there are likely to be demand shocks in the opposite direction for different goods due to the law of large numbers. Aggregate exports are therefore more stable, which lowers the need for changes in the exchange rate (Kenen, 2019). A common currency between countries is thus more beneficial when these countries produce and consume a diverse range of products.

vi) *Similar inflation rates.* When inflation rates between countries are consistently similar, this leads to more stable terms of trades and therefore balanced current accounts (Mongelli, 2002). There is then less of a need for exchange rate adjustments.

vii) *Fiscal integration.* When countries are fiscally integrated, fiscal policy can be used to offset regional differences in unemployment and income (Kenen, 2019).

viii) *Political integration.* A high degree of political integration ensures better cooperation between countries and makes it more likely that countries can get behind shared policy goals. As Kawai (1991) points out, surrendering national sovereignty of monetary policy to an overarching authority requires a political process to take place. Having low political integration between countries of a common currency would make decision-making much harder.

ix) *Similarity of shocks.* According to Mongelli (2002), this is a sort of "meta" property for the OCA theory. If countries face very similar shocks, this decreases the need for different policy responses to such shocks. The countries are therefore more likely to benefit from a common currency.

These criteria provide a basis by which to judge the common currency that is the euro, which in turn can be used to assess through which mechanisms the euro affects welfare in the participating countries. There is already an extensive area of research which empirically investigates whether these properties hold for the European context. The following section therefore discusses what the main

findings are for Europe in relation to these criteria. For a more detailed description of literature on these topics, I refer the reader to Mongelli (2002).

2.2 Empirical literature on the OCA properties for the euro area

There seems to be a consensus in the literature that wage flexibility in the European Union is low. OECD (1999) note that real wages seem to respond to changes much slower in Europe than in the United States. Instead, much of the response happens in terms of employment rather than wages. Arpaia & Pichelmann (2007) find a "significant degree of nominal wage rigidity" (p. 313), although they do find that wages react to labor market conditions such as the rate of unemployment. They conclude, nevertheless, by stating that wage flexibility is insufficient in the euro area. Rusinova et al. (2015) find that real wage flexibility is particularly low in the EU during downturns of the business cycle, which is when wage flexibility would actually be most beneficial. They also find heterogeneous effects with regards to labor market regulation, where countries with more heavily regulated labor markets generally show lower wage flexibility. This finding is similar to that found by Holden & Wulfsberg (2008), who show that downward nominal wage rigidity is higher in the South and Nordic regions than in the Core and Anglo regions due to differences in institutional backgrounds.

When it comes to price flexibility, the literature is not as clearly pointing in one direction. Alvarez et al. (2005) show that prices are changed less frequently in the euro area when compared to the United States. There is heterogeneity across sectors though, with the service sector having the lowest price flexibility. They also find no evidence for a high degree of downward price rigidity in the euro area. A more recent paper by Furceri et al. (2020), however, found that price flexibility is much larger in the European Monetary Union than in the US and plays a significant role in absorbing asymmetric shocks. Nonetheless, it seems likely that countries with a large service sector would be harmed the most by losing the ability to control their exchange rate.

Production factor mobility is also low in the euro area. Bentivogli & Pagano (1999) show that changes in the relative unemployment rate in the euro area have no effect on migration, which shows that labor mobility is low. Stiglitz (2016) even goes a step further and argues that free mobility of labor, when paired with national debts, causes divergence between countries and leads to an inefficient allocation of labor within the euro area. Stiglitz argues that the same has happened with regards to capital mobility. With regards to labor mobility, countries with high debt are hit the hardest, whereas for capital mobility it is countries with weak economies who suffer most.[2] It is therefore likely that the

[2] Stiglitz (2016) provides the following economic reasoning for these statements. Countries with high debt need high taxes to be able to finance this debt, which causes lower net wages and therefore makes labor flow out of the country. This labor outflow makes the burden of debt even higher on the remaining individuals, which causes a reinforcing effect. When it comes to capital mobility, there is more confidence in rich countries to bail out banks in times of crises. This causes capital to flow from poor to rich countries which means banks must raise

countries in the euro area with high levels of debt are harmed most by a common currency in this regard. The country with the highest debt-to-GDP-ratio in the euro area is, perhaps unsurprisingly, Greece, followed by Italy and Portugal (Statista, 2020).

According to Mongelli (2002), the general view is that financial market integration is lower between European countries than in the US. One indicator for financial market integration is the law of one price, which Affinito & Farabullini (2009) find to not hold among retail banks in the euro area. They also show that financial market integration is much higher within countries than between countries, further showing that financial market integration is not yet optimal within the euro area. Jappelli & Pagano (2008) study financial market integration within the euro area for different markets. They find high degrees of integration for money and public debt markets after introduction of the euro, but low degrees of integration in equity, repo, corporate bond and credit markets. A high degree of integration would increase competition and therefore lower the cost of financial services, particularly for countries with less developed financial systems (Jappelli & Pagano, 2008). Here, again, I expect a lack of financial integration to adversely harm the weaker economies in the euro area.

The euro area is considered to have a high degree of economic openness and countries within it have highly diversified production and consumption. The ratio of exports and imports to GDP, a measure of the degree of economic openness, averages about 45% for the euro area. Krugman (2001) pointed out that regions in the United States were actually more specialized than similar regions in Europe. He, however, also argued that increased integration would lead to more specialization and therefore less diversified production. This result is also empirically found by Gianelle et al. (2017), but whether this effect dominates the positive effects of trade integration is not yet clear.

Inflation rates have converged between euro areas after the introduction of the euro, but Greece and Spain still report consistently higher inflation in the period between 2000 and 2008 (Lopez & Papell, 2012). Lopez & Papell argue that this is also the reason why these countries were most negatively impacted by the 2008 financial crisis.

According to Mongelli (2002), fiscal integration has happened to a large degree in the euro area. However, there is no banking union, which in the view of Stiglitz (2016) is essential to make the euro area work better. Countries which are harmed by asymmetric shocks would benefit most from a banking union, as this would allow transfers to take place within the euro area to help them soften such a shock. Political integration has also happened to a large extent with the different governmental bodies within the political framework of the European Union, and individual countries handing over sovereignty with regards to their monetary policy, for example. However, according to Stiglitz, political

their interest rates, but this only makes their economy even less competitive and therefore makes them even poorer. This too is a reinforcing negative effect.

integration has actually decreased and there is more conflict and distrust between countries in the euro area due to the improper functioning of the euro. This makes it harder to get all countries behind the same policy goals and is therefore likely to exacerbate any differences between countries, making a common currency less optimal.

Finally, the general consensus is that shocks are not entirely symmetric within the euro area. Belke et al. (2017) study the synchronization of business cycles in regards to two different regions within the euro area, namely the core and peripheral countries. The core countries include Germany, France, Austria, Finland and The Netherlands, whereas the peripheral countries include Portugal, Italy, Ireland, Greece and Spain. They find that synchronization between these two regions fell after the 2008 financial crisis, and that synchronization of the peripheral countries also fell when compared to non-euro countries as well as between the countries within the region. For the core countries, synchronization between them remained constant. It therefore seems likely that the core countries could benefit from common policies, whereas the peripheral countries would benefit more from choosing their own policies.

The literature studying the euro area with regards to the OCA properties gives a clearer picture of who the winners and losers are of the euro. Losers should include countries with more heavily regulated labor markets, a larger service sector, higher levels of debt, weaker economies, high inflation as well as the peripheral countries. Southern European countries such as Portugal, Spain, Italy and Greece seem like primary examples of countries that fit many of these descriptions. On the other hand, Western and Northern European countries such as Germany, The Netherlands, Finland and Austria do not fit most of these descriptions and therefore seem more likely to have gained from euro adoption. This research focuses on one of each of these groups, namely Italy and The Netherlands, to empirically study the effects closer. Based on the theory above, I formulate the following hypotheses.

Hypothesis I: Implementing the euro caused a decrease in material welfare in Italy.
Hypothesis II: Implementing the euro caused an increase in material welfare in The Netherlands.

The next step is then to investigate whether these differences that are expected based on the theory, are also visible in empirical research into the effects of the euro. The following section summarizes the main findings of this strand of literature.

2.3 Empirical literature on the effects of the euro

Current literature has looked at the effects of euro adoption on GDP growth (see e.g., Fernández & Garcia-Perea, 2015; Gabriel & Pessoa, 2020; Žúdel & Melioris, 2016) as well as the effect of not

joining the euro on trade flows between the United Kingdom and its trade partners (Saia, 2017) and the effects of leaving the euro for Italy (Bagnai et al., 2017).

Fernández & Garcia-Perea (2015) use the synthetic control method and find no effect of euro adoption on GDP per capita in The Netherlands, Germany and Austria, a positive effect for Finland, Spain, Greece and Ireland, and a negative effect for Belgium, France, Italy and Portugal. Gabriel & Pessoa (2020) also use the synthetic control method and find negative effects on GDP for France, Germany, Italy and Portugal and a positive effect for Ireland. Žúdel & Melioris (2016) once again use the synthetic control method but only study Slovakia and find positive effects of euro adoption on GDP per capita. Bagnai et al. (2017) take a different approach, using a macro-econometric model to estimate what the effects would be for Italy of leaving the euro and returning to their national currency. They find that, paired with expansionary monetary policy, this withdrawal would have a positive effect on both output and employment.

These results largely correspond with the expectations of the effect on different countries based on OCA theory. France, Italy and Portugal are consistently found to have experienced negative effects of adopting the euro on GDP. Surprisingly, Ireland seems to have had clear positive effects according to empirical research, whereas the theory would predict negative effects for them.

The current literature provides a good overview of the effects of the euro on GDP for countries in the euro area. However, GDP per capita is generally considered a bad indicator of social welfare and therefore not a good measurement to evaluate the impacts of a certain policy (Fleurbaey, 2009). Instead, I use multiple indicators of material welfare, based on the recommendations by Stiglitz et al. (2009). The following section dives deeper into the theory behind measuring welfare and how I intend to get close to measuring the effect of euro adoption on it for Italy and The Netherlands.

2.4 Literature on social welfare analysis

Investigating the effects of a certain governmental policy in its most extensive form is, within the field of economics, ideally done by considering the social welfare function. A social welfare function is constructed by taking a weighted sum of individual welfare levels. Here individual welfare levels are determined by the utility individuals derive from scarce goods, possibly including but not limited to consumption, environmental quality, leisure and public goods. Weighting is done by using Pareto weights, which are based on political or ethical judgements about how much a person's personal welfare influences social welfare. However, using the social welfare function in an empirical analysis runs into two problems. Firstly, individuals' utility functions cannot possibly be observed, only their actual behavior. Secondly, the Pareto weights for the social welfare function are also not observed. It is therefore practically impossible to investigate how euro adoption affected social welfare.

I therefore base my analysis on the suggestions made by Stiglitz et al. (2009) in an influential report on measuring economic performance and social progress, which was constructed by a commission containing some of the world's most renowned economists. They make a number of recommendations, which I now discuss in short.

Measuring material well-being

Rather than taking one single indicator of well-being, Stiglitz et al. (2009) argue that measuring well-being necessarily requires a variety of measures. An important first part of measuring well-being is measuring material well-being. Not just average levels of indicators should be included, but the distribution of them should also be taken into consideration as average levels do not show the diversity in people's experiences. An increase in average income with a less equal distribution could make most people less off, for example. When it comes to GDP, this measures market production, whereas material well-being is better indicated by net national income, real household income and consumption. The authors recommend combining such measures with a measure of wealth, as this can display the tradeoff between current and future consumption and its association with wealth. They also argue that you should ideally look at household rather than individual data. With regards to the distribution of certain measures, it can also be useful to look at what happens at the bottom or top of the income/wealth distribution. Finally, non-market activities should also be included. Purchasing a certain good or service on the market rather than receiving it from a friend of family member, for example, would generate an increase in consumption without necessarily making an individual better off.

Multi-dimensional well-being

To measure overall well-being, Stiglitz et al. (2009) suggest not only looking at material well-being but also at other dimensions that influence well-being. These at least include health, education, personal activities including work, political voice and governance, social connections and relationships, environment and insecurity.

The focus of this research is on material well-being. Although including more dimensions would give a wider view of the effect of the euro on overall well-being, the lack of data on these dimensions prevents this from being an option.[3] This means I cannot definitively conclude how the euro has affected social welfare as a whole, but it seems likely that the effects mainly run through material welfare. It follows from sections 2.2 and 2.3 how the euro might affect material welfare measures such as consumption and income but the effects on environmental quality or health, for example, are not

[3] Although there are multiple indices that aim to provide a broader measure of welfare, such as the Human Development Index, the Index of Sustainable Economic Welfare and the Genuine Progress Indicator, none of these indices have been calculated for all OECD countries over a long period of time. The same applies to data on the individual dimensions suggested by Stiglitz et al. (2009), with the exception of some environmental measures.

clear. The lack of any literature studying the relationship between the euro and these other dimensions is further indication that material measures are the more relevant focus for this research.

To get an answer to my research question, I need to answer two separate questions. Firstly, I want to know how adopting the euro has affected the average material welfare of both countries considered in this study. Secondly, I want to know how adopting the euro has affected the distribution of material welfare within countries. For the first question, measures of average consumption, income and net worth are used. To answer the second question, I consider the income distribution within a country as well as average income at both the bottom and top of the income distribution. Household data are available for final consumption and net worth, so here the household perspective is used. Non-market activities cannot be included, as data are not available for this. Besides these two deviations, I follow the suggestions by Stiglitz et al. (2009).

It is important to also include distributional measures as average levels of material welfare may increase, but I can only claim that this has positively contributed to social welfare when this is paired with a more equal distribution. When average material welfare increases (decreases), but the material welfare distribution becomes less equal (more equal), the effect on social welfare is ambiguous. In the following section, I will give a description of the data and the synthetic control method that I will use.

3 Data and methodology

3.1 Data

Most data are taken from the World Bank Databank, which contains annual national data for a wide range of variables. The data period considered is 1980-2019, which contains a sufficient pre-euro and post-euro period, and stretches to the most recent available data period for most variables. The three variables that I use for average material welfare are the adjusted net national income per capita, households and NPISHs final consumption per capita and household financial net worth. The first two variables are collected by the World Bank and the last variable is collected by the OECD, but only goes back to 1995. This severely restricts my pre-euro period, which means the findings for this variable are less reliable than for the previous two variables. Considering these three indicators gives a comprehensive view of material welfare, as was suggested by Stiglitz et al. (2009). For example, a steady consumption combined with decreasing household net worth might indicate that households are using up their savings to finance their consumption. This would show that current material welfare is not sustainable and will likely drop in the future.

To study the distribution of material welfare, I consider the disposable income Gini coefficient and the average pre-tax national income of both the bottom 50% and the top 10% of the income distribution. Although the Gini coefficient gives a broad view of the distribution of income or

consumption, it can also give a misleading view of reality. For example, if income inequality and therefore the Gini coefficient rises, this does not necessarily mean that those at the bottom of the income distribution are worse off. It is entirely possible that everyone in society is better off if the Gini coefficient rises but it is paired with a rise in average income. This is why the final two variables are also included, since these give an idea what happened to absolute income for different parts of the income distribution rather than relative income. All of these variables are taken from the World Inequality Database, which combines multiple data sources to reach a consistent annual time series. It contains the disposable income Gini index and the income share of the bottom 50% and top 10% of the income distribution. I calculate average income in these groups myself by multiplying the income share with national income and dividing by the number of people in the income group. A full overview of all variables, their definitions and sources can be found in table A1.

3.2 Methodology: Synthetic Control Method

The research method I use is the synthetic control method, as constructed by Abadie et al. (2010). This method assigns weights to countries from a donor pool to form a linear combination of the dependent variable that is as close as possible to that of the country of interest. Abadie et al. (2015) argue that it is important to pick a donor pool consisting of similar countries to the treated country, in order to reduce interpolation biases. The donor pool I use consists of OECD countries, excluding those countries which also have the euro. These are all democratic countries with fairly well-developed free-market economies that could provide a good counterfactual to Italy and The Netherlands.

The main advantage of the synthetic control method over a regular OLS is that with an OLS you have to include all relevant control variables, which is unlikely and therefore limits the extent to which this model can be used for causal inference. In this research I know exactly what caused the variation I am interested in, namely adopting the euro or not, and it is known that it happened at the country level. Another method that is often used with this kind of design is a Difference-in-Differences model. However, the disadvantage of this method is that it requires the parallel trends assumption to hold, which means that the trends in the dependent variable should have been the same for the treatment and control group in the absence of treatment. This would imply hand-picking a country to serve as a control group for both Italy and The Netherlands. Instead, the synthetic control group can be formed by a combination of countries, and this combination is objectively chosen based on the available data. The equation that I want to estimate for this method, based on Abadie (2021), is as follows:

$$\hat{\tau}_{1t} = Y_{1t} - \sum_{j=2}^{J+1} w_j^* Y_{jt}$$

Here, $\hat{\tau}_{1t}$ is the estimated treatment effect of euro adoption in period t for either Italy or The Netherlands, which makes it country 1. Y_{1t} is the observed outcome for this country 1 in period t, J is

the total number of countries and the donor pool consists of j=2,....,J+1. Y_{jt} is the observed outcome for country j in period t and w_j^* is the weight assigned to each country j (Abadie, 2021). In essence, the first part of the right-hand side of the equation gives the observed outcome for either Italy or The Netherlands, and the second part of the right-hand side of the equation should be very close to this value in the pre-intervention period. After the intervention occurs in t=1999, the difference between these two values is then interpreted as the treatment effect of euro adoption on the outcome variable. The vector of weights $W^* = w_2^* + \cdots + w_{J+1}^*$ is chosen to minimize

$$||X_1 - X_0 W||_V = \sqrt{(X_1 - X_0 W)' V (X_1 - X_0 W)}$$

with X_1 being a matrix containing characteristics of either Italy or The Netherlands, X_0 being a matrix containing the same characteristics but for the control countries, and V being a symmetric and positive semidefinite matrix that is chosen to minimize the mean square prediction error of the outcome variable over a set of pre-intervention periods (Abadie et al., 2011). According to Abadie et al., the purpose of V is to be able to give different weights to the characteristics in X_1 and X_0, depending on how well they predict the outcome variable. Choosing the right characteristics that influence the outcome variable is quite important for this research design, and I therefore now discuss which characteristics I use.

Similar to the approach taken by Abadie et al. (2015), the predictors that I use are the inflation rate, net investment in nonfinancial assets, secondary and tertiary school enrollment and trade as a share of GDP. The link between these predictors and my outcome variables have been studied extensively. Barro (2013), for example, studies approximately 100 countries over a period of 30 years and finds a negative effect of inflation on economic growth. This shows that it is likely that inflation is also a predictor for net national income. Gylfason & Herbertsson (2001) furthermore show that higher inflation can cause lower saving, which therefore negatively affects household wealth. Finally, Koskela & Viren (1985) find a negative effect of inflation on consumption. Khan & Reinhart (1990) show that both public and private investment contribute positively to economic growth. It also influences consumption through the trade-off between current and future consumption and increases household wealth in the long-term. Schooling allows individuals to gain greater income, therefore also contributing positively to wealth and consumption. Finally, Makki & Somwaru (2004) study developing countries and find a positive effect of trade on economic growth.

For the distributional outcomes, national income per capita, the unemployment rate, share of the population older than 65 and the ratio of female to male labor force participation rate are used. Data for all of these variables are also available in the World Bank Databank. Barro (2008) finds evidence for

the so-called Kuznets curve, which establishes a relationship between income inequality and GDP per capita. Mocan (1999) finds that a higher unemployment rate increases income inequality, whereas higher inflation lowers it. Lee et al. (2013) study income inequality in South-Korea and find that a higher elderly share of the working population causes higher income inequality. Finally, Albrecht & Albrecht (2007) find that a higher female labor participation rate lowers income inequality. Table A2 gives an overview of the predictors and donor countries that are used for each indicator of material welfare.

Assumptions and robustness checks

There are three assumptions that must hold for reliable use of the synthetic control method, as summed up by McClelland & Gault (2017). Firstly, only the treated state should be affected by the policy. To ensure that this condition is satisfied, I only consider countries which do not use the euro for the donor pool. This condition also implies that there cannot be any spillover effects of the euro on other countries in the donor pool. One paper by Hájek & Horváth (2016) did indeed find spillover effects of shocks originating in the euro area to other European countries. If there are spillover effects, the validity of my findings is harmed as I either overestimate or underestimate the treatment effect depending on the direction of the spillover effects. As a robustness check, I therefore repeat the analysis with only non-European countries as possible donor countries, where spillover effects should be smaller or absent. Regardless, it is hard to fully rule out spillover effects. Studying the assigned donor weights can also give an indication of the direction of possible spillover effects. This will be discussed further in the discussion section.

Secondly, the policy should not have an effect before it is enacted. Berger & Nitsch (2008) argue that an anticipation effect seems unlikely, as the final countries were only decided in 1998 and there were more remaining uncertainties. Žúdel & Melioris (2016), who study Slovakia's adoption of the euro in 2009, do actually find a strong anticipation effect. Although Slovakia's adoption is different from the first wave of adopting countries including Italy and The Netherlands in 1999, an anticipation effect could be a valid concern for this research setup. To account for this, I perform a robustness check which Abadie (2019) call "backdating". This involves setting the treatment period back to a few years prior to the intervention, which would capture anticipation effects. This is more well-known as an "in-time placebo test", and also provides credibility to the model if the effect only appears after the real intervention period.

The final assumption is that the treated unit’s counterfactual outcome can be approximated by a fixed combination of donor units. Whether this assumption holds is inspected in the data analysis, where I can see how closely the counterfactual approximates the real trend pre-intervention. Using OECD countries as a donor pool increases the chance that this is possible, as previously mentioned.

Though it is usually not stated as one of the assumptions, it is also important that there are no so-called contaminating events. Since the intervention is studied at an aggregate level, I need to be

sure that the introduction of the euro is the main policy that would have such an influence on the treated countries. Investigating policy changes in Italy and The Netherlands revealed no other large policies around the time that the euro was introduced.

For all analyses, the placebo gaps will also be presented. This is done by assigning a placebo treatment to each donor country and taking the difference between the post-intervention trend of each donor country and its synthetic control. These placebo gaps are then used to calculate p-values, which are defined as the probabilities of finding an effect larger than the effect for the actually treated country (Abadie et al., 2015). I report standardized p-values, where the normal p-values are weighted by the pre-intervention fit. This is done because normal p-values might be too conservative, if some countries do not have a good fit in the pre-intervention period for the placebo tests (Galiani & Quistorff, 2017).

4 Results

This section discusses the main results that I find for the chosen measures of material welfare. I first look at the effects for Italy, starting with the average indicators in section 4.1 and followed by the distributional indicators in section 4.2. After that, I look at the effects for The Netherlands, and again first look at the average indicators in section 4.3 and then at the distributional indicators in section 4.4. I conclude with multiple robustness checks in section 4.5 to see how reliable my results are.

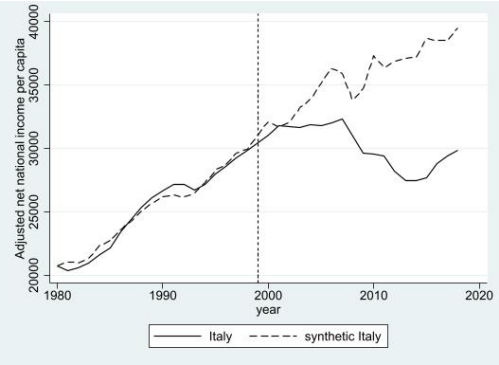
4.1 Average indicators of material welfare for Italy

Panels A1, B1 and C1 of Figure 1 provide the results for the synthetic control regression for my main indicators of average material welfare. Panels A2, B2 and C2 of Figure 1 show the results of assigning a placebo treatment to each donor country, where each graph shows the difference between the actual country and its synthetic counterfactual. As can be seen in Panel A1 of Figure 1, the synthetic control for adjusted net national income per capita matches the trend of real Italy fairly well in the pre-intervention period. For all indicators, Table B1 shows the weights that are used to construct the synthetic counterfactual and Table B2 shows how balanced the predictor variables are in the pre-intervention period. In the first few years after adopting the euro in 1999, Italy's national income seems to match the national income in the synthetic country. However, after two to three years, Italy's income seems to plateau and it starts falling around 2008 when a global financial crisis hit the world's economies. Where synthetic Italy is back to its pre-crisis level of national income around 2010, Italy never reaches its pre-crisis level again in my data period. This could be caused by the desynchronization that occurred between peripheral and core countries of the eurozone due to the crisis, as was discussed in section 2.2. In the final time period, which is 2018, the difference between the adjusted net national income per capita between synthetic Italy and real Italy rises to approximately $9632 in

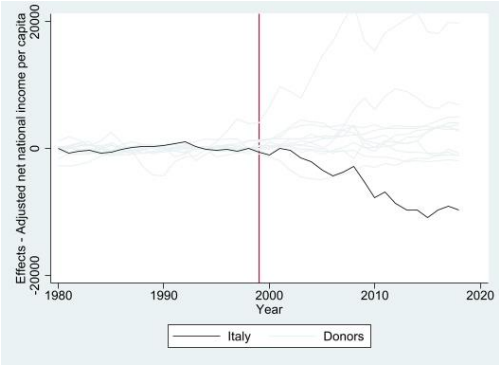
constant 2010 US$. This is equal to a loss of nearly one quarter of net national income per capita in 2018 for Italy due to adopting the euro. Panel A2 of Figure 1 reveals that this effect is more negative than all placebo gaps, leading to a significant effect at the 10% level from 2009 forward and a significant effect at the 1% level in three of the four final years. A full overview of the effects per year, including standardized p-values, can be found in table B3 for all indicators.

Figure 1: Effects and placebo gaps of euro adoption on average material welfare indicators in Italy

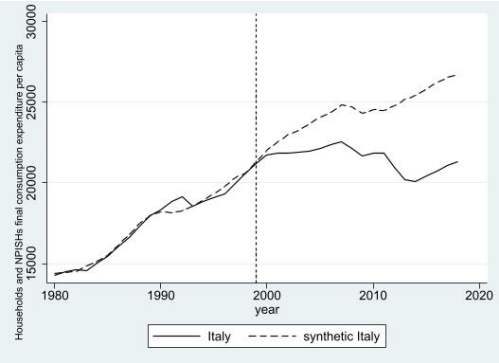
Panel A1: Adjusted net national income per capita



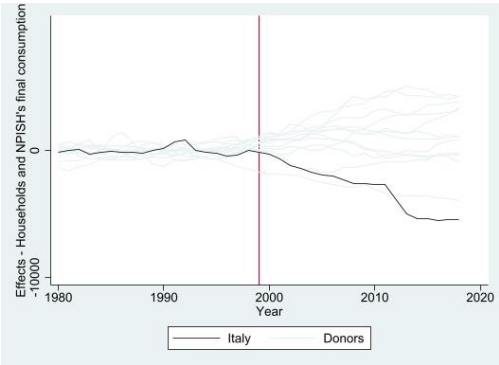
Panel A2: Adjusted net national income per capita gap in Italy and placebo gaps in donor countries



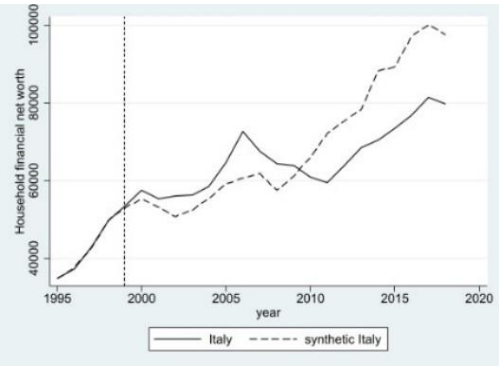
Panel B1: Households and NPISHs final consumption expenditure per capita



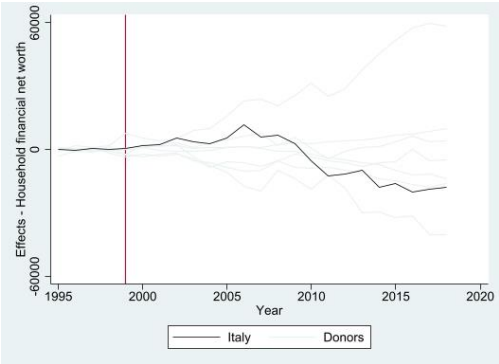
Panel B2: Households and NPISHs final consumption expenditure per capita gap in Italy and placebo gaps in donor countries



Panel C1: Household financial net worth



Panel C2: Household financial net worth gap in Italy and placebo gaps in donor countries



Panel B1 of Figure 1 shows how consumption per capita has evolved for Italy. The synthetic control country matches Italy well in the pre-intervention period, and immediately starts to diverge after 1999. Here, again, Italy seems to have a much harder time to recover from the 2008 financial crisis when compared to its counterfactual. In the final years of the data period, the loss in consumption equals approximately $5400 in constant 2010 US$. This is equal to a loss of roughly one fifth of households and NPISHs final consumption expenditure per capita in 2018 for Italy due to introducing the euro. Panel B2 of Figure 1 shows that the effect for Italy is again more negative than all placebo gaps, leading to a negative effect that is statistically significant at the 10% level from 2002 to 2012, and at the 1% level from 2013 to 2018. Note that both national income and consumption are annual values, which means that cumulative losses will be much larger than simply the $9632 and $5424 respectively in 2018.

The synthetic control for household financial net worth seems to fit even better in the pre-intervention period, but this might simply be caused by the very short pre-intervention period. After 1999, household financial net worth actually rises faster in Italy than in the counterfactual, until it spikes in 2006 and is caught up around 2009. In 2011, it hits its lowest point and then starts to rise again. Surprisingly then, euro adoption seems to have had positive effects on household financial net worth in the first 10 years, but negative effects after that. The effect in Panel C2 of Figure 1 is more negative than all but one of the placebo gaps, leading to statistical significance at the 1% level in all years from 2000 forward except 2001 and 2009. However, it is dangerous to conclude this simply from this regression due to the short pre-intervention period, which makes the findings less reliable.

The effect of euro adoption on average material welfare in Italy seems to be negative. I find a divergence between actual Italy and my synthetic control starting in the first years after introducing the euro for both income and consumption. As mentioned, I also want to consider the distribution of material welfare, which will be the focus of the next section. In section 4.2, I show my results for the Gini index and average income in both the top 10% and bottom 50% of the income distribution in Italy.

4.2 Distributional indicators of material welfare for Italy

As panel A1 of Figure 2 shows, the pre-intervention trend of the synthetic control does not fit the actual trend highly accurately. Nonetheless, the overall direction of the trend is matched fairly well, although Italy has much larger spikes than the synthetic control. After the euro is introduced, Italy's Gini index seems to drop, whereas synthetic Italy experiences an increase. This graph indicates that although Italy saw a decrease in average material welfare, this was (partly) compensated by a more equal distribution of material welfare. I am cautious to conclude this just from this single regression, however, for two reasons. Firstly, Table B3 shows that the treatment effect is not statistically significant in any of the post-intervention years. This might be caused by the very large placebo gaps

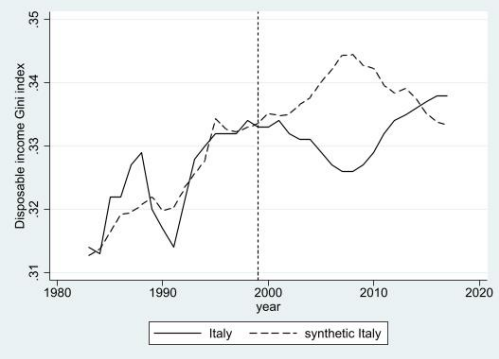
in Panel A2 of Figure 2, which make it hard to say whether there actually is an effect or if it is simply due to inherent fluctuations which can also be seen in the placebo gaps. Secondly, as mentioned earlier, a decrease in the Gini index can be caused by different combinations of changes in absolute income. As World Bank (nd) also states, Gini coefficients are not unique and the Gini can rise while the number of people in poverty decreases. I therefore now look at average income in both the bottom 50% and top 10%, to get an idea of how absolute levels of income have changed at the bottom and top of the income distribution.

Panel B1 of Figure 2 shows a similar trend to adjusted net national income per capita for the whole population in Figure 1, where Italy starts to diverge from synthetic Italy after three years. Average pre-tax national income of the top 10% seems to stagnate until 2008, when the crisis makes their average income fall. Where the top 10% in the synthetic control hardly experience a drop in income, this is quite strong for Italy and it does not recover to the pre-crisis level in this data time period. Panel B2 of Figure 2 shows that the effect is lower than all placebo gaps, leading to an effect that is significant at the 10% level from 2013 forward and at the 1% level in 2014. Combining these results with the results in Panel C1 of Figure 2 gives an indication of why the Gini index seems to drop in the period between 1999 and 2008. Average income in the bottom 50% rises slightly faster in Italy than in its counterfactual until 2008, but strongly decreases afterwards. The decrease in equality that is seen in panel A1 seems to correspond with a decrease in income in the top 10% and constant or rising income in the bottom 50% leading up to the crisis. The following increase in inequality starting in 2008, which actually makes Italy catch up with its counterfactual at the end, seems to correspond with a stronger decrease in income in the bottom 50% than in the top 10% after 2008. I therefore conclude that, although inequality is lower in Italy than in synthetic Italy in much of the pre-intervention period, the decrease in average material welfare is not compensated enough by a more equal distribution. The increase in relative income between the bottom 50% and the top 10% is caused by lower absolute income in all income distribution groups, which unambiguously causes lower material welfare for Italy on the whole. Although the effect is more negative than nearly all placebo gaps, as can be seen in Panel C2 of Figure 2, the effects are not statistically significant in any of the years. This could point to the fact that this is not a “true zero”, where there is actually no effect, but rather an effect that is non-significant due to poor fits for the placebo runs, for example. It should be noted that the results still support my conclusion because the top 10% sees a significant drop in income, even if the effect for the bottom 50% is actually zero.

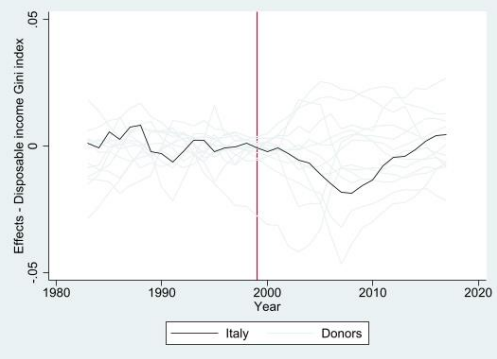
My analysis indicates that Italy has clearly seen a decrease in material welfare due to introducing the euro, which is in line with my first hypothesis. The next step is now to test my second hypothesis, which concerns The Netherlands. Section 4.3 will focus on the effects of euro adoption on the chosen average indicators of material welfare for The Netherlands.

Figure 2: Effects and placebo gaps of euro adoption on distributional material welfare indicators in Italy

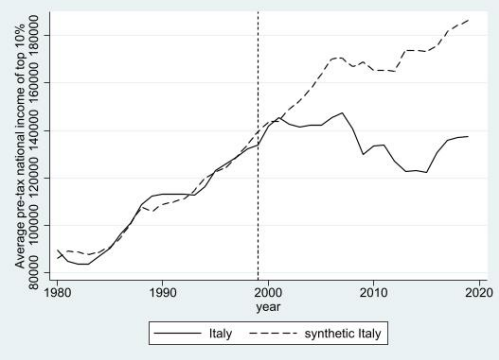
Panel A1: Disposable income Gini index



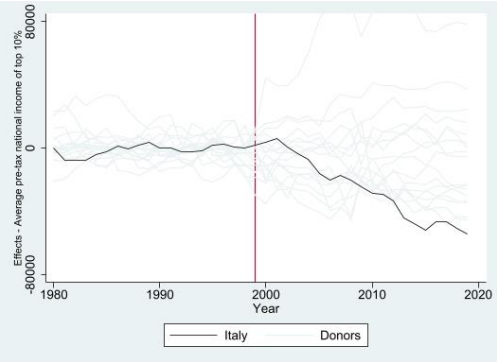
Panel A2: Disposable income Gini index gap in Italy and placebo gaps in donor countries



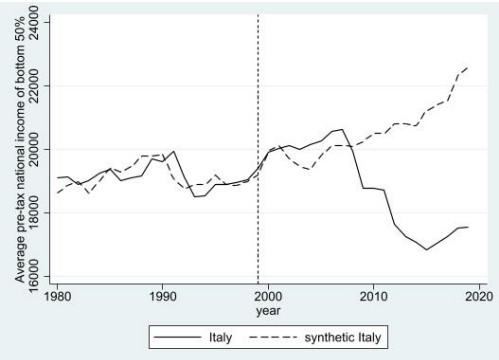
Panel B1: Average pre-tax national income of top 10%



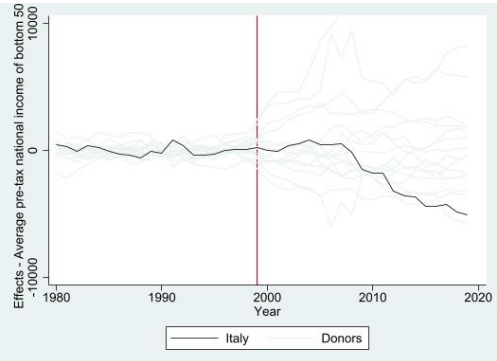
Panel B2: Average pre-tax national income of top 10% gap in Italy and placebo gaps in donor countries



Panel C1: Average pre-tax national income of bottom 50%



Panel C2: Average pre-tax national income of bottom 50% gap in Italy and placebo gaps in donor countries



4.3 Average indicators of material welfare for The Netherlands

Panel A1 of Figure 3 shows that the synthetic country matches the pre-intervention trend of The Netherlands sufficiently well for adjusted net national income per capita. An overview of the weights that are used to form the synthetic control for all indicators can be found in table C1 for The

Netherlands. Table C2 shows how well the synthetic control and The Netherlands match on predictor variables in the pre-intervention period for all indicators. In Panel A1 of Figure 3, there is an initial positive effect visible that disappears after only a few years. Panel A2 of Figure 3 shows that the effect is very close to a lot of placebo gaps. As can be seen in Table C3, this leads to an effect that is statistically significant at the 1% level in the first two years but not significant in the remaining years. This indicates that, despite the positive effects in the first years, euro adoption has had no effect on adjusted net national income per capita for The Netherlands in the long run.

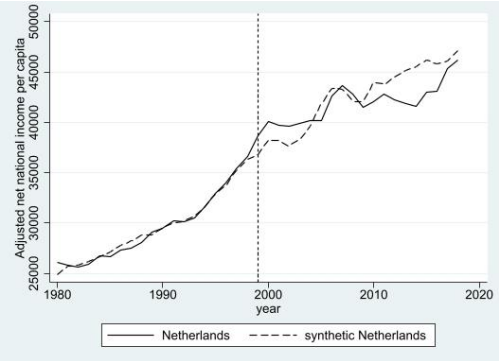
Panel B1 of Figure 3 shows the analysis for households and NPISHs final consumption expenditure per capita, where the trend of synthetic Netherlands matches the trend of The Netherlands reasonably well. As with adjusted net national income per capita, there seems to be an initial increase after introducing the euro. However, where the trends moved together again after the first years for the previous indicator, the trend for consumption in The Netherlands seems to clearly lag behind its synthetic counterfactual after the first years. Panel B2 displays that the effect is lower than all placebo gaps, leading to statistical significance in the last ten years at the 10% significance level and at the 1% level in the last five years. The loss in consumption amounts to nearly $6000 in constant 2010 US$, which again is similar to approximately one fifth of households and NPISHs final consumption expenditure per capita compared to the case where the euro is not introduced.

Panel C1 of Figure 3 shows the analysis for household financial net worth, where the pre-intervention fit is reasonably good. There are no clear effects visible of introducing the euro when comparing The Netherlands to the synthetic Netherlands. Panel C2 indicates that the effect is larger than most placebo gaps, but the spread is so wide that Table C3 shows that the effect is not statistically significant in any of the years. Combined with the very short pre-euro period, I find no evidence to state that introducing the euro has had an effect on household financial net worth in The Netherlands.

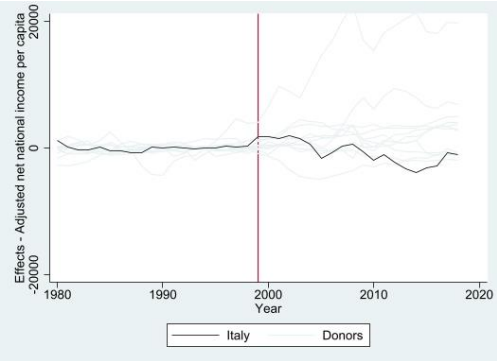
My findings for the average indicators of material welfare are mixed. I find negative effects of euro adoption in The Netherlands on households and NPISHs final consumption expenditure per capita, but no effects on adjusted net national income per capita and household financial net worth. There might be a stronger effect if the distribution of material welfare is affected by the euro. Section 4.4 therefore once again looks at the effect of the euro on the Gini index, average income in the top 10% and average income in the bottom 50%.

Figure 3: Effects and placebo gaps of euro adoption on average material welfare indicators in The Netherlands

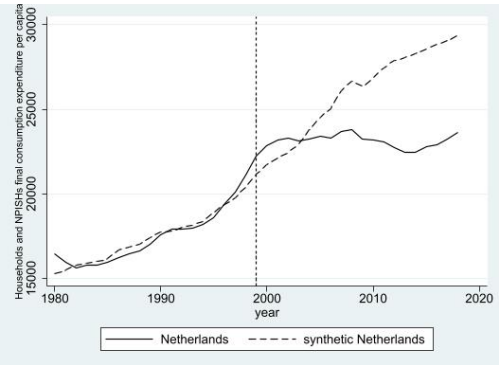
Panel A1: Adjusted net national income per capita



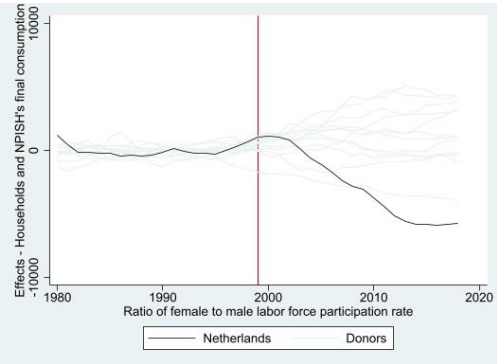
Panel A2: Adjusted net national income per capita gap in Netherlands and placebo gaps in donor countries



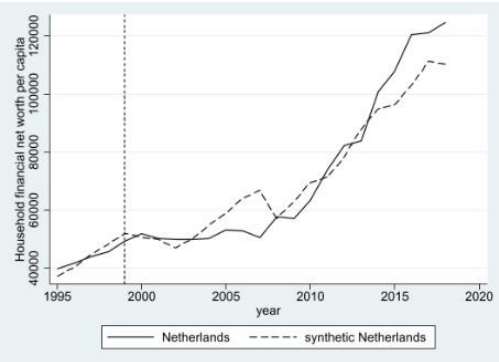
Panel B1: Households and NPISHs final consumption expenditure per capita



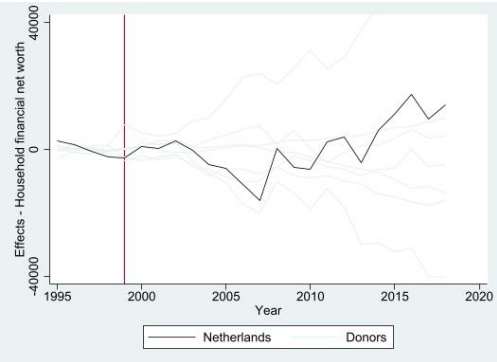
Panel B2: Households and NPISHs final consumption expenditure per capita gap in Netherlands and placebo gaps in donor countries



Panel C1: Household financial net worth



Panel C2: Household financial net worth gap in Netherlands and placebo gaps in donor countries



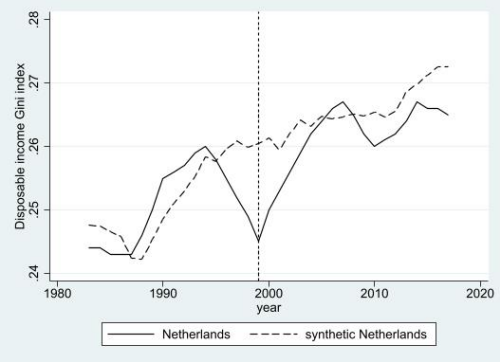
4.4 Distributional indicators of material welfare for The Netherlands

The fit of the synthetic control for the disposable income Gini index in Panel A1 of Figure 4 seems to get worse just before the introduction of the euro. Panel A2 shows an effect that is one of the lowest around 1999, but ends up in the middle of the placebo gaps in the final years. Table C3 indeed indicates that there is only a significant effect in 1999, but the gap between The Netherlands and its counterfactual seems to already be present in the years before the euro is introduced. As the following years all show no statistically significant effects, I find no evidence of an effect of introducing the euro on the disposable income Gini index.

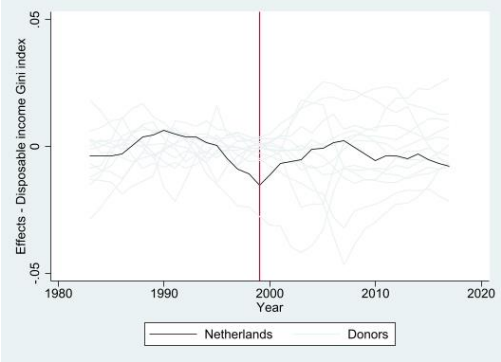
Table C3 and Panel B of Figure 4 indicate that introducing the euro has had no effect on the average pre-tax national income of the top 10%. This can also be seen in Panel B2 where the effect is always around the middle of all placebo gaps, pointing to no clear effects of introducing the euro. Panel C1 of Figure 4 seems to show the average income of the bottom 50% in The Netherlands outperforming that of the counterfactual, but Panel C2 shows that the effect is average when compared to the placebo gaps. Table C3 indeed reveals that the effect is not significant in any of the post-euro years. Combining this result with the fact that most of the effect seems to already occur before the 1999, I find no effect of adopting the euro on distributional indicators of material welfare in The Netherlands. I thus conclude that adopting the euro has had a small negative effect on material welfare in The Netherlands, in the form of a loss in consumption. To test how robust and reliable my findings are, I perform multiple robustness checks in section 4.5.

Figure 4: Effects and placebo gaps of euro adoption on distributional material welfare indicators in The Netherlands

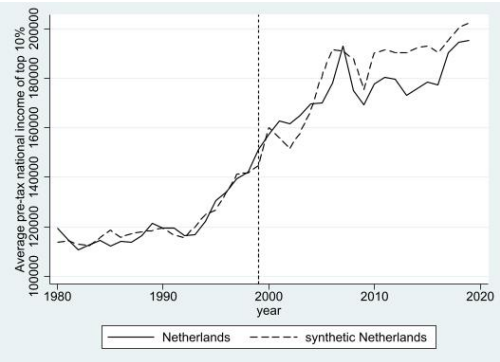
Panel A1: Disposable income Gini index



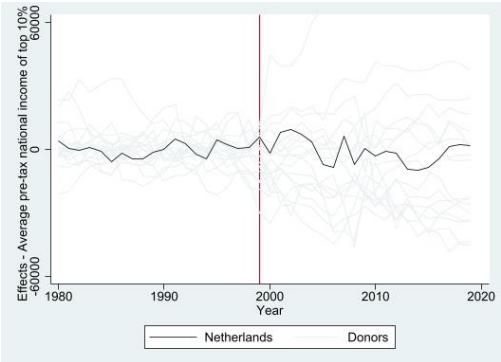
Panel A2: Disposable income Gini index gap in Netherlands and placebo gaps in donor countries



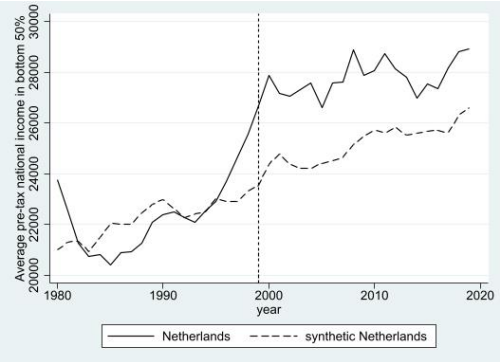
Panel B1: Average pre-tax national income of top 10%



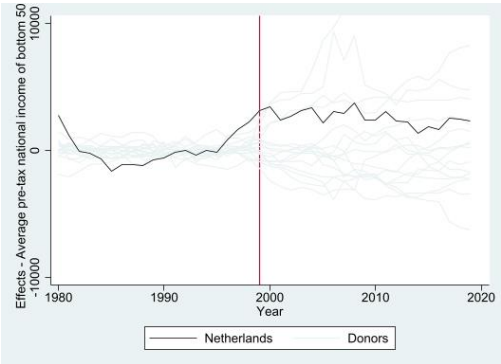
Panel B2: Average pre-tax national income of top 10% gap in Netherlands and placebo gaps in donor countries



Panel C1: Average pre-tax national income of bottom 50%



Panel C2: Average pre-tax national income of bottom 50% gap in Netherlands and placebo gaps in donor countries



4.5 Robustness checks

Now that I know what results my main analysis finds, I want to check how robust and reliable these findings are. The first test that I perform is to use the same analysis, but restrict the donor pool to only include non-European countries. This has the advantage that it restricts potential spillover effects, as introducing the euro might also influence material welfare in neighboring countries. However, a drawback is that European countries are generally most similar to Italy and The Netherlands and face similar shocks, which is important for constructing a donor pool. For that reason I have chosen to include European countries in my main analysis, but performing the same analysis excluding European countries also has value for the robustness of my results.

All findings for this robustness check for Italy are reported in Appendix D. The analyses for adjusted net national income per capita, households and NPISHs final consumption expenditure per capita and average pre-tax national income of the top 10% are very similar to my main analysis. The graphs and treatment effects in Appendix D match my previous findings and therefore make them more credible. The synthetic trends for household financial net worth, disposable income Gini index and average pre-tax national income of the bottom 50% all insufficiently match the real trend and are therefore not usable to assess the credibility of my main findings. The fact that the findings of this robustness check largely correspond with my main findings also indicates that spillover effects were not an issue in the analysis for Italy.

The robustness check for The Netherlands is reported in Appendix E. For adjusted net national income per capita, household financial net worth and average pre-tax national income of the top 10%, I again find no effect of Euro adoption for The Netherlands. The robustness check for households and NPISHs final consumption expenditure per capita also matches my main findings very closely, with an initial increase followed by a negative effect after about five years. The findings for the disposable income Gini index and average pre-tax national income of the bottom 50% are not usable due to a poor pre-intervention fit. The robustness check for The Netherlands also supports my main findings and indicates that spillover effects are not an issue in the analysis for The Netherlands.

The next robustness check I perform is an in-time placebo test, which allows me to assess whether anticipation effects are biasing the results. Since this is used to validate whether any effects I find are actually caused by the introduction of the Euro, I only perform this test for the variables which have found significant effects in my main analysis. Due to the limited pre-intervention data availability for household financial net worth, this variable cannot be used. This means that for Italy, I use this test on adjusted net national income per capita, households and NPISHs consumption expenditure per capita, disposable income Gini index and average pre-tax national income of the top 10%. For The Netherlands, I only consider households and NPISHs final consumption expenditure per capita. The

artificial treatment period that I use is 1992, as this is when it was decided that the European Union would move forward with its idea of a common currency. All predictor variables used are the same, except for the lagged outcome variables which are changed accordingly.

The results for Italy are shown in Appendix F. Visual inspection indicates that adjusted net national income per capita, households and NPISHs final consumption expenditure per capita and average pre-tax national income for the top 10% in Italy and synthetic Italy move very closely until around 2000, when they start to diverge. Table F3 reveals that the effect for income becomes significant in 2009, the effect for consumption becomes significant in 2002 and the effect for income of the top 10% becomes significant in 2007. The fit for the disposable income Gini index is very weak, which makes it hard to draw conclusions from the test for this variable. These findings nonetheless provide further proof that it is in fact the euro causing a material welfare loss for Italy, since the effect starts just after its introduction for nearly all variables.

The result for households and NPISHs final consumption expenditure per capita in The Netherlands is provided in Appendix G. A small divergence upwards can already be seen before the actual euro introduction period, and a small divergence downwards occurs after the euro is introduced. However, the effect is not statistically significant in any of the years. This test therefore does not provide more support for my findings of a negative effect of adopting the euro on consumption in The Netherlands.

5 Discussion

Although my analyses point to material welfare losses for Italy caused by introducing the euro, these losses seem to be particularly exacerbated by the Great Recession in 2008. If this is an event that only affected the eurozone, this could bias my results as I am then not only estimating the effect of introducing the euro but also of experiencing the 2008 crisis. However, the global nature of the crisis makes it so that each OECD country essentially "underwent treatment" when it comes to the financial crisis. This ensures that my results are not biased, but the effects might still be larger due to the presence of the euro for Italy. The synthetic control method ensures that synthetic Italy is very similar to Italy before the euro is introduced, and the effects of a global crisis should then be comparable if the euro had not been introduced. The large loss due to the crisis might point to an adverse effect of the euro in dealing with crises in general, as is also argued by Stiglitz (2016). Although the Great Recession affected each country in the OECD, it might still be considered an asymmetric shock within countries where some sectors are hit harder than others. This is exactly what the literature on optimum currency areas, which was discussed in section 2.1, focuses on. If the eurozone is not an optimum currency area, which the literature seems to indicate it is not, then recovery to asymmetric

shocks will be much harder. My theoretical framework also indicated that countries with weaker economies would especially be harmed by this, which is precisely what my empirical analysis finds. Where Italy suffered large losses and is still recovering from the crisis, its counterfactual as well as The Netherlands seem to have been hurt much less.

It will be interesting to see whether a similar pattern will be visible due to COVID-19. Lockdowns and general fear of the virus have pushed countries all over the globe into recessions (World Bank, 2020). As large parts of Italy are highly dependent on tourism, this crisis might have hit Italy even harder than the average country. On top of that, this might be considered another asymmetric shock where countries within the eurozone would ideally benefit from different types of monetary policy. Similar to the crisis in 2008, Italy might then fall behind even further in the coming years. Whether this actually happened will be visible in a few years.

Although my robustness check without European countries in the donor pool indicates that there are no spillover effects, this is under the assumption that spillover effects are only present in other European countries. A possible limitation of my research would thus be the presence of spillover effects to countries outside of Europe. I find no material welfare effect for The Netherlands, who I expected to have benefited from the euro, and previous empirical literature establishes more countries who have lost GDP instead of gained GDP from adopting the euro. Fernández & Garcia-Perea (2015) also find no strong effect of euro adoption on GDP per capita for the eurozone. These findings point to a negative or neutral effect for the eurozone as a whole, which would lead to negative or neutral spillover effects to countries outside of Europe if such effects are present. In this case, I could underestimate the negative effect for Italy and underestimate a positive effect for The Netherlands. However, this is mostly speculation and further research would have to be done to confirm if such spillover effects truly exist. Based on the findings of Hájek & Horváth (2016), spillover effects seem to be stronger between countries with more integrated markets, which they show is mainly Central Europe for the eurozone. My main analysis assigns weight to at least one Central European country for every indicator, with Switzerland in particular receiving large weights for some indicators. The fact that my results do not change much at all when excluding European donor countries is at least suggestive evidence that spillover effects of introducing the euro are minimal.

The analysis for household financial net worth reveals an interesting pattern. After the euro is introduced, household net worth actually increases and only falls behind its counterfactual around the 2008 crisis. According to Stiglitz (2016), the euro made capital flow into Ireland and Spain and contributed to real estate bubbles in these countries. A similar pattern might have occurred in Italy, where capital flowed into the country and individuals used this new capital to invest into mortgages. In perfect markets, this would cause an increase in the supply of housing. However, as was seen leading up to the 2008 crisis and still in recent years for some countries, lagging demand can instead mainly

increase prices of real estate. This might be what is visible in Panel C1 of Figure 1: household financial net worth initially increased as house prices increased due to the capital inflow caused by the euro, but dropped due to the bursting of the real estate bubble in 2008. Although the short pre-intervention period in this analysis is reason enough to be weary of drawing too many conclusions from these findings, it might be interesting to investigate further whether this was the mechanism driving the pattern in my analysis.

I would expect to find similar welfare losses for other countries with weaker economies within the eurozone such as Spain, Greece and Portugal, but further research would have to be done to investigate this. The policy implications of my findings are up to interpretation. Proponents of the euro might argue that the goal of the euro is not only strengthening economic development, but also improving cohesion between citizens of the participating countries. However, the rise of anti-EU parties and movements in nearly all eurozone countries seems to indicate that this goal is also not being achieved. Indeed, it seems likely that a policy which exacerbates differences between the participating countries will struggle to improve cohesion between these countries.

There seem to be two directions that can be taken with regards to policy if the goal is to make the euro function better. The first is to reform the eurozone to strengthen the influence of the European Union even more. Stiglitz (2016) sums up the reforms that are necessary as establishing a banking union, debt mutualization, a common framework for stability, making policy aimed at converging the economies, ensuring full employment and growth, and committing to shared prosperity. A different policy response could be to split the euro into multiple currencies. Stiglitz suggests making Northern European countries such as The Netherlands and Germany leave the currency, so that the remaining euro countries can adjust their exchange rate to the Northern countries. My analysis of the OCA literature also revealed that the so-called core countries differ substantially from the peripheral countries. Splitting the euro into a currency for the core countries and a currency for the peripheral countries might then be a better policy, where each area at least comes closer to being an optimum currency area. Stiglitz also mentions the possibility of a flexible euro, where it should be realized that the eurozone is not yet ready for a common currency. Until it is, each country or group of countries could have its own euro which can fluctuate within bounds and is still affected by the policies of the eurozone.

Another direction that could be taken is to completely abolish the euro project and let the eurozone countries return to their national currencies. Some countries might then still choose to form a currency union together, but if these countries are similar, they will form better currency areas than the eurozone. Such a policy would also bring significant costs with it in the transition period, as a large degree of integration between countries in the eurozone has already taken place. Which option gets

chosen is in the hands of policy makers, who should consider the political, social and economic consequences of these policies.

Although my research shows what the material welfare effects of the euro are for Italy and The Netherlands, a full overview of the effects on social welfare cannot be given. Unless more data become available for a variety of components of social welfare in the pre-euro period, the effects on social welfare cannot be investigated using this method. Nonetheless, the main dimension in which effects should be expected is in material welfare, pointing towards a loss in social welfare for Italy due to introduction of the euro.

6 Conclusion

This thesis investigates what the effects of introducing the euro have been on material welfare in Italy and The Netherlands. I use the synthetic control method with OECD countries who did not adopt the euro as donor countries and use different predictor variables and lags of the outcome variables to form the synthetic control.

Consistent with my expectations as formulated in hypothesis I, I find adverse effects on material welfare for Italy. Average material welfare has decreased in the form of adjusted net national income per capita and households and NPISHs final consumption expenditure per capita, which survive multiple robustness checks. The effect on household financial net worth is not clear due to a short pre-intervention period. For distributional measures, I find an initial decrease in income inequality followed by an increase in the long run. However, further investigation reveals that this is mainly driven by a lower income for the top 10% rather than a higher income for the bottom 50%. In fact, I find negative but non-significant effects on income for the bottom 50%. My robustness checks reveal that spillover effects are minimal, and that it is indeed the euro causing these negative effects for Italy. I therefore conclude that the euro has caused a decrease in average material welfare with no accompanying decrease in income inequality to make up for it, unambiguously causing lower material welfare for Italy.

The effects for The Netherlands do not show a clear loss or gain in material welfare. I find no effect for adjusted net national income per capita or household financial net worth, but a decrease in the long run for households and NPISHs final consumption expenditure per capita. However, an in-time placebo test calls into question how robust these findings are, as it does not necessarily show that the effect is caused by the euro. I also discover no effects on distributional measures of material welfare for The Netherlands. I therefore find no evidence for hypothesis II, and conclude that my findings do not point to an effect of introducing the euro on material welfare in The Netherlands.

My findings largely correspond with those of Fernández & Garcia-Perea (2015) and Gabriel & Pessoa (2020), who find no effect of introducing the euro for The Netherlands and a negative effect for Italy on GDP per capita. The effect that Fernández & Garcia-Perea find is equal to approximately one sixth of GDP per capita when compared to Italy's counterfactual in 2013. Gabriel & Pessoa find a loss in GDP per capita of about one-seventh when compared to Italy's counterfactual in 2007. In comparison, I find a loss in adjusted net national income per capita of approximately one-tenth in 2007, and a quarter in 2013. The loss in households and NPISHs final consumption expenditure per capita in my analysis equals approximately one-tenth in 2007, and one-fifth in 2013. The findings for the GDP per capita loss due to introduction of the euro in these papers therefore seem to be somewhat larger than the effect I find for income and consumption in 2007, but smaller in 2013. My research adds to this literature by analyzing the broader material welfare effects of the euro, which in turn forms a large part of social welfare. Further research could contribute to these findings by performing a similar analysis for other eurozone countries, or by looking at the effects of the euro on other dimensions of social welfare.

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Appendix A: Data description

Table A1: Variable descriptions and sources

Variable	Definition	Years covered	Source
Adjusted net national income per capita	Adjusted net national income is calculated by subtracting from GNI a charge for the consumption of fixed capital (a calculation that yields net national income) and for the depletion of natural resource. The deduction for the depletion of natural resource, which covers net forest depletion, reflects the decline in asset values associated with the extraction and harvesting of natural resource. Reported in constant 2010 US$.	1980-2019	World Development Indicators (World Bank, nd)
Households and NPISHs final consumption expenditure per capita	Household final consumption expenditure (formerly private consumption) is the market value of all goods and services, including durable products (such as cars, washing machines, and home computers), purchased by households. It excludes purchases of dwellings but includes imputed rent for owner-occupied dwellings. It also includes payments and fees to governments to obtain permits and licenses. Here, household consumption expenditure includes the expenditures of nonprofit institutions serving households, even when reported separately by the country. Reported in constant 2010 US$.	1980-2019	World Development Indicators (World Bank, nd)

Household financial net worth	Household total net worth represents the total financial value of assets minus the total value of outstanding liabilities of households (including non-profit institutions serving households). Please note that this indicator only takes into account the value of dwellings, and not other types of non-financial assets. The following financial assets and liabilities are included: currency and deposits; debt securities; loans; equity and investment fund shares/units; insurance, pensions and standardized guarantee schemes; financial derivatives and employee stock options; and other accounts receivable/payable. Reported in US$.	1995-2019	OECD (OECD, 2021)
Disposable income Gini index	The average difference in income between all pairs in a population, divided by twice the average income in the population. It is calculated using disposable income, defined as post-tax, post-transfer income. Reported in percentage points.	1980-2019	The Standardized World Income Inequality Database (Solt, 2020)
Bottom 50% income share	Share of pre-tax national income earned by bottom 50% of the income distribution. Reported in percentage points.	1980-2019	World Inequality Database (WID.World, nd)
Top 10% income share	Share of pre-tax national income earned by bottom 50% of the income distribution. Reported in percentage points.	1980-2019	World Inequality Database (WID.World, nd)

Average national income per capita	Average income or wealth per capita in constant 2019 US$ at PPP.	1980-2019	World Inequality Database (WID.World, nd)
Total population		1980-2019	World Inequality Database (WID.World, nd)
Average pre-tax national income of bottom 50%	Calculated using the following formula: Income share of bottom 50% * average national income * population / (population * 50%). All inputs are taken from WID.World to ensure consistent data usage.	1980-2019	-
Average pre-tax national income of top 10%	Calculated using the following formula: Income share of top 10% * average national income * population / (population * 10%). All inputs are taken from WID.World to ensure consistent data usage.	1980-2019	-
Market income Gini index	The average difference in income between all pairs in a population, divided by twice the average income in the population. It is calculated using market income, defined as pre-tax, pre-transfer income. Reported in percentage points.	1980-2019	The Standardized World Income Inequality Database (Solt, 2020)
Female to male labor participation rate	Labor force participation rate is the proportion of the population ages 15 and older that is economically active: all people who supply labor for the production of goods	1990-2019	World Development Indicators (World Bank, nd)

	and services during a specified period. Ratio of female to male labor force participation rate is calculated by dividing female labor force participation rate by male labor force participation rate and multiplying by 100. This is the modeled ILO estimate. Reported in percentage points.		
Inflation rate	Inflation as measured by the consumer price index reflects the annual percentage change in the cost to the average consumer of acquiring a basket of goods and services that may be fixed or changed at specified intervals, such as yearly. The Laspeyres formula is generally used. Reported in percentage points.	1980-2019	World Development Indicators (World Bank, nd)
Net investment rate in nonfinancial assets	Net investment in government nonfinancial assets includes fixed assets, inventories, valuables, and non-produced assets. Nonfinancial assets are stores of value and provide benefits either through their use in the production of goods and services or in the form of property income and holding gains. Net investment in nonfinancial assets also includes consumption of fixed capital. Reported as % of GDP. Reported in percentage points.	1980-2017	World Development Indicators (World Bank, nd)
Secondary education rate	Gross enrollment ratio is the ratio of total enrollment, regardless of age, to the population of the age group that officially corresponds to the level of education shown. Secondary education completes the provision of basic education that began at the primary	1980-2018	World Development Indicators (World Bank, nd)

	level, and aims at laying the foundations for lifelong learning and human development, by offering more subject- or skill-oriented instruction using more specialized teachers. Reported in percentage points.		
Tertiary education rate	Gross enrollment ratio is the ratio of total enrollment, regardless of age, to the population of the age group that officially corresponds to the level of education shown. Tertiary education, whether or not to an advanced research qualification, normally requires, as a minimum condition of admission, the successful completion of education at the secondary level. Reported in percentage points.	1980-2018	World Development Indicators (World Bank, nd)
Trade rate	Trade is the sum of exports and imports of goods and services measured as a share of gross domestic product. Reported in percentage points.	1980-2019	World Development Indicators (World Bank, nd)
Unemployment rate	Unemployment refers to the share of the labor force that is without work but available for and seeking employment. This is the modeled ILO estimate. Reported in percentage points.	1991-2019	World Development Indicators (World Bank, nd)
Elderly share of population	Population ages 65 and above as a percentage of the total population. Population is based on the de facto definition of population, which counts all residents regardless of legal status or citizenship. Reported in percentage points.	1980-2019	World Development Indicators (World Bank, nd)

Notes: Definitions are taken from the respective source.

Table A2: Indicators of material welfare and their used predictor variables

Indicator	Predictors	Donor pool	Years covered
Adjusted net national income per capita	Inflation rate, net investment rate in nonfinancial assets, secondary education rate, tertiary education rate, trade rate, adjusted net national income per capita in 1980, adjusted net national income per capita in 1990, adjusted net national income per capita in 1998.	Australia, Canada, Chile, Colombia, Denmark, Israel, South Korea, Mexico, New Zealand, Norway, Sweden, Switzerland, United Kingdom, United States.	1980-2018
Households and NPISHs final consumption expenditure per capita	Inflation rate, net investment rate in nonfinancial assets, secondary education rate, tertiary education rate, trade rate, households and NPISHs final consumption expenditure per capita in 1980, households and NPISHs final consumption expenditure per capita in 1990, households and NPISHs final consumption expenditure per capita in 1998.	Australia, Canada, Chile, Colombia, Denmark, Israel, South Korea, Mexico, New Zealand, Norway, Sweden, Switzerland, United Kingdom, United States.	1980-2018
Household financial net worth	Inflation rate, net investment rate in nonfinancial assets, secondary education rate, tertiary education rate, trade rate, household financial net worth in 1995, household financial net worth in 1998.	Australia, Canada, Czech Republic, Denmark, Hungary, Norway, Poland, Sweden, United Kingdom, United States.	1995-2018

Disposable income Gini index	Adjusted net national income per capita, unemployment rate, bottom 50% income share, top 10% income share, elderly share of population, female to male labor participation rate, disposable income Gini index in 1983, disposable income Gini index in 1992, disposable income Gini index in 1998.	Australia, Canada, Chile, Colombia, Denmark, Hungary, Israel, Mexico, New Zealand, Norway, Poland, Sweden, Switzerland, United Kingdom, United States.	1983-2017
Average pre-tax national income of top 10%	Adjusted net national income per capita, unemployment rate, bottom 50% income share, top 10% income share, elderly share of population, female to male labor participation rate, average pre-tax national income of top 10% in 1980, average pre-tax national income of top 10% in 1990, average pre-tax national income of top 10% in 1998.	Australia, Canada, Chile, Colombia, Czech Republic, Denmark, Hungary, Israel, Japan, South Korea, Mexico, New Zealand, Norway, Poland, Sweden, Switzerland, Turkey, United Kingdom, United States.	1980-2019
Average pre-tax national income of bottom 50%	Adjusted net national income per capita, unemployment rate, bottom 50% income share, top 10% income share, elderly share of population, female to male labor participation rate, average pre-tax national income of bottom 50% in 1980, average pre-tax national income of bottom 50% in 1990, average pre-tax national income of bottom 50% in 1998.	Australia, Canada, Chile, Colombia, Czech Republic, Denmark, Hungary, Israel, Japan, South Korea, Mexico, New Zealand, Norway, Poland, Sweden, Switzerland, Turkey, United Kingdom, United States.	1980-2019

Notes: Years covered differ between indicators due to data availability in outcome variable. Donor pools differ between indicators due to data availability in outcome variable and/or predictor variables.

Appendix B: Main analysis results for Italy

Table B1: Unit weights for Italy's counterfactuals

Indicator	Country	Weight
Adjusted net national income per capita	Australia	0
	Canada	0
	Chile	0
	Colombia	0
	Israel	0
	South Korea	0.511
	Mexico	0
	New Zealand	0
	Norway	0
	Sweden	0.126
	Switzerland	0.335
	United Kingdom	0
	United States	0.028
Households and NPISHs final consumption expenditure per capita	Australia	0
	Canada	0
	Chile	0
	Colombia	0.069
	Israel	0
	South Korea	0.226
	Mexico	0
	New Zealand	0
	Norway	0
	Sweden	0
	Switzerland	0.254
	United Kingdom	0.451
	United States	0

Household financial net worth	Australia	0
	Canada	0
	Czech Republic	0
	Hungary	0
	Norway	0
	Poland	0.145
	Sweden	0
	United Kingdom	0.776
	United States	0.079
Disposable income Gini index	Australia	0.38
	Canada	0
	Chile	0.093
	Colombia	0.063
	Hungary	0
	Israel	0.006
	Mexico	0
	New Zealand	0
	Norway	0
	Poland	0.221
	Sweden	0
	Switzerland	0.237
	United Kingdom	0
	United States	0
Average pre-tax national income of top 10%	Australia	0.386
	Canada	0
	Chile	0
	Colombia	0
	Czech Republic	0
	Hungary	0.188
	Israel	0.203
	Japan	0
	South Korea	0
	Mexico	0

	New Zealand	0
	Norway	0
	Poland	0
	Sweden	0
	Switzerland	0
	Turkey	0
	United Kingdom	0.222
	United States	0
Average pre-tax national income of bottom 50%	Australia	0
	Canada	0
	Chile	0
	Colombia	0
	Czech Republic	0.215
	Hungary	0
	Israel	0
	Japan	0
	South Korea	0
	Mexico	0.251
	New Zealand	0
	Norway	0
	Poland	0
	Sweden	0
	Switzerland	0.534
	Turkey	0
	United Kingdom	0
	United States	0

Table B2: Predictor balance for Italy

Indicator	Variable	Italy value	Synthetic value
Adjusted net national income per capita	Inflation rate	8.0	5.6
	Net investment rate in non-financial assets	9.4	95.1
	Secondary education rate	79.8	94.7
	Tertiary education rate	32.5	33.7
	Trade rate	40.1	65.9
	Adjusted net national income per capita in 1998	29898.5	29948.8
	Adjusted net national income per capita in 1990	26621.8	26222.1
	Adjusted net national income per capita in 1980	20703.4	20704.3
Households and NPISHs final consumption expenditure per capita	Inflation rate	8.0	6.5
	Net investment rate in non-financial assets	93.9	104.8
	Secondary education rate	79.8	89.3
	Tertiary education rate	32.5	29.7
	Trade rate	40.1	59.3
	Households and NPISHs final consumption expenditure per capita in 1998	20633.3	20627.9
	Households and NPISHs final consumption expenditure per capita in 1990	18345.1	18194.6
	Households and NPISHs final consumption expenditure per capita in 1980	14272.5	14376.1
Household financial net worth	Inflation rate	3.3	4.7
	Net investment rate in non-financial assets	112.3	125.9
	Secondary education rate	89.8	99.8
	Tertiary education rate	44.7	51.5
	Trade rate	44.6	48.2
	Household financial net worth in 1998	49594.0	49667.7
	Household financial net worth in 1995	34820.0	34829.6

Disposable income Gini index	Adjusted net national income per capita	25908.9	23291.7
	Unemployment rate	11.1	8.4
	Bottom 50% income share	23.7	19.8
	Top 10% income share	27.1	32.3
	Elderly share of population	15.1	10.8
	Female to male labor participation rate	53.8	69.6
	Disposable income Gini index in 1998	33.4	33.3
	Disposable income Gini index in 1992	32.1	32.3
	Disposable income Gini index in 1983	31.4	31.3
Average pre-tax national income of top 10%	Adjusted net national income per capita	25062.7	19043.8
	Unemployment rate	11.1	9.6
	Elderly share of population	14.8	12.0
	Female to male labor participation rate	53.8	71.2
	Bottom 50% income share	24.2	20.5
	Top 10% income share	26.6	31.4
	Average pre-tax national income of top 10% in 1998	132048.9	133755.3
	Average pre-tax national income of top 10% in 1990	113168.5	108765.5
	Average pre-tax national income of top 10% in 1980	89679.4	85999.1
Average pre-tax national income of bottom 50%	Adjusted net national income per capita	25062.7	29624.3
	Unemployment rate	11.1	3.8
	Elderly share of population	14.8	11.5
	Female to male labor participation rate	53.8	64.9
	Bottom 50% income share	24.2	21.1
	Top 10% income share	26.6	34.2
	Average pre-tax national income of bottom 50% in 1998	19054.3	18993.3
	Average pre-tax national income of bottom 50% in 1990	19620.9	19864.1
	Average pre-tax national income of bottom 50% in 1980	19620.9	18626.5

Notes: Values reported are averages over entire pre-intervention period.

Table B3: Synthetic control regression results for Italy

Year	Outcome variable					
	Adjusted net national income per capita	**Households and NPISHs final consumption expenditure per capita**	**Household financial net worth**	**Disposable income Gini index**	**Average pre-tax national income of top 10%**	**Average pre-tax national income of bottom 50%**
1999	-601.6	-129.9	438.036	-0.1	1755.6	216.4
2000	-1066.4	-252.8	2043.9***	-0.2	3853.2	-20.7
2001	64.8	-681.3	2304.9	-0.1	6117.0	-90.9
2002	-291.1	-1160.6*	5344.7***	-0.3	754.9	419.3
2003	-1526.9	-1379.3*	3834.8***	-0.6	-3626.6	534.7
2004	-2005.9	-1706.2*	2928.8***	-0.7	-6971.8	798.6
2005	-3365.7	-1920.5*	5631.3***	-1.1	-15969.3	455.5
2006	-4282.9***	-1981.4*	11828.9***	-1.5	-20145.3	469.8
2007	-3657.7	-2288.7*	5714.6***	-1.8	-17423.4	522.0
2008	-2832.1	-2598.9*	6823.9***	-1.8	-20307.6	-148.4
2009	-5139.8*	-2620.8*	2671.6	-1.6	-24261.4	-1463.1
2010	-7745.6*	-2691.0*	-5208.0***	-1.3	-28516.2	-1758.4
2011	-6925.3*	-2656.7*	-12561.2***	-0.8	-29226.3	-1773.2
2012	-8649.7*	-3797.9*	-11535.5***	-0.4	-33238.5	-3186.1
2013	-9635.4*	-4970.1***	-9873.1***	-0.4	-43985.0*	-3545.0
2014	-9701.0*	-5351.7***	-17751.1***	-0.1	-47679.4***	-3664.8
2015	-10961.5***	-5336.8***	-16029.8***	0.2	-51969.7*	-4403.6
2016	-9682.5***	-5489.5***	-20323.8***	0.4	-46422.2*	-4393.4
2017	-9125.9*	-5432.0***	-18639.7***	0.5	-46322.1*	-4270.1
2018	-9631.5***	-5423.8***	-17955.4***		-50766.3*	-4819.0
2019					-54499.3*	-5059.1

Notes: Standardized p-values are reported with the following values: *p<.1 **p<.05 ***p<.01.

Appendix C: Main analysis results for The Netherlands

Table C1: Unit weights for The Netherlands' counterfactuals

Indicator	Country	Weight
Adjusted net national income per capita	Australia	0.096
	Canada	0
	Chile	0
	Colombia	0
	Denmark	0
	Israel	0.424
	South Korea	0
	Mexico	0
	New Zealand	0
	Norway	0.177
	Sweden	0
	Switzerland	0.24
	United Kingdom	0.063
	United States	0
Households and NPISHs final consumption expenditure per capita	Australia	0.617
	Canada	0.023
	Chile	0.183
	Colombia	0
	Israel	0
	South Korea	0
	Mexico	0
	New Zealand	0
	Norway	0.089
	Sweden	0
	Switzerland	0.089
	United Kingdom	0
	United States	0

Household financial net worth	Australia	0
	Canada	0.243
	Czech Republic	0.424
	Denmark	0
	Hungary	0
	Norway	0
	Poland	0
	Sweden	0
	United Kingdom	0
	United States	0.333
Disposable income Gini index	Australia	0
	Canada	0
	Chile	0
	Colombia	0
	Denmark	0
	Hungary	0.115
	Israel	0
	Mexico	0
	New Zealand	0
	Norway	0.353
	Poland	0
	Sweden	0.259
	Switzerland	0.273
	United Kingdom	0
	United States	0
Average pre-tax national income of top 10%	Australia	0
	Canada	0.105
	Chile	0
	Colombia	0
	Czech Republic	0.229
	Hungary	0.033
	Israel	0.077
	Japan	0

	South Korea	0
	Mexico	0.05
	New Zealand	0
	Norway	0.21
	Poland	0
	Sweden	0
	Switzerland	0.296
	Turkey	0
	United Kingdom	0
	United States	0
Average pre-tax national income of bottom 50%	Australia	0.392
	Canada	0
	Chile	0
	Colombia	0
	Czech Republic	0
	Hungary	0
	Israel	0
	Japan	0
	South Korea	0
	Mexico	0
	New Zealand	0
	Norway	0
	Poland	0
	Sweden	0
	Switzerland	0.608
	Turkey	0
	United Kingdom	0
	United States	0

Table C2: Predictor balance for The Netherlands

Indicator	Variable	Netherlands value	Synthetic value
Adjusted net national income per capita	Inflation rate	2.7	33.9
	Net investment rate in non-financial assets	87.5	88.5
	Secondary education rate	116.1	98.9
	Tertiary education rate	37.4	34.4
	Trade rate	105.0	68.4
	Adjusted net national income per capita in 1998	36614.9	36335.0
	Adjusted net national income per capita in 1990	29508.5	29529.2
	Adjusted net national income per capita in 1980	26071.6	24890.5
Households and NPISHs final consumption expenditure per capita	Inflation rate	2.7	7.5
	Net investment rate in non-financial assets	87.5	109.2
	Secondary education rate	116.1	121.7
	Tertiary education rate	37.4	37.5
	Trade rate	105.0	45.8
	Households and NPISHs final consumption expenditure per capita in 1998	21107.4	20419.5
	Households and NPISHs final consumption expenditure per capita in 1990	17597.2	17752.7
	Households and NPISHs final consumption expenditure per capita in 1980	16431.5	15245.7
Household financial net worth	Inflation rate	2.0	5.1
	Net investment rate in non-financial assets	153.5	107.5
	Secondary education rate	133.7	96.1
	Tertiary education rate	47.7	54.3
	Trade rate	110.9	60.8
	Household financial net worth in 1998	39835.0	37200.3
	Household financial net worth in 1995	45790.0	48255.8

Disposable income Gini index	Adjusted net national income per capita	30146.7	36954.3
	Unemployment rate	6.2	6.1
	Bottom 50% income share	24.7	26.3
	Top 10% income share	27.1	27.5
	Elderly share of population	12.7	15.7
	Female to male labor participation rate	66.3	78.9
	Disposable income Gini index in 1998	24.9	26.0
	Disposable income Gini index in 1992	25.7	25.3
	Disposable income Gini index in 1983	24.4	24.8
Average pre-tax national income of top 10%	Adjusted net national income per capita	29463.7	29731.8
	Unemployment rate	6.2	5.5
	Elderly share of population	12.5	13.0
	Female to male labor participation rate	66.3	73.1
	Bottom 50% income share	24.9	23.9
	Top 10% income share	27.0	30.2
	Average pre-tax national income of top 10% in 1998	141926.8	141777.5
	Average pre-tax national income of top 10% in 1990	119386.1	119517.1
	Average pre-tax national income of top 10% in 1980	119419.8	113674.4
Average pre-tax national income of bottom 50%	Adjusted net national income per capita	29463.7	39080.5
	Unemployment rate	6.2	5.7
	Elderly share of population	12.5	13.0
	Female to male labor participation rate	66.3	71.5
	Bottom 50% income share	24.9	21.6
	Top 10% income share	27.0	29.1
	Average pre-tax national income of bottom 50% in 1998	25551.0	23299.0
	Average pre-tax national income of bottom 50% in 1990	22376.0	23001.3
	Average pre-tax national income of bottom 50% in 1980	23775.4	20990.8

Notes: Values reported are averages over the entire pre-intervention period.

Table C3: Synthetic control regression results for The Netherlands

Year	Outcome variable					
	Adjusted net national income per capita	**Households and NPISHs final consumption expenditure per capita**	**Household financial net worth**	**Disposable income Gini index**	**Average pre-tax national income of top 10%**	**Average pre-tax national income of bottom 50%**
1999	1876.2***	1073.2	-2795.3	-0.5***	5888.6	3153.0
2000	1881.1***	1132.5	1042.2	-1.1	-1675.4	3485.7
2001	1520.7	1063.4	221.9	-0.7	8159.2	2402.7
2002	1969.4	832.6	2765.5	-0.6	9450.6	2675.9
2003	1570.4	181.9	-290.7	-0.5	7299.8	3115.4
2004	577.4	-556.5	-4638.9	-0.1	3774.7	3377.0
2005	-1645.5	-1127.2	-6006.3	-0.1	-6952.9	2204.5
2006	-725.5	-1722.4	-11155.6	0.2	-8438.1	3079.9
2007	327.9	-2407.3	-16234.6	0.2	6246.4	2963.0
2008	652.3	-2854.3	428.6	-0.0	-6893.5	3722.9
2009	-605.9	-3088.0*	-5618.1	-0.3	423.8	2411.9
2010	-1943.3	-3716.2*	-6153.9	-0.5	-2860.8	2373.8
2011	-964.4	-4394.3*	2315.1	-0.4	-918.3	3099.1
2012	-2249.4	-5156.4*	4060.4	-0.4	-1560.3	2308.8
2013	-3214.9	-5617.8*	-4217.5	-0.5	-9504.8	2284.2
2014	-3926.0	-5855.9***	5968.7	-0.3	-9821.4	1375.9
2015	-3181.0	-5786.2***	11221.0	-0.5	-8374.6	1869.3
2016	-2799.0	-5920.6***	17316.3	-0.7	-4317.4	1656.4
2017	-761.2	-5785.9***	9732.5	-0.8	1336.0	2571.6
2018	-1002.4	-5764.2***	14183.5		2317.5	2491.7
2019					1728.1	2303.9

Notes: Standardized p-values are reported with the following values: *p<.1 **p<.05 ***p<.01

Appendix D: Robustness check for Italy with only non-European donor countries

Table D1: Unit weights for Italy's counterfactuals with only non-European donor countries

Indicator	Country	Weight
Adjusted net national income per capita	Australia	0
	Canada	0.056
	Chile	0
	Colombia	0.123
	Israel	0
	South Korea	0
	Mexico	0.032
	New Zealand	0
	United States	0.788
Households and NPISHs final consumption expenditure per capita	Australia	0.035
	Canada	0
	Chile	0
	Colombia	0
	Israel	0
	South Korea	0
	Mexico	0.273
	New Zealand	0
	United States	0.692
Household financial net worth	Australia	0
	Canada	0
	United States	1
Disposable income Gini index	Australia	0.486
	Canada	0
	Chile	0

	Colombia	0
	Israel	0
	Mexico	0
	New Zealand	0
	United States	0.514
Average pre-tax national income of top 10%	Australia	0.0398
	Canada	0
	Chile	0.215
	Colombia	0
	Israel	0.01
	Japan	0.329
	South Korea	0.048
	Mexico	0
	New Zealand	0
	United States	0
Average pre-tax national income of bottom 50%	Australia	0
	Canada	0
	Chile	0
	Colombia	0
	Israel	0
	Japan	0
	South Korea	0
	Mexico	0
	New Zealand	0
	United States	1

Table D2: Predictor balance for Italy with only non-European donor countries

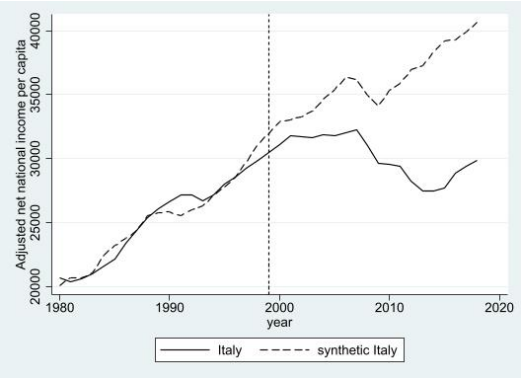
Indicator	Variable	Italy value	Synthetic value
Adjusted net national income per capita	Inflation rate	8.0	08.1
	Net investment rate in non-financial assets	93.9	63.0
	Secondary education rate	79.8	88.4
	Tertiary education rate	32.5	59.8
	Trade rate	40.1	23.6
	Adjusted net national income per capita in 1998	29898.5	31072.1
	Adjusted net national income per capita in 1990	26621.8	25816.2
	Adjusted net national income per capita in 1980	20703.4	20076.5
Households and NPISHs final consumption expenditure per capita	Inflation rate	8.0	15.9
	Net investment rate in non-financial assets	93.9	68.9
	Secondary education rate	79.8	85.7
	Tertiary education rate	32.5	52.0
	Trade rate	40.1	24.1
	Households and NPISHs final consumption expenditure per capita in 1998	20633.3	20979.1
	Households and NPISHs final consumption expenditure per capita in 1990	18345.1	17905.9
	Households and NPISHs final consumption expenditure per capita in 1980	14272.5	14275.8
Household financial net worth	Inflation rate	3.3	2.4
	Net investment rate in non-financial assets	112.3	27.9
	Secondary education rate	89.8	96.6
	Tertiary education rate	44.7	76.6
	Trade rate	44.6	22.8
	Household financial net worth in 1998	49594.0	67930.0
	Household financial net worth in 1995	34820.0	90471.0

Disposable income Gini index	Adjusted net national income per capita	25908.9	27756.2
	Unemployment rate	11.1	7.6
	Bottom 50% income share	23.7	17.1
	Top 10% income share	27.1	33.2
	Elderly share of population	15.1	11.8
	Female to male labor participation rate	53.8	74.3
	Disposable income Gini index in 1998	33.4	34.1
	Disposable income Gini index in 1992	32.1	32.4
	Disposable income Gini index in 1983	31.4	30.4
Average pre-tax national income of top 10%	Adjusted net national income per capita	25062.7	20964.7
	Unemployment rate	11.1	6.2
	Elderly share of population	14.8	9.9
	Female to male labor participation rate	53.8	63.4
	Bottom 50% income share	24.2	17.3
	Top 10% income share	26.6	37.3
	Average pre-tax national income of top 10% in 1998	132048.9	130995.1
	Average pre-tax national income of top 10% in 1990	113168.5	114054.2
	Average pre-tax national income of top 10% in 1980	89679.4	86392.4
Average pre-tax national income of bottom 50%	Adjusted net national income per capita	25062.7	29034.9
	Unemployment rate	11.1	6.0
	Elderly share of population	14.8	12.3
	Female to male labor participation rate	53.8	77.0
	Bottom 50% income share	24.2	16.5
	Top 10% income share	26.6	38.1
	Average pre-tax national income of bottom 50% in 1998	19054.3	17606.8
	Average pre-tax national income of bottom 50% in 1990	19620.9	15931.3
	Average pre-tax national income of bottom 50% in 1980	19620.9	15443.3

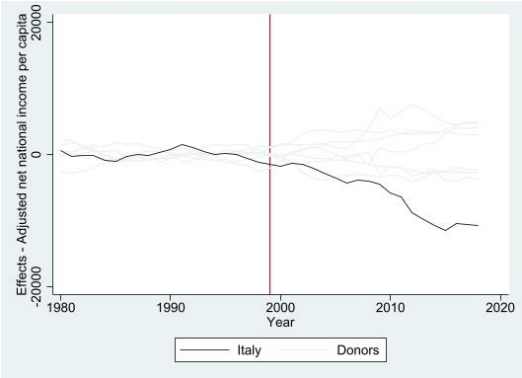
Notes: Values reported are averages over entire pre-intervention period.

Figure D1: Effects and placebo gaps of euro adoption on average material welfare indicators in Italy with only non-European donor countries

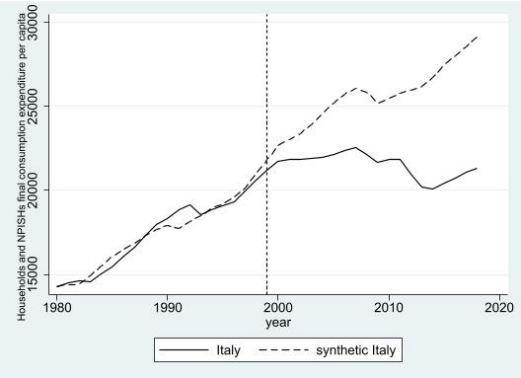
Panel A1: Adjusted net national income per capita



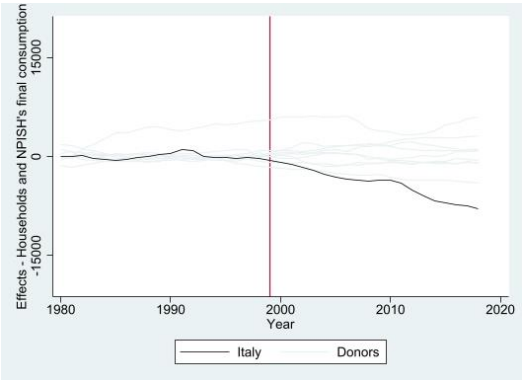
Panel A2: Adjusted net national income per capita gap in Italy and placebo gaps in donor countries



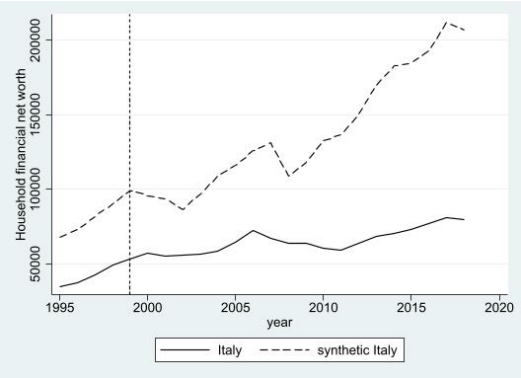
Panel B1: Households and NPISHs final consumption expenditure per capita



Panel B2: Households and NPISHs final consumption expenditure per capita gap in Italy and placebo gaps in donor countries



Panel C1: Household financial net worth



Panel C2: Household financial net worth gap in Italy and placebo gaps in donor countries

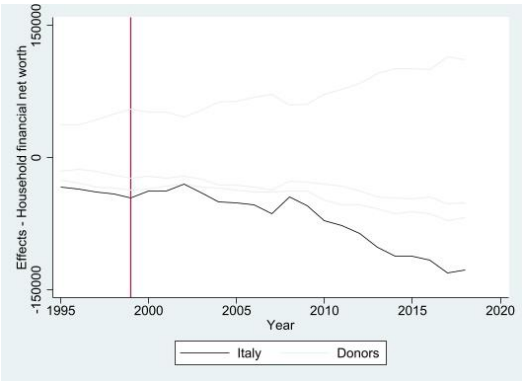
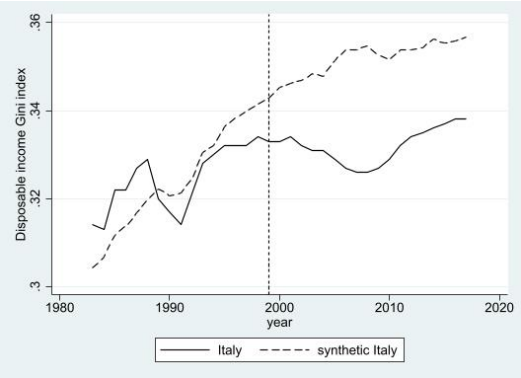
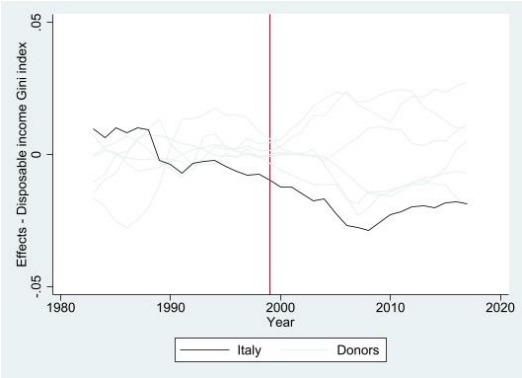


Figure D2: Effects and placebo gaps of euro adoption on distributional material welfare indicators in Italy with only non-European donor countries

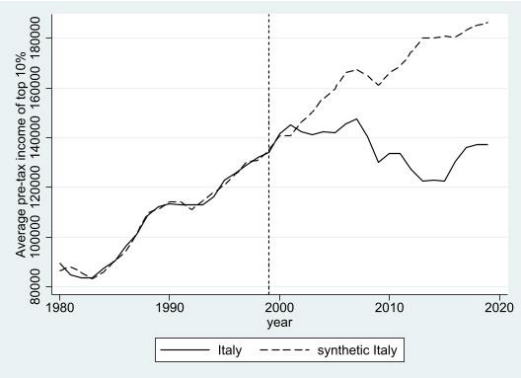
Panel A1: Disposable income Gini index



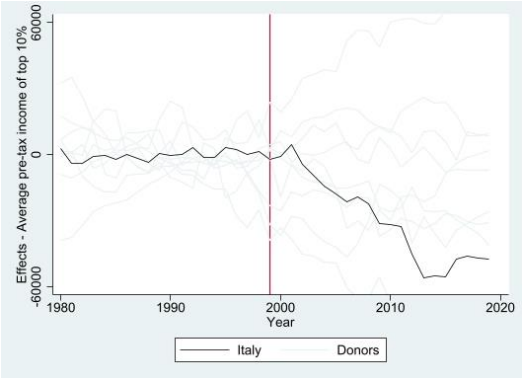
Panel A2: Disposable income Gini index gap in Italy and placebo gaps in donor countries



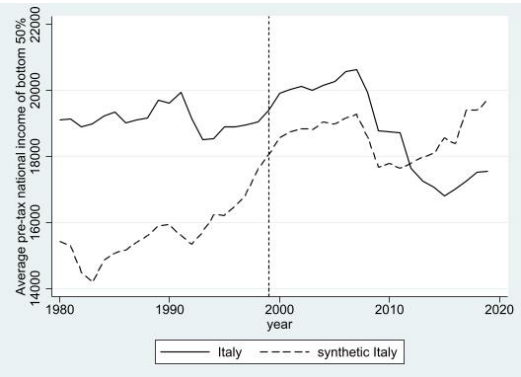
Panel B1: Average pre-tax national income of top 10%



Panel B2: Average pre-tax national income of top 10% gap in Italy and placebo gaps in donor countries



Panel C1: Average pre-tax national income of bottom 50%



Panel C2: Average pre-tax national income of bottom 50% gap in Italy and placebo gaps in donor countries

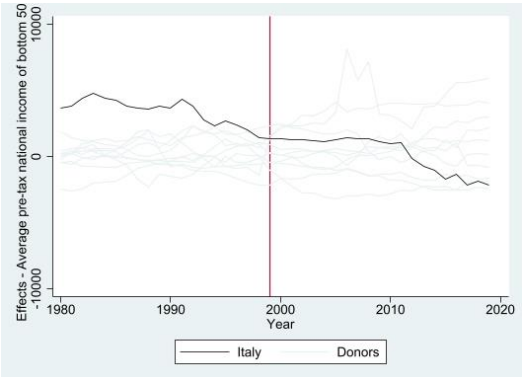


Table D3: Synthetic control regression results for Italy with only non-European donor countries

Year	Outcome variable					
	Adjusted net national income per capita	**Households and NPISHs final consumption expenditure per capita**	**Household financial net worth**	**Disposable income Gini index**	**Average pre-tax national income of top 10%**	**Average pre-tax national income of bottom 50%**
1999	-1502.5	-626.8	-45802.0	-1.0	-2266.0	1335.3
2000	-1835.2***	-946.3	-38493.0	-1.2	-683.4	1370.7
2001	-1252.3	-1156.5	-38341.0	-1.2	4693.5	1274.9
2002	-1513.8	-1552.5***	-30624.0	-1.5	-4434.6	1275.0
2003	-2037.0	-2019.9***	-40668.0	-1.7	-9247.8***	1198.5
2004	-2747.8	-2636.0***	-50562.0	-1.7	-14085.0***	1108.9
2005	-3606.8	-3066.2***	-51521.0	-2.2	-17944.6***	1292.8
2006	-4306.6***	-3364.2***	-53424.0	-2.7	-21501.5***	1421.8
2007	-3913.8***	-3564.6***	-63918.0	-2.8	-19363.9***	1365.3
2008	-3950.0	-3712.4***	-44634.0	-2.9	-22526.1***	1330.9
2009	-4510.4	-3506.8***	-54381.0	-2.6	-31488.2***	1122.9
2010	-5746.1	-3602.8***	-71889.0***	-2.3	-31689.2***	967.5
2011	-6475.4	-3947.7***	-77416.0***	-2.2	-32470.0***	1088.0
2012	-8761.4	-5021.1***	-86634.0***	-2.0	-45058.1***	-167.7
2013	-9802.4***	-5953.5***	-101692.0***	-2.0	-56060.8***	-726.8
2014	-10777.0***	-6645.7***	-112439.0***	-2.0	-54925.9***	-1000.6
2015	-11525.4***	-7020.4***	-111644.0***	-1.8	-55494.2***	-1741.3
2016	-10450.4***	-7286.2***	-116291.0***	-1.8	-47443.9***	-1360.1
2017	-10531.3***	-7476.2***	-130553.0***	-1.9	-46254.4***	-2158.2
2018	-10762.4***	-7834.4***	-127455.0***		-46993.9***	-1881.9
2019					-47682.0***	-2182.3

Notes: Standardized p-values are reported with the following values: *p<.1 **p<.05 ***p<.01.

Appendix E: Robustness check for The Netherlands with only non-European donor countries

Table E1: Unit weights for The Netherlands' counterfactuals with only non-European donor countries

Indicator	Country	Weight
Adjusted net national income per capita	Australia	0
	Canada	0.021
	Chile	0
	Colombia	0
	Israel	0
	South Korea	0
	Mexico	0
	New Zealand	0
	United States	0.979
Households and NPISHs final consumption expenditure per capita	Australia	0.789
	Canada	0.145
	Chile	0.067
	Colombia	0
	Israel	0
	South Korea	0
	Mexico	0
	New Zealand	0
	United States	0
Household financial net worth	Australia	0
	Canada	0.955
	United States	0.045
Disposable income Gini index	Australia	0
	Canada	1

	Chile	0
	Colombia	0
	Israel	0
	Mexico	0
	New Zealand	0
	United States	0
Average pre-tax national income of top 10%	Australia	0
	Canada	0.369
	Chile	0
	Colombia	0
	Israel	0
	Japan	0.031
	South Korea	0.025
	Mexico	0.108
	New Zealand	0.468
	United States	0
Average pre-tax national income of bottom 50%	Australia	0
	Canada	0
	Chile	0
	Colombia	0
	Israel	0
	Japan	0
	South Korea	0
	Mexico	0
	New Zealand	0
	United States	1

Table E2: Predictor balance for The Netherlands with only non-European donor countries

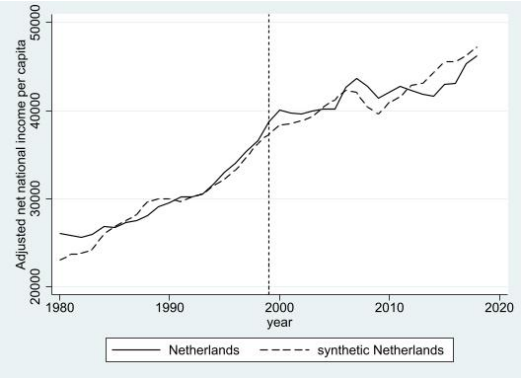
Indicator	Variable	Netherlands value	Synthetic value
Adjusted net national income per capita	Inflation rate	2.7	4.4
	Net investment rate in non-financial assets	87.5	33.9
	Secondary education rate	116.1	94.4
	Tertiary education rate	37.4	67.3
	Trade rate	105.0	20.4
	Adjusted net national income per capita in 1998	36614.	36240.0
	Adjusted net national income per capita in 1990	29508.5	29974.4
	Adjusted net national income per capita in 1980	26071.6	22962.1
Households and NPISHs final consumption expenditure per capita	Inflation rate	2.7	6.3
	Net investment rate in non-financial assets	87.5	85.8
	Secondary education rate	116.1	131.8
	Tertiary education rate	37.4	46.9
	Trade rate	105.0	38.3
	Households and NPISHs final consumption expenditure per capita in 1998	21107.4	20429.9
	Households and NPISHs final consumption expenditure per capita in 1990	17597.2	17871.3
	Households and NPISHs final consumption expenditure per capita in 1980	16431.5	15198.7
Household financial net worth	Inflation rate	2.0	1.6
	Net investment rate in non-financial assets	153.5	57.8
	Secondary education rate	133.7	105.0
	Tertiary education rate	47.7	79.6
	Trade rate	110.9	70.9
	Household financial net worth in 1998	39835.0	36146.6
	Household financial net worth in 1995	45790.0	47507.5

Disposable income Gini index	Adjusted net national income per capita	30146.7	27649.9
	Unemployment rate	6.2	10.0
	Bottom 50% income share	24.7	17.8
	Top 10% income share	27.1	35.9
	Elderly share of population	12.7	11.2
	Female to male labor participation rate	66.3	78.2
	Disposable income Gini index in 1998	24.9	30.5
	Disposable income Gini index in 1992	25.7	29.1
	Disposable income Gini index in 1983	24.4	28.5
Average pre-tax national income of top 10%	Adjusted net national income per capita	29463.7	20414.8
	Unemployment rate	6.2	8.2
	Elderly share of population	12.5	10.1
	Female to male labor participation rate	66.3	71.9
	Bottom 50% income share	24.9	16.0
	Top 10% income share	27.0	35.5
	Average pre-tax national income of top 10% in 1998	141926.8	143052.8
	Average pre-tax national income of top 10% in 1990	119386.1	120782.9
	Average pre-tax national income of top 10% in 1980	119419.8	114017.0
Average pre-tax national income of bottom 50%	Adjusted net national income per capita	29463.7	29034.9
	Unemployment rate	6.2	6.0
	Elderly share of population	12.5	12.3
	Female to male labor participation rate	66.3	77.0
	Bottom 50% income share	24.9	16.5
	Top 10% income share	27.0	38.1
	Average pre-tax national income of bottom 50% in 1998	25551.0	17606.8
	Average pre-tax national income of bottom 50% in 1990	22376.0	15931.3
	Average pre-tax national income of bottom 50% in 1980	23775.4	15443.3

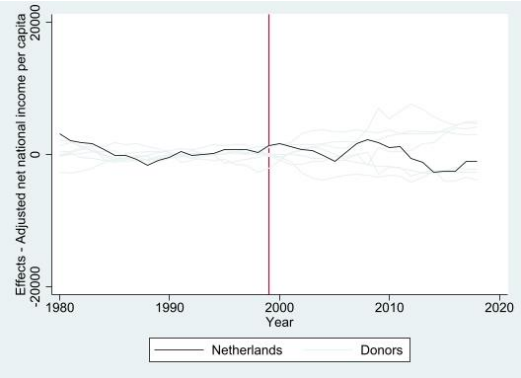
Notes: Values reported are averages over the entire pre-intervention period.

Figure E1: Effects and placebo gaps of euro adoption on average material welfare indicators in The Netherlands with only non-European donor countries

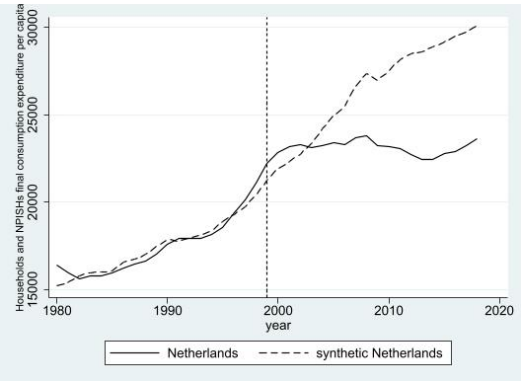
Panel A1: Adjusted net national income per capita



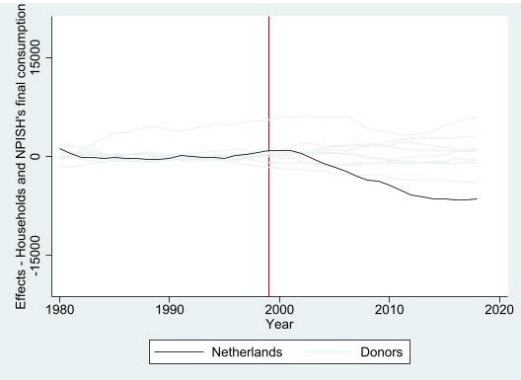
Panel A2: Adjusted net national income per capita gap in Netherlands and placebo gaps in donor countries



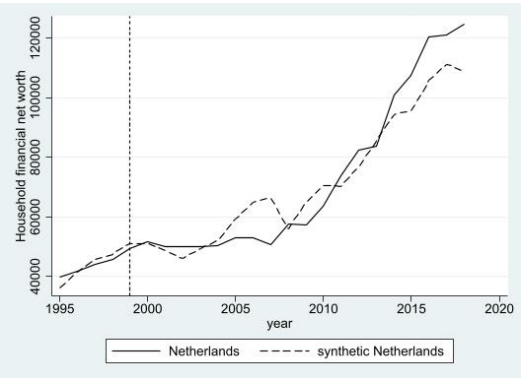
Panel B1: Households and NPISHs final consumption expenditure per capita



Panel B2: Households and NPISHs final consumption expenditure per capita gap in Netherlands and placebo gaps in donor countries



Panel C1: Household financial net worth



Panel C2: Household financial net worth gap in Netherlands and placebo gaps in donor countries

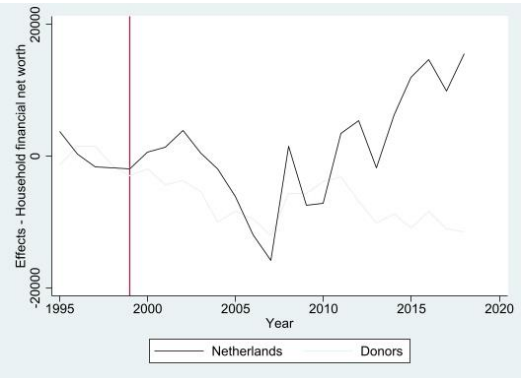
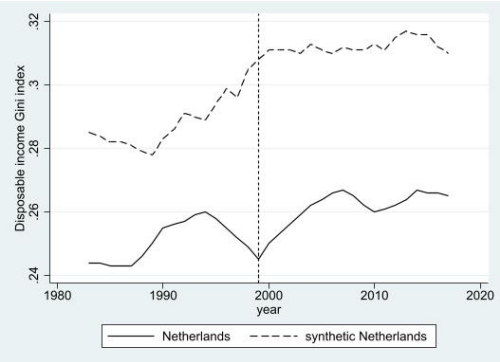
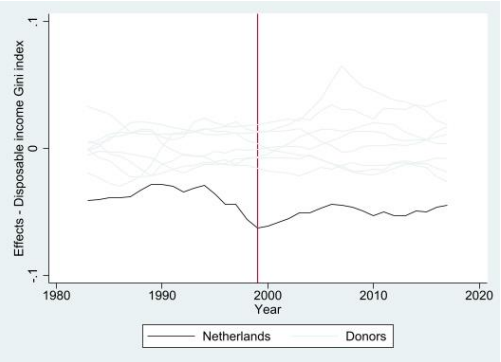


Figure E2: Effects and placebo gaps of euro adoption on distributional material welfare indicators in The Netherlands with only non-European donor countries

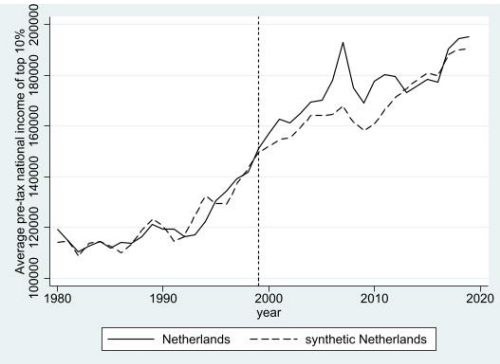
Panel A1: Disposable income Gini index



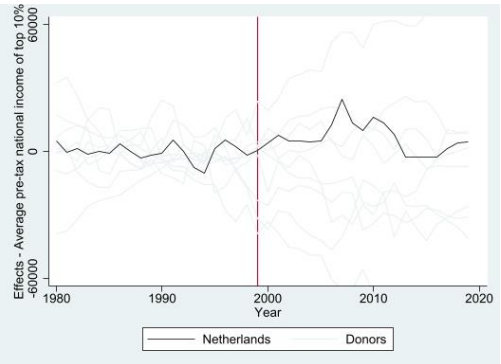
Panel A2: Disposable income Gini index gap in Netherlands and placebo gaps in donor countries



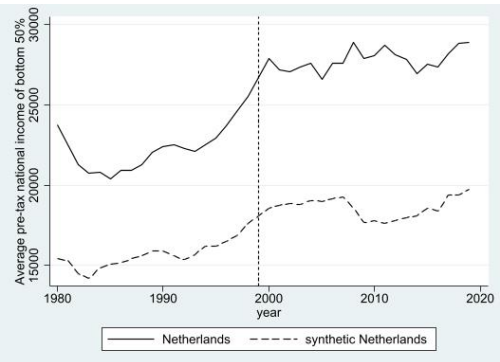
Panel B1: Average pre-tax national income of top 10%



Panel B2: Average pre-tax national income of top 10% gap in Netherlands and placebo gaps in donor countries



Panel C1: Average pre-tax national income of bottom 50%



Panel C2: Average pre-tax national income of bottom 50% gap in Netherlands and placebo gaps in donor countries

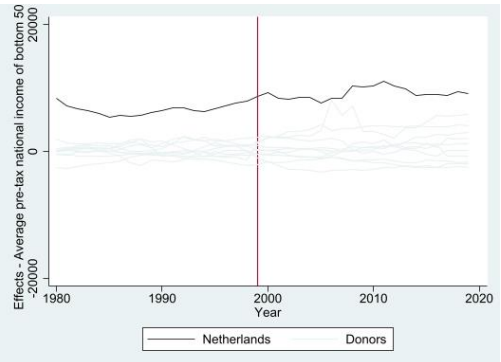


Table E3: Synthetic control regression results for The Netherlands with only non-European donor countries

Year	Outcome variable					
	Adjusted net national income per capita	**Households and NPISHs final consumption expenditure per capita**	**Household financial net worth**	**Disposable income Gini index**	**Average pre-tax national income of top 10%**	**Average pre-tax national income of bottom 50%**
1999	1388.0	926.4	-1900.8	-6.3***	648.2	8627.2
2000	1735.3	930.8	601.0	-6.1***	4155.8	9313.6
2001	1181.8	847.3	1421.4	-5.8***	7657.5	8427.3
2002	805.3	525.2	3909.9	-5.5***	5141.9	8199.9
2003	638.5	-212.8	516.3	-5.1	5120.8	8527.2
2004	-152.6	-965.0	-1886.1	-5.1	4612.8	8545.5
2005	-1061.2	-1581.5	-6164.7	-4.7	4930.6	7628.7
2006	319.8	-2157.6***	-11970.1	-4.4	12706.6	8442.4
2007	1603.3	-2945.0***	-15792.9	-4.5	24688.1***	8337.7
2008	2318.2	-3547.0***	1589.9	-4.6	13560.1	10282.0
2009	1887.6	-3725.2***	-7492.4	-4.9	10089.2	10223.5
2010	1087.3	-4333.6***	-7086.0***	-5.3	16354.9	10287.4
2011	1215.9	-5099.5***	3412.1	-5.0	13678.1	11088.9
2012	-563.2	-5787.2***	5477.3	-5.3	8176.9	10338.1
2013	-1234.7	-6162.4***	-1702.3	-5.3	-2542.9	9833.1
2014	-2691.5	-6452.4***	6345.3	-4.9	-2653.7	8882.6
2015	-2553.5	-6393.7***	12057.4	-5.0	-2528.3	8992.5
2016	-2557.1	-6588.5***	14601.5***	-4.6	-2486.2	8977.1
2017	-988.5	-6485.8***	9821.6	-4.5	1632.7	8787.0
2018	-996.5	-6480.3***	15558.9		4224.5	9430.5
2019					4464.7	9188.8

Notes: Standardized p-values are reported with the following values: *p<.1 **p<.05 ***p<.01

Appendix F: In-time placebo tests for Italy

Table F1: Unit weights for Italy's counterfactuals for in-time placebo test

Indicator	Country	Weight
Adjusted net national income per capita	Canada	0
	Chile	0
	Israel	0
	South Korea	0.43
	Mexico	0
	New Zealand	0
	Norway	0
	Sweden	0
	Switzerland	0.271
	United Kingdom	0
	United States	0.299
Households and NPISHs final consumption expenditure per capita	Canada	0
	Chile	0
	Israel	0
	South Korea	0
	Mexico	0.152
	New Zealand	0
	Norway	0
	Sweden	0
	Switzerland	0.163
	United Kingdom	0.684
	United States	0
Disposable income Gini index	Australia	0.282
	Canada	0
	Chile	0.093
	Colombia	0
	Israel	0

	Mexico	0
	New Zealand	0
	Norway	0
	Sweden	0
	Switzerland	0.625
	United Kingdom	0
	United States	0
Average pre-tax national income of top 10%	Australia	0.096
	Canada	0
	Chile	0.248
	Colombia	0
	Israel	0.005
	Japan	0.348
	South Korea	0
	Mexico	0
	New Zealand	0
	Norway	0
	Sweden	0.304
	Switzerland	0
	Turkey	0
	United Kingdom	0
	United States	0

Table F2: Predictor balance for Italy for in-time placebo test

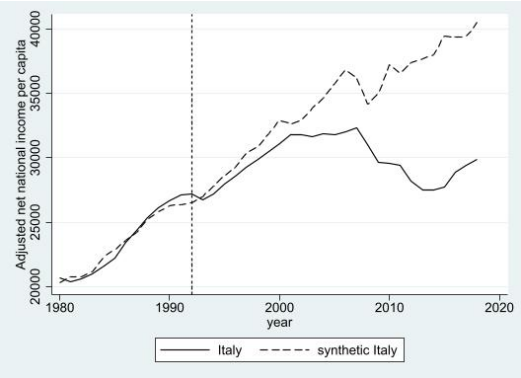
Indicator	Variable	Italy value	Synthetic value
Adjusted net national income per capita	Inflation rate	10.4	6.3
	Net investment rate in non-financial assets	79.3	71.7
	Secondary education rate	75.4	91.5
	Tertiary education rate	26.8	36.5
	Trade rate	19.3	54.5

	Adjusted net national income per capita in 1991	27142.1	26348.4
	Adjusted net national income per capita in 1985	22184.6	22815.1
	Adjusted net national income per capita in 1980	20703.4	20291.9
Households and NPISHs final consumption expenditure per capita	Inflation rate	10.4	14.9
	Net investment rate in non-financial assets	79.3	99.9
	Secondary education rate	75.4	80.8
	Tertiary education rate	26.8	21.1
	Trade rate	39.3	53.1
	Households and NPISHs final consumption expenditure per capita in 1991	18823.4	18042.7
	Households and NPISHs final consumption expenditure per capita in 1985	15436.8	15457.9
	Households and NPISHs final consumption expenditure per capita in 1980	14272.5	14318.7
Disposable income Gini index	Adjusted net national income per capita	24200.1	36706.3
	Unemployment rate	10.1	4.3
	Bottom 50% income share	24.8	20.9
	Top 10% income share	25.7	32.0
	Elderly share of population	13.9	12.4
	Female to male labor participation rate	53.2	67.7
	Disposable income Gini index in 1991	31.4	32.1
	Disposable income Gini index in 1987	32.7	32.0
	Disposable income Gini index in 1983	31.4	31.7
Average pre-tax national income of top 10%	Adjusted net national income per capita	23287.5	21848.2
	Unemployment rate	10.1	4.0
	Elderly share of population	13.8	11.3
	Female to male labor participation rate	53.2	66.8
	Bottom 50% income share	25.2	19.4
	Top 10% income share	25.2	38.0
	Average pre-tax national income of top 10% in 1991	113074.5	113221.5
	Average pre-tax national income of top 10% in 1985	90396.1	91361.2
	Average pre-tax national income of top 10% in 1980	89679.4	86375.5

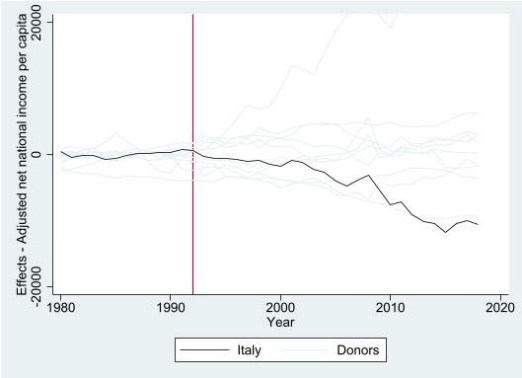
Notes: Values reported are averages over entire pre-intervention period.

Figure F3: Effects and placebo gaps of euro adoption on average material welfare indicators in Italy for in-time placebo test

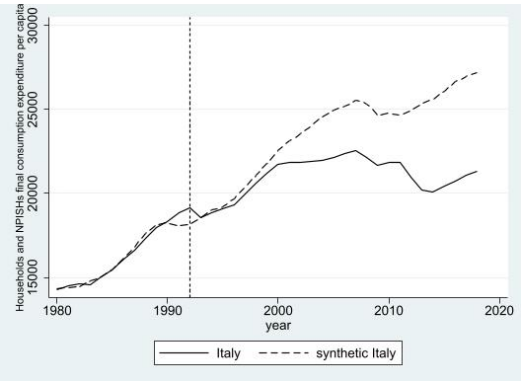
Panel A1: Adjusted net national income per capita



Panel A2: Adjusted net national income per capita gap in Italy and placebo gaps in donor countries



Panel B1: Households and NPISHs final consumption expenditure per capita



Panel B2: Households and NPISHs final consumption expenditure per capita gap in Italy and placebo gaps in donor countries

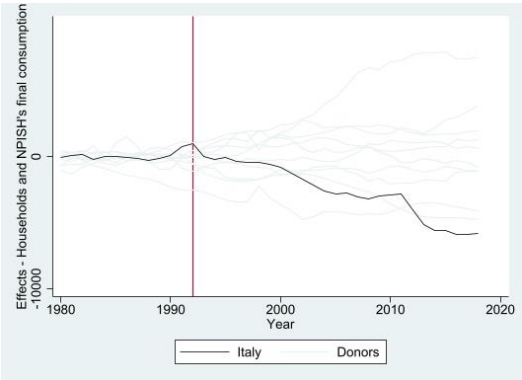
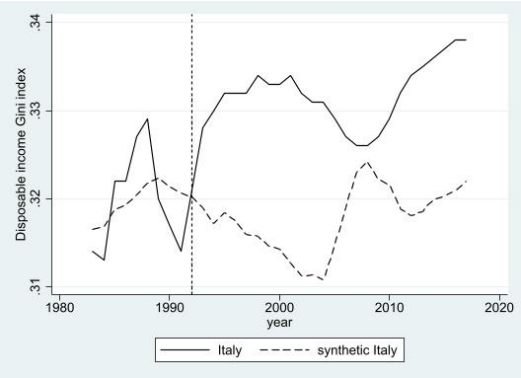
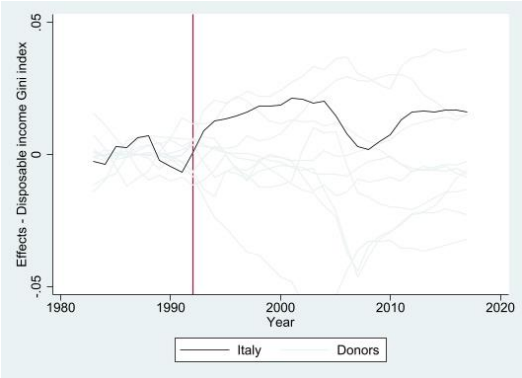


Figure F4: Effects and placebo gaps of euro adoption on distributional material welfare indicators in Italy for in-time placebo test

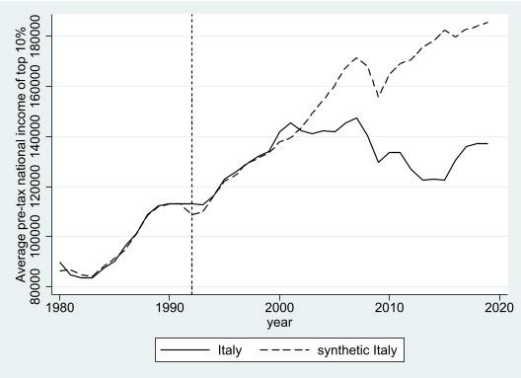
Panel A1: Disposable income Gini index



Panel A2: Disposable income Gini index gap in Italy and placebo gaps in donor countries



Panel B1: Average pre-tax national income of top 10%



Panel B2: Average pre-tax national income of top 10% gap in Italy and placebo gaps in donor countries

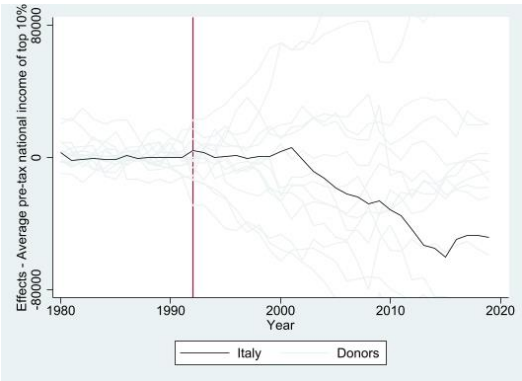


Table F3: Synthetic control regression results for in-time placebo test Italy

Year	Outcome variable			
	Adjusted net national income per capita	**Households and NPISHs final consumption expenditure per capita**	**Disposable income Gini index**	**Average pre-tax national income of top 10%**
1992	680.1	965.3	0.1	4455.9***
1993	-260.1	-15.8	0.9	2881.2
1994	-616.7	-178.9	1.3	-13.8
1995	-633.8	-82.8	1.4	817.8
1996	-704.6	-386.6	1.5	1275.9
1997	-1082.4	-426.8	1.6	-368.1
1998	-933.4	-449.7	1.8	743.0
1999	-1409.7	-594.4	1.8	647.4
2000	-1824.7	-780.7	1.9	3781.8
2001	-831.1	-1238.2	2.1	5925.3
2002	-1177.6	-1711.2***	2.1	-1136.5
2003	-2186.4	-2128.0***	2.0	-8278.5
2004	-2735.3	-2595.2***	2.0	-12450.9
2005	-3985.7	-2793.2***	1.4	-18284.0
2006	-4733.3	-2790.2***	0.8	-22142.9
2007	-3939.7	-3022.5***	0.3	-24125.0*
2008	-3141.3	-3217.1***	0.2	-27856.6*
2009	-5388.6***	-2957.3***	0.5	-25948.3***
2010	-7642.1***	-2939.4***	0.7	-31603.2***
2011	-7107.3***	-2820.2	1.3	-35295.5***
2012	-9172.3***	-3932.7***	1.6	-43621.7***
2013	-10185.8***	-5127.2***	1.6	-53089.7***
2014	-10495.2***	-5560.3***	1.6	-55238.1***
2015	-11730.4***	-5616.7***	1.7	-60183.6***
2016	-10483.9***	-5897.3***	1.7	-49417.4***
2017	-10036.6***	-5872.5***	1.6	-46979.4***
2018	-10605.9***	-5848.2***		-46976.6***
2019				-48220.8***

Notes: Standardized p-values are reported with the following values: *p<.1 **p<.05 ***p<.01.

Appendix G: In-time placebo tests for The Netherlands

Table G1: Unit weights for The Netherlands' counterfactuals for in-time placebo test

Indicator	Country	Weight
Households and NPISHs final consumption expenditure per capita	Canada	0.752
	Chile	0
	Israel	0
	South Korea	0.17
	Mexico	0
	New Zealand	0
	Norway	0
	Sweden	0
	Switzerland	0.078
	United Kingdom	0
	United States	0

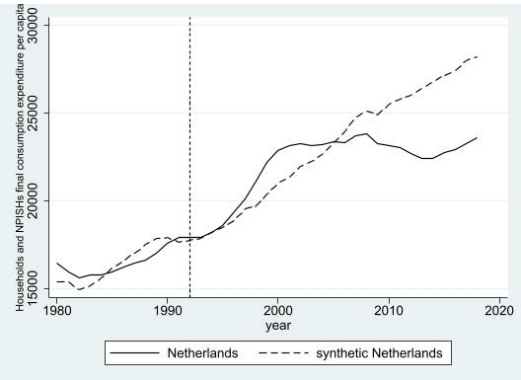
Table G2: Predictor balance for The Netherlands for in-time placebo test

Indicator	Variable	Netherlands value	Synthetic value
Households and NPISHs final consumption expenditure per capita	Inflation rate	2.9	6.5
	Net investment rate in non-financial assets	72.6	88.2
	Secondary education rate	107.2	95.0
	Tertiary education rate	32.1	70.4
	Trade rate	103.9	55.1
	Households and NPISHs final consumption expenditure per capita in 1991	17931.8	17660.5
	Households and NPISHs final consumption expenditure per capita in 1985	15942.1	16163.9
	Households and NPISHs final consumption expenditure per capita in 1980	16431.5	15367.4

Notes: Values reported are averages over entire pre-intervention period.

Figure G5: Effects and placebo gaps of euro adoption on households and NPISHs final consumption expenditure per capita in The Netherlands for in-time placebo test

Panel A1: Households and NPISHs final consumption expenditure per capita



Panel A2: Households and NPISHs final consumption expenditure per capita gap in Netherlands and placebo gaps in donor countries

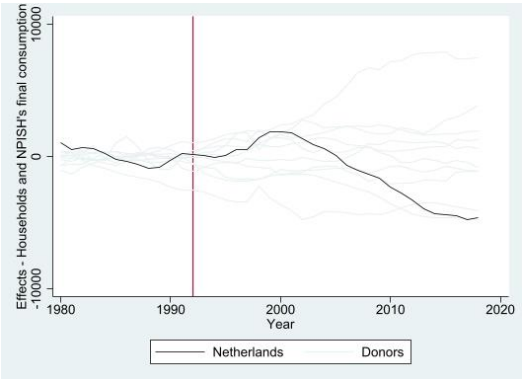


Table G3: Synthetic control regression results for in-time placebo test The Netherlands

	Outcome variable
Year	**Households and NPISHs final consumption expenditure per capita**
1992	176.976
1993	69.129
1994	-37.736
1995	67.342
1996	512.428
1997	569.253
1998	1401.911
1999	1845.868
2000	1846.943
2001	1808.071
2002	1325.820
2003	895.196
2004	589.342
2005	113.635
2006	-642.768
2007	-1038.059
2008	-1313.258
2009	-1666.715
2010	-2342.237
2011	-2726.408
2012	-3300.010
2013	-3979.489
2014	-4333.792
2015	-4380.451
2016	-4512.705
2017	-4738.497
2018	-4599.947
2019	

Notes: Standardized p-values are reported with the following values: *p<.1 **p<.05 ***p<.01.