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Should We Turn Back Time?

A Synthetic Control Study on the Trade Effects of Sweden's Choice Not To Enter the Eurozone

by

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"I have suffered the biggest defeat
a Swedish prime minister has ever suffered"

Göran Persson, Swedish prime minister (1996-2006) after the 2003 euro referendum that resulted in the Swedish rejection of the euro.

Abstract

The formation of the Economic and Monetary Union, combined with the introduction of the euro, further deepened a long-going European economic integration. Sweden has been a member of the European Union since 1995 but has not yet given up its independent currency. In this study, we estimate the trade flows that would have occurred between Sweden and its major trading partners if Sweden had joined the euro in 1999. Furthermore, we use the synthetic control method to estimate the causal effect on trade of Sweden's choice not to enter the euro. We create a counterfactual scenario where Sweden joins the euro and compare these synthetic outcomes with actual Swedish outcomes. Our results suggest that if Sweden had joined the euro, aggregate export flows between Sweden and euro countries would have been 80% higher in 2019, and aggregate import flows would have been 16% higher in 2019 if Sweden had adopted the euro. We also estimate the (hypothetical) euro's effect on trade flows between Sweden and Sweden's biggest non-euro trading partners. According to our findings, adopting the European currency would have resulted in 30% higher export flows and 25% higher import flows in 2019 between Sweden and its seven biggest non-euro trading partners.

Key words: Euro, Trade, European Union, Sweden, Synthetic control method

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Contents

1. Introduction

According to the binding economic and legal conditions from the Maastricht Treaty in 1992, all members of the European Union (EU) are required to adopt the euro and join the euro area once they are ready to fulfill them, except for Denmark and the United Kingdom. However, in 2003 Sweden chose to refrain from adopting the euro without a legal exception after a referendum that rejected the euro.

Sweden is very dependent on its exports. As of 2022, 45 percent of Swedish GDP consists of exports of goods and services, and 42 percent of GDP constitutes imports of goods and services, according to Ekonomifakta (2022). As of 2022, Sweden has been a member of the EU for 27 years and is now one of eight member states that still has not adopted the common currency. The only reason why Sweden has not adopted the euro is that Sweden does not fulfill all convergence criteria, which is a conscious decision. How has a small, heavy exporting country like Sweden, been affected by the decision not to join the common currency in the European Union? This question has many dimensions, and trade is not the only determinant of an adoption of the euro, but hopefully this analysis will shed some light on the consequences of Sweden's decision to stay out of the euro area.

This paper aims to evaluate the effect of adopting the euro on trade flows by looking at one country that has decided to maintain its independent currency: Sweden. In order to evaluate this, we analyze changes in export and import flows since the adoption of the euro in 1999 and answer the following research question: how would Swedish trade flows have been affected if Sweden had imposed the euro in 1999?

In order to answer our research question, we begin by describing the Economic and Monetary Union and its role in the EU and how discussions about the euro have evolved in Sweden since the early 90s. After that, we use a synthetic control method to evaluate how the euro could have affected Swedish trade flows. Our analysis is divided into two samples. First, we examine the trade flows between Sweden and the euro countries that adopted the euro in 1999. Then, we analyze the trade flows between Sweden and its seven biggest trading partners outside of the euro area, to see how trade with non-euro countries would have been affected if Sweden joined the euro area. We create a synthetic Sweden, a weighted average of the countries that adopted the euro in 1999, to analyze how Swedish trade flows would have developed if Sweden had adopted the euro in 1999. The euro countries are similar to Sweden in terms of some chosen predictor variables but differ from Sweden as they share a common

currency. The predictor variables consist of economic and demographic indicators, such as GDP, trade flows before the introduction of the euro, and sharing a common ethnological language. Synthetic Sweden is an estimate of the unobserved Sweden that adopted the common currency, which is referred to as the counterfactual for Sweden. Comparing trade flows between Sweden and its trading partners with those of synthetic Sweden, we investigate how Sweden's decision to maintain its independent currency has affected Swedish trade flows.

This analysis, with the chosen method, has to our knowledge not been done before. Previous studies of the effect of Sweden's decision not to adopt the euro have been done on GDP (see Eriksson and Ljungkvist, 2021, Olsson, 2019, Gyoerk, 2017, and Campos, 2016), but studying Swedish trade flows and the effect that the euro would have had on them is yet to be done.

The rest of the paper is organized as follows. Section 1 covers the background of the Economic and Monetary Union, as well as Sweden's attitude towards the common currency. Following that, we review some previous research belonging to this subject. Thereafter, we present the theory of optimal currency areas presented by Mundell in 1961, followed by a discussion about why the euro is expected to affect trade. Section 2 explains the synthetic control method, the econometric framework, and a motivation for why this method can answer our research question. In section 3, we present the outcome, predictor, and treatment variables. In section 4, we present and analyze the results for how Swedish trade flows would have been affected if Sweden had imposed the euro. We then perform a series of placebo and robustness exercises as inference in section 5. Lastly, section 6 concludes the paper with a discussion and suggestions for future research.

1.1 Background

1.1.1 The Economic and Monetary Union

The formation of the Economic and Monetary Union, hereafter referred to as EMU, results from a long-going, deep European economic integration. Establishing a currency union in the EU has been discussed since the 1960s, when unstable exchange rates caused problems for pricing systems in common agricultural politics (Eriksson & Ljungkvist, 2021).

As the members of the European Union signed the Maastricht Treaty in 1991, they agreed to form an economic and monetary union. The treaty implied that the countries should have structured coordination of fiscal policies and a common monetary policy run by the European Central Bank (ECB). Most importantly, they all agreed to a common currency, the euro (European Commission, 2022). Today, all 27 EU member countries are included in the economic union, and some member states have adopted the euro, taking the integration one step further. Together, these countries make up the euro area.

When joining the common currency in the EMU, national governments agree to give up control over their monetary policy. The European Central Bank, ECB, controls monetary policy. Fiscal and tax policies that cover governments' budgets and determine how income is raised are under national control. Also, structural policies that determine capital- and labor market regulations and pension systems are still under federal control (European Commission, 2022). However, having this construction of the EMU increases the risk of a growing budget deficit. If a country with its national currency is experiencing expansive fiscal policy, one can implement instruments such as changing interest rates, exchange rates, and inflation. In a currency union, these instruments will be implemented equally across the union, such that the effects will differ across the member countries (Eriksson & Ljungkvist, 2021). This could potentially have devastating effects on some member states.

According to the European Commission (2022), a common monetary policy is crucial because otherwise, the single market would be less effective, and trade could risk disruption. For this reason, monetary policy is strongly coordinated under the EMU, and within the euro area, it is centralized.

To join the EMU, one must first fulfill a set of restrictions established by the Maastricht Treaty in 1992. As formulated by the European Commission, these restrictions are called Convergence criteria. The convergence criteria are:

- *Price stability.* The average inflation rate cannot be more than 1.5 percentage points above the rate of the three best-performing member states.
- *Sound and sustainable public finances.* The government deficit and debt may not be under excessive deficit procedure at the time of examination.
- *The durability of convergence.* The long-term interest rate is not allowed to be more than two percentage points above the rate of the three best-performing member states.

- *Exchange rate stability.* The state needs to have participated in the Exchange Rate Mechanism (ERM II) for at least two years without severe tensions, in particular without devaluing against the euro.

1.1.2 Sweden and the euro

Sweden became a member of the European Union in 1995, together with Finland and Austria who both adopted the euro in 1999. At this time, establishing a monetary union was in full swing. However, whether Sweden should join the common currency union was never discussed. The political debate preceding the referendum about joining the European union treated these two memberships as entirely different subjects – even though membership in the EU would imply membership in the EMU as well (Eriksson & Ljungkvist, 2021).

In September 2003, Sweden held a referendum to decide whether to adopt the euro or stick to their national currency, the Swedish krona. The results were quite clear. 56% of the voters voted against a euro accession, and 42% voted in favor of a common currency. After the referendum, there were discussions about whether the results were equitable. At this time, Sweden was in an economic boom which made the adoption of the euro a threat to a prosperous economy rather than an opportunity. Politicians were ambivalent about their position on the matter, which may have influenced the people. Furthermore, four days before the referendum, all election campaigns were canceled due to the murder of the Minister for Foreign Affairs, Anna Lindh. However, according to Eriksson and Ljungkvist (2021), this should not have affected the referendum.

As of 2020, 19 out of 27 EU member countries have adopted the euro. Denmark is the only current member of the EU that is exempted from the EMU by the Maastricht treaty. Sweden is not exempt from the EMU. According to Eriksson and Ljungkvist (2021), the only reason why Sweden has not joined the common currency yet is that they knowingly do not fulfill all convergence criteria for a euro accession. As soon as Sweden meets these criteria, they are obligated to adopt the euro as its currency.

The Swedish Central Bureau of Statistics has once a year since 1996 performed a survey about Sweden's euro preferences. Throughout time the Swedish people have mostly been against joining the euro. 2009 was the only year where the for and against sides were almost equally significant. Since then, the share opposing the euro has dominated. In the last survey from November 2021, only 20 % claimed that they would have voted for the euro.

1.2 Previous research

1.2.1 Early works using the gravity model of bilateral trade

Early studies of the EU and the common currency area, such as Rose (2000), Micco et al. (2003), and Berger and Nitch (2008), use the gravity model to investigate the effect that the currency union has on both euro countries and EU member states outside of the euro area.

One of the first studies on currency unions and their effect on trade was conducted by Rose (2000). According to his estimates, a common currency area increases bilateral trade by over 200 percent. Micco et al. (2003) found significantly lower estimates. Trade increased between euro member countries by about 10–20 percent, depending on what country pair is compared. A notable exception to Micco et al. (2003) and other gravity model approaches is the work of Berger and Nitch (2008), who explores the historical perspective of the euro's trade effect by using a dataset from 1948 to 2003. Using an augmented gravity model, they find that there has been a gradual increase in trade intensity between European countries over time. However, the effect of the formation of the European monetary union disappears once they control for the trend in trade integration. Rather than an increase from the implementation of the currency union in 1999, the authors argue that the creation of the European monetary union has been a long series of policy changes that have led to gradually increasing economic integration among the countries that today constitute the currency union.

Frankel (2010) re-evaluates the results of Micco et al. (2003), as their results differed in magnitude compared to other papers. Micco et al. (2003) suggest that the magnitude is much lower than other papers published at that time, such as the estimates reported by Rose (2000). Frankel (2010) addresses this issue and investigates what this discrepancy might depend on. He finds that the discrepancy might depend on the sample size, such that estimation in a gravity model with a large dataset will result in substantial effects on the euro. Frankel also mentions lags and endogeneity as an issue. These issues mentioned by Frankel have led to more recent studies using other methods than the gravity model when investigating the common currency.

1.2.2 More recent works using the synthetic control method

In more recent applications, the synthetic control method has proven to be a reasonable means to assess the impact of policy-related events. Zúdel and Melioris (2016) use the synthetic control method to estimate the economic effects of adopting the euro in Slovakia in 2009. They found that Slovakia gained approximately 10% of real GDP per capita in 2011 from adopting the euro when comparing the synthetic control to the actual GDP.

Synthetic control results of whether the Swedish economy has benefited from being outside the euro are presented by Campos et al. (2016), Gyoerk (2017), Olsson (2019), and Eriksson and Ljungkvist (2021). Campos et al. (2016) found that the benefits to the Swedish economy of adopting the euro are relatively small. On the other hand, Gyoerk (2017) presented results indicating that joining the common currency would have invoked lower exports, labor productivity, investments, and consumption in Sweden, combined with higher imports and government expenditure levels. Olsson (2019) reports akin results to Gyoerk (2017), suggesting that Sweden's economic development has been more robust thanks to the fact that the country has been outside the monetary union. Olsson's results show that Sweden's actual GDP is 24% higher than it would have been if Sweden had adopted the euro after the referendum in 2003. The trends show similar results when computing more models with different weights assigned and comparisons of country pairs. Sweden's economic activity would be lower if it adopted the euro. Olsson (2019) concludes that theoretical and empirical evidence suggests that Sweden has benefited from staying out of the currency union.

Eriksson and Ljungkvist (2021) argue that the synthetic control method cannot convincingly answer whether Sweden has benefited from being outside the euro area. Using GDP per capita as their variable of interest, the authors report much smaller numbers of Sweden's synthetic development over time than Olsson (2019).

Gunella et al. (2021) from the European Central Bank studied the euro's effect on bilateral trade, focusing on the countries that have adopted the euro since 2009. They perform a gravity model and a synthetic control estimation. Their results with the gravity model indicate that joining the euro had an effect ranging between 4.3–6.3% bilateral trade on total average. The synthetic control method estimates a 30% increase in bilateral trade. The authors think

this significant difference might be because the gravity model can control unobserved characteristics via fixed effects. In contrast, the synthetic control approach may fail to do so.

Saia (2017) investigated whether the UK would have been better off with the euro as a national currency or if sticking to the sterling pound has benefited British trade flows. Using the synthetic control method, Saia provides an estimate for the trade flows that would have been between the UK and its main trading partners if the UK had adopted the euro back in 1999. His findings show that the UK would have traded more with both euro countries and other trading partners had they adopted the euro in 1999.

1.2.3 Works on benefits from joining a currency union

Revising the question of what countries will benefit from joining a currency union, the works of Alesina and Barro (2002) and Alesina, Barro, and Tenreyro (2002) depart from the same discovery. They claim that the optimal number of currencies in the world is lower than the number of countries in the world, meaning that an individual country may not be an optimal currency area. Adding to Mundell's (1961) theory of optimal currency areas, Alesina and Barro (2002) investigate the relationship between currency unions and trade flows and whether there are more currencies than optimal. Their findings show that countries that trade more with each other will benefit more from adopting the same currency. Moreover, their results suggest that the number of currencies will increase less than proportionally or even fall as the number of countries in the world increases.

Building on the conclusions of Alesina and Barro (2002), Alesina, Barro, and Tenreyro (2002) investigates which countries should form currency unions from an empirical investigation. They define the characteristics of a country that would benefit most from trade and commitment to a currency union. Among other things, smaller countries should be more willing to give up their independent currencies, which is in line with Alesina and Barro's (2002) conclusions that the number of currencies in the world should increase less than proportionally as the number of countries increases. As the number of countries in the world increases, countries' size will on average be smaller, increasing the probability of more currency areas. Alesina, Barro, and Tenreyro (2002) continue their analysis by saying that the countries that will gain the most from giving up their currencies are those that have a history

of high and volatile inflation, which is a symptom of lack of internal discipline from monetary policy. They conclude that there exists a well-defined euro area, basing their conclusion on historical data on inflation, trade, and co-movements of prices and output.

1.2.4 Contributions of our study

Our thesis contributes to the literature that tries to evaluate the effects of the euro on Sweden. Analyzing what effect the euro would have had on Swedish exports to the countries that joined the euro in 1999. This knowledge is important for policymaking. The Maastricht Treaty states that all EU members should strive to join the common currency. As mentioned above, previous research has looked at the development of Sweden as a whole by trying to look at how Sweden's GDP would have evolved with the euro. Instead, we took inspiration from Saia's (2017) paper and looked at how Swedish export and import would have been affected by joining the euro. Furthermore, our study also looks at the effect the euro would have had on trade with Sweden's seven biggest trading partners outside of the euro area. Moreover, our study extends the analysis of the euro effect until the end of 2019 while Saia only looked at it until 2012.

1.3 Theory

1.3.1 Theory of optimal currency areas

Robert Mundell first introduced the theory of optimal currency areas in 1961. Essentially, Mundell (1961) discussed the criteria for which two or more countries could be considered an optimal currency area. Optimal means a balance between the benefits of the currency for socioeconomic effectiveness and the currency's stabilizing policy disadvantages. McKinnon (1963) further developed the concept of an optimum currency area. He claimed the more open a country is, the more it can benefit from lower trade transaction costs inside the union. Furthermore, McKinnon (1963) argues that giving up independent monetary policy is less costly for more open countries since aggregate price levels are determined to a greater extent by international tradable prices.

The foremost advantage of a common currency is that risks connected to the exchange rate are heavily reduced. When firms no longer have to consider currency changes in their trade, this should, according to theory, increase trade and investment. Moreover, it should also lead to a deeper integration of the financial markets within the area. As Eriksson and Ljungkvist (2021) argue, the more you trade with members of your currency area, the bigger the expected profit from having a common currency.

The monetary policy is adjusted towards the entire currency area rather than individual countries. This implies that a country experiencing an economic boom and high inflation rate will receive a too low-interest rate. In contrast, countries in recession will receive a too high-interest rate. When a country loses its tools to confront macroeconomic disruptions with national monetary policy, these disturbances must be handled through wage or price adjustments or, alternatively, by increasing labor mobility (Eriksson and Ljungkvist, 2021).

According to the theory of optimal currency areas (Mundell, 1961), at least one of the following terms needs to be fulfilled:

1. *There is an integrated labor market with free labor movement*. Unemployment due to a recession in a region or state is reduced by enabling the labor force to work in other regions in the currency area.
2. *The member states' nominal price- and wage mobilities are high.* Prices of goods, capital, services, and labor combined with the free movement of capital can

compensate for imbalances in the economy. Furthermore, imports and exports should dominate the trade flows within the currency area rather than trading with a third country.

3. *Fiscal policy integration is deep*, enabling redistribution of resources to areas affected by an economic recession.
4. *Disturbances that hit the member states are symmetrical,* as a common currency makes it impossible to implement different monetary policy measures if a part of the currency area is affected by an asymmetrical disruption.

Implementing these terms of the theory of optimal currency areas on the euro area, we stumble across several issues. Even though only one of these conditions needs to be satisfied, the euro seems to not fulfill any of them. Although the EU strives for free movement of goods, capital, services, and labor, the movement of prices, wages and labor is low across most European economies. It is merely the movement of capital that is relatively large.

Moreover, after the eurozone debt crisis in 2009, the theory of optimal currency areas was incomplete. Eichengreen (2014) argues that the following lessons can be drawn from the theory and the euro as a common currency:

- *Asymmetric shocks are intrinsic to a monetary union.* The shocks can be both endogenous and exogenous. The policy implication of this is that cross-border capital flows and account imbalances within the euro area cannot be neglected. They need to be counteracted with a policy response.

- *A monetary union without a banking union will not work.* This may seem obvious, as the EMU is heavily bank-based. Banks are important for supervision and regulation, and the integration of financial markets is crucial globally and even more so within a currency union. When the theory of optimal currency areas was introduced back in 1961, the integration of financial markets was very bounded.

- *A monetary union needs a central bank that works as a lender of last resort.* The ECB's ability to act as a lender of last resort was restricted before the eurozone crisis, which led to disbelief in the euro. The announcement of the president of the ECB Mario Draghi in 2012, “do whatever it takes to preserve the euro”, was enough to calm down the markets and stabilize the ECB as a lender of last resort.

- *Labor mobility in the monetary union is a mixed blessing.* Mundell (1961) argued that labor mobility was an alternative to changes in monetary policy and exchange rates. The eurozone debt crisis hit the entire euro area, such that there were only a few countries that would make it worthwhile emigrating to. Furthermore, it is often the highly educated labor that can move to other parts of the union which can lead to an impoverishment of educated people in less central parts of the euro area.

- *A fiscal union has distributional consequences, making it indefensible.* The euro area has relatively low political integration, which makes it hard to argue why a common fiscal policy would be beneficial.

- *The euro area needs a mechanism for restructuring unsustainable debts.* To reduce the all too large national debts of periphery countries such as Greece and Italy.

- *A monetary union is forever, more or less.* While the adjustment to adopt the euro may be difficult and costly, exiting the euro area would be even more difficult and costly. Taking Greece as an example, leaving the monetary union would have been worse than staying and accepting the austerity policy that followed.

When Sweden held the euro referendum in 2003, the theory of optimal currency areas was an essential element of the preceding debate. Although the theory might not be applicable today, it gave important insights into the benefits and costs of joining the common currency. Flam (2009) and Polák (2019) have investigated several reports on the euro's trade effects. They both mainly found positive and statistically significant effects. However, the effect seems to be prominent in the beginning when the euro was first adopted. However, after that, the effect diminishes over time.

The fourth criterion of the theory of optimal currency areas is that shocks that hit the member states are symmetrical, implying that all member states' business cycles should be synchronized. Campos and Macchiarelli (2020) investigate the distance between EU member states in terms of core countries (symmetrical business cycles) and periphery countries (asymmetric business cycles). Austria, Belgium, France, Germany, Italy, and the Netherlands are defined as core countries. In contrast, Finland, Ireland, Portugal, and Spain are periphery countries with asymmetrical business cycles. According to the authors, Sweden has moved further away from the core towards the periphery and is now the country that continues to increase the distance from the core after Brexit. Any shocks hitting the currency union would

therefore hit Sweden asymmetrically compared to the core countries. Therefore, it could be damaging for Sweden to give up its independent monetary policy in the event of the adoption of the euro.

1.3.2 Four reasons why the euro should affect trade

Currency unions have long been a well-discussed subject for economists. This section will list the most prominent reasons the euro should affect trade.

Neighboring countries trade more with each other

Geography is an essential part of the creation of common currency areas. Frankel and Rose (2002) argue that countries tend to trade more with neighboring countries, especially if the neighbor is a large country. Thus, all other things equal, a country would benefit more from adopting the currency of a giant neighbor than that of a more distant, smaller nation. The European Monetary Union, hereafter EMU, is composed of a mixed group of both large and small countries. Countries such as Germany, France, and Spain constitute some of the biggest trading nations in the world. At the same time, Luxembourg, Belgium, and the Netherlands are smaller countries that have joined the common currency with large neighboring countries.

Transaction cost elimination

One of the most prominent arguments in favor of a currency union is eliminating transaction costs arising from the need to operate with multiple currencies when trading across different countries. When trading with a country with the same currency as one's own, these transaction costs are entirely eradicated.

Removal of exchange rate volatility

One of the most common convictions is that exchange rate volatility dampens trade, as a floating currency creates uncertainty, discouraging trade and investment. According to Micco et al. (2003), sharing a common currency will result in fixed exchange rates, thus removing the exchange rate volatility between all currency union trading partners. Moreover, as Micco et al. (2003) argue, in giving up the national currency for a common one, the currency union may provide its member countries with an instrument to hedge exchange risk in their trading with non-member countries. This should lead to the euro increasing trade flows among euro members and other trading partners, according to Micco et al. (2003). Rose (2000) found similar results using a gravity model, suggesting that belonging to a common currency

significantly affects trade. There is indeed a negative effect of exchange rate volatility on bilateral trade.

Losing control of monetary policy

The most significant disadvantage of joining the monetary union is the abandonment of the nation's currency and the loss of the sovereign monetary policy. This partially means that a country will not be able to change the price of its currency through devaluation or revaluation (De Grauwe, 2009). Furthermore, it is possible that the euro can affect trade negatively. Through devaluation and the possibility of holding a weak exchange rate, one can stimulate the economy and maintain the competitiveness of the export industry. This tool may be lost through the termination of an independent monetary policy (Johansson & Ljungberg, 2010).

2. The Synthetic Control Method

In this section, we will use the synthetic control method to provide an estimate of the export flows that would have been between Sweden and the European countries that have adopted the euro as their common currency, if Sweden had joined the common currency. We will also look into how Swedish trade with its biggest trading partners would have been affected if Sweden had adopted the euro.

Comparative case studies are frequently used to detect the effects of an intervention that affects aggregate units on a large scale. To determine whether an intervention has an effect on an outcome, we must compare the results of a unit exposed to the intervention to the outcomes that would have occurred if the unit had not been exposed. Therefore, comparative case studies are only conceivable when some units are exposed and others are not (Abadie et al., 2010). In the following analysis, Sweden, as a treated unit, will be subject to a treatment, which is joining the euro. To determine the effects of the treatment, we compare the outcomes of the treated unit to the outcomes that would have been if the unit had not been treated, i.e. the counterfactual. Since a unit can only be treated or untreated, the counterfactual is unobserved by definition. We need a control unit to estimate the counterfactual because we only have one of the outcomes. The goal is to select a control unit as close as possible to the true counterfactual (Abadie and Gardeazabal, 2003; Abadie et al., 2010).

We use Sweden as the treated unit and generate a synthetic Sweden with the euro as its currency using the synthetic control method. This synthetic control unit is created as a weighted average of the countries that joined the Euro in 1999.[1] With this method, we can more credibly estimate the counterfactual for Sweden, i.e., how Sweden's trade flows would have developed if Sweden had joined the common currency. By doing this, we can evaluate the treatment's effect by comparing the outcome variables following treatment in actual Sweden and synthetic Sweden (Abadie and Gardeazabal, 2003; Abadie et al., 2010). In our study, we estimate the effect on trade flows for Sweden if Sweden had joined the euro in 1999. We will investigate Swedish trade flows to the euro countries, and to make the analysis more thorough, we will include the trade flows that there would have been between Sweden and Sweden’s biggest trading partners if Sweden had joined the euro in 1999.

[1] Austria, Finland, France, Germany, Ireland, Italy, the Netherlands, Portugal and Spain

2.1 The structure of the model

In this part, we will explain the structure of the model succeeding Abadie and Gardeazabal (2003), as well as Abadie et al. (2010:2015). In a balanced sample, we have $J + 1$ countries, indexed by j, for $t = 1, ..., T$ time periods, such that all units are observed at the same time. The first country, $j = 1$, receives an intervention, whereas countries $j = 2, \ldots, J + 1$ make up a donor pool. The donor pool can be used to approximate the counterfactual to the unit of interest by providing potential comparison units. Therefore, it is important that the donor pool contains units that are comparable to the treated unit and that they have not been exposed to structural shocks to the outcome variable throughout the study's sample period.

The treatment is joining the euro. The treated unit is Sweden and the donor pool is the nine countries that joined the euro in 1999 and Sweden's biggest non-euro trading partners. Assume that T_0 is a positive number of pre-treatment periods (in our case: 1980–1998) and that T_1 is a positive number of post-treatment periods (in our study: 1999–2019). Further, we also assume that $T = T_0 + T_1$, $1 \leq T_0 < T$ and that the treatment happens at $T_0 + 1 < T$. The treatment should affect the treated unit and not the other J countries. In our case, it means that the treatment should only affect Sweden, which it does as the other countries already have adopted the euro (Abadie et al., 2010:2015; Andersson, 2019).

Y_{jt}^{N} is the outcome for country j at time t if the country was exposed to the treatment in periods $T_0 + 1$ to T for countries $j = 1,..., J + 1$ and periods $t = 1,..., T$. We define this as the outcome for the treated unit. Let Y_{jt}^{L} be the outcome for country j at time t in the absence of treatment. This is our observed unit. Making the assumption that the treatment has no effect on the outcome before 1999, the outcome in country j during the pre-treatment period is the same regardless of whether the country is treated or not (Abadie et al., 2010).

Following Abadie et al. (2010), $\alpha_{jt} = Y_{jt}^{L} - Y_{jt}^{N}$ is described as the causal effect of the treatment for country j at time t. D_{jt} is a dummy equal to one if country j is exposed to treatment and zero otherwise. The dummy variable has a value of one if $j = 1$ and $t > T_0$. The observed outcome for country j at time t is

$$Y_{jt} = Y_{jt}^{L} + \alpha_{jt} D_{jt} \quad (1)$$

The aim is to figure out the treatment's causal effect on the treated unit's outcome variable in the post-treatment period ($t > T_0$): $\alpha_1 = (\alpha_{1T_0+1,}, \ldots, \alpha_{1T})$

$$\alpha_{1t} = Y_{1t}^{L} - Y_{1t}^{N} = Y_{1t} - Y_{1t}^{N} \quad (2)$$

Because Y_{1t}^{L} is known, we aim to estimate the counterfactual outcome Y_{1t}^{N}, so that we can estimate α_{1t}. Meaning how the treated unit would have done in the post-intervention period with intervention. The outcome for country *j* at time *t* in the absence of treatment is given by:

$$Y_{jt}^{L} = \delta_t + \theta_t Z_j + \lambda_t \mu_j + \varepsilon_{jt} \quad (3)$$

In the equation above δ_t is an unknown constant factor across countries, Z_j is a vector of observed covariates that are not affected by adopting a common currency; λ_t is a vector of unobserved covariates common across countries; θ_t and μ_j are vectors of unknown parameters; and ε_{jt} is an error term consisting of unobserved temporary shocks for country *j*. On average, the error term is zero. (Abadie et al., 2010).

Next, we examine a vector of weights for the *J* untreated units: $W = (w_2, \ldots, w_{J+1})'$where $w_j \geq 0$ and the sum of the weights is one. The weights in the synthetic control unit represent how significant each untreated unit is. The value of the outcome variable in the synthetic control unit is defined as

$$\sum_{j=2}^{J+1} w_j Y_{jt} = \delta_t + \theta_t \sum_{j=2}^{J+1} w_j Z_j + \lambda_t \sum_{j=2}^{J+1} w_j \mu_j + \sum_{j=2}^{J+1} w_j \varepsilon_{jt} \quad (4)$$

Furthermore, we presume that there are weights $(w_2^*, \ldots, w_{J+1}^*)$ so that for each time period in the pre-treatment period ($T = 1, \ldots, T_0$) the value of the outcome variable in the treated unit ($j = 1$) is equal to the value of the outcome variable in the synthetic control unit and the value of

these observed variables for the treated unit is equal to the weighted value of the observed covariates. This can be stated in the following way:

$$\sum_{j=2}^{J+1} w_j^* Y_{j1} = Y_{11,} \sum_{j=2}^{J+1} w_j^* Y_{j2} = Y_{12} \ \ldots, \sum_{j=2}^{J+1} w_j^* Y_{jT_0} = Y_{1T_0} \qquad (5)$$

$$\text{and} \sum_{j=2}^{J+1} w_j^* Z_j = Z_1 \qquad (6)$$

To create an estimator of Y_{1t}^N, we create a synthetic control unit using the created weights so that the treatment effect can be estimated in the post-treatment period ($t = T_0 + 1, \ldots, T$):

$$\hat{\alpha}_{1t} = Y_{1T} - \sum_{j=2}^{J+1} w_j^* Y_{jt} \qquad (7)$$

Only if the following holds will the synthetic control unit be an unbiased estimator of Y_{1t}^N

$$\sum_{j=2}^{J+1} w_j^* Z_j = Z_1 \text{ and } \sum_{j=2}^{J+1} w_j^* \mu_j = \mu_1 \qquad (8)$$

$\mu_1, \ldots, \mu_{J+1}$ cannot be taken into consideration while choosing a synthetic control because they are not observed. However, equation (3) suggests that a synthetic control can fit Z_1 and pre-treatment outcome $Y_{11}, \ldots, Y_{1T_0}$ only if it fits both Z_1 and μ_1 (Abadie et al., 2010). This means that these equations hold approximately and we are able to estimate the treatment effect as in equation (7).

2.2 Implementation of the model

In this section, we will show how we perform the synthetic control method to provide an estimate of the trade flows that there would have been between Sweden and the European countries that have adopted the euro as their currency if Sweden had adopted the euro as well. Furthermore, we also investigate the trade flows that would have been between Sweden and its main trading partners, had Sweden adopted the euro.

Our first sample contains Sweden and the nine euro countries that adopted the euro in 1999. The second sample contains Sweden and its ten biggest trading partners in 1999. The country pair $i \in X$ is our chosen unit, and the trade flows of the country pair are our chosen outcome. Using the ten countries from our first sample as an example, we observe 45 country pairs, where nine of them are Swe-euro member pairs. The Swe-euro pairs are denoted as $X_{Sek-€}$ and the rest of the pairs are denoted $X_{€€}$. For simplicity, the application of the synthetic control method to the Sweden-Finland country pair is presented (hereafter *Swe−Fin*). We then explain how we use the method to assess the hypothetical effect of the euro on trade between Sweden and euro countries if Sweden had adopted the euro in 1999. The results from the equation below will tell us the percentage loss or gain in trade flows for Sweden and Finland, from the decision not to adopt the same currency over the period 1999 to 2019.

$$\eta_{1999-2019,\,SWE-FIN} = \frac{\sum_{t=1999}^{2019} (TF_{t,\,Swe-Fin}(Sek-€) - TF_{t,\,Swe-Fin}(€€))}{\sum_{t=1999}^{2019} TF_{t,\,Swe-Fin\,(€€)}} \quad (9)$$

$TF_t Swe - Fin\,(Sek - €)$ represents the trade flows between Sweden and Finland when the countries do not have the same common currency. $TF_t Swe - Fin\,(€€)$ shows the trade flows between the two countries if both would have had the same currency, the euro. $TF_t Swe - Fin\,(€€)$ shows the trade flows between the two countries if both would have had the euro. $\eta_{1999-2019,\,SWE-FIN}$ is not observable. This is because Sweden did not join the euro 1999, we can only observe $TF_t Swe - Fin\,(Sek - €)$ and not $TF_t Swe - Fin\,(€€)$. To best possibly create a credible estimate of $\eta_{1999-2019,\,SWE-FIN}$ we need to create a conceivable counterfactual. Following Saia (2017)[2], but examining Sweden instead of the UK, we need to identify a country pair, or a group of country pairs, within the currency union that is qualified to reproduce the evolution of trade flows between Sweden and Finland that would have occurred if Sweden had also joined the euro. We will construct a counterfactual unit as the euro country pair units' weighted average with the synthetic control method (Abadie et al., 2010). We will provide an estimate for $\eta_{1999-2019,\,SWE-FIN}$ using:

[2] We want to thank professor Alessandro Saia at the University of Bologna for sharing his material with us, and answering our question quickly.

$$\widehat{\eta}_{1999-2019,\,SWE-FIN} = \frac{\sum_{t=1999}^{2019}\left(TF_{t,\,Swe-Fin}(Sek-€) - \sum_{i=1}^{X_{€€}} w_i TF_{t,i,}(€€)\right)}{\sum_{t=1999}^{2019}\sum_{i=1}^{X_{€€}} w_i TF_{t,i\,(€€)}} \quad (10)$$

In the equation above $\sum_{i=1}^{X_{€€}} w_i TF_{t,i,}(€€)$ stands for the created synthetic counterfactual unit for country pair *Swe-Fin*. w_i is the non-negative weight of the *i*-th European country pair which in the equation above is the weight of *Swe- Fin* and $\sum_{i=1}^{X_{€€}} w_i = 1$.

We select the vector W^* of weights that minimizes the distance of

$$argmin_{\{w \in W\}} \sqrt{\left(Z_{Swe-Fin} - Z_i W\right)' V \left(Z_{Swe-Fin} - Z_i W\right)} \quad (11)$$

This is because each combination of weights produces a different synthetic unit. $Z_{Swe-Fin}$ is a vector of our selected unit's pre-euro characteristics, and Z_i is a matrix of some economic and demographic indicators of alternative counterfactual units that were unaffected by the euro introduction. Following Saia (2017), we include five pre-euro indicators when performing our synthetic matching exercise. The chosen indicators are the values of export flows in million dollars and the logs of country pairs' GDPs averaged over the period 1980-1998, as well as three endogenous variables computed as multilateral resistance terms as suggested by Anderson and van Wincoop (2003): log of geographical distance between two countries, and the two dummies common ethnological language and common border.

The term *V* is a [5 × 5] diagonal and positive definite matrix. It contains the weights that measure how important each indicator is, such that the mean-squared prediction error is minimized. If the matching window is large enough, the synthetic control mechanism will successfully reproduce the observed and unobserved determinants of trade for each country pair. The synthetic unit must provide a good resemblance of the country pair before 1999 when the euro was introduced. Any significant differences between the counterfactual and the actual unit after 1999 should then represent the effect that Sweden's decision not to join the euro had on Swedish trade flows.

2.3 Motivation for choosing the model

The difference-in-differences method is widely used in comparative case studies when it comes to analyzing the effect of a policy intervention or an event. The method compares the change in a certain variable of interest before and after an intervention to the change in a control group. The control group is made out of a country that was similar before the policy intervention occurred. The control group should not be subject to a similar intervention, as the purpose of the approach is to distinguish the effects that the intervention had on the treated units. With this said, one could then be tempted to perform a difference-in-differences and compare for example Sweden to Finland since both countries are very similar and have connected economies. However, there are some distinct differences between the countries, the Nokia effect being the biggest one. How it is going for the telecom company Nokia has had a major impact on the Finnish economy. Nokia's production collapse was a crucial reason behind Finland's economic downturn during the euro crisis. Finland also has a less diversified and less competitive sector than Sweden and is therefore potentially more susceptible to disturbances (Eriksson and Ljungkvist, 2021).

Therefore, we will use the synthetic control method since it has several advantages, one of them being that it is not built on only using a single control unit, but combining several weighted average units that can lead to a better control unit. Another advantage compared to the difference-in-differences method is that the synthetic control relaxes the parallel trends assumption by allowing unobserved covariates to vary over time (Abadie et al., 2010). This is advantageous because the assumption of parallel trends is difficult to guarantee and cannot be checked (Andersson, 2019). The ability to build a control unit as a weighted average of numerous alternative control units, as well as the ability to enable unobserved country-specific effects to vary over time, makes the synthetic control method suitable for evaluating the effect of Sweden not joining the euro on Swedish trade flows.

One advantage that the synthetic control method has compared to traditional regression analysis is that the weighted average of possible control units creates transparency. It does so firstly by showing how the treated unit and the synthetic control unit are similar. Secondly, it becomes apparent how each possible control unit contributes to the creation of the synthetic control unit because each control unit is assigned a certain weight. This method also avoids extrapolation biases since, unlike regression approaches, it restricts the weights assigned to possible control units to a range of zero to one. The use of interpolation, instead of

extrapolation, provides a more concentrated analysis of the relationship between the unit of interest and the control units. However, there is a potential of interpolation bias, especially if the donor pool comprises units that are significantly different from the treated unit. To avoid the potential of bias, the donor pool can be limited to units that have similar characteristics to the unit of interest (Abadie et al., 2010, 2015).

Moreover, Campos et al. (2016) argue that uncertainty in all types of forecasts increases over time when using synthetic control. This is because there are no acknowledged methods of stating confidence intervals that show the degree of statistical uncertainty in relation to the measured development. That is why we perform several different falsification tests to evaluate the credibility and robustness of our results.

3. Data

Outcome variable

Our outcome variable is trade flows between Sweden and its trading partners. To make the analysis more comprehensive, we will include both export flows from Sweden and import flows to Sweden. By doing so, we will be able to investigate more aspects of Swedish trade and how it would have been affected by adopting the single currency. Furthermore, we will divide our research into two samples. In the first sample, we investigate how Sweden's trade with euro countries would have changed if Sweden had adopted the euro in 1999. To further deepen our analysis, we include a second sample, to investigate how Sweden's trade with its seven biggest trading partners would have been affected if Sweden had adopted the euro in 1999.

The data on trade flows is retrieved from the International Monetary Fund Direction of Trade Statistics. We have retrieved data on trade flows between the years 1980 and 2019 of the countries that adopted the euro in 1999: Austria, Germany, Finland, France, Ireland, Italy, the Netherlands, Portugal, and Spain. Belgium and Luxembourg are excluded because there exists no individual trade data for these countries before 1996. Greece is also excluded because they did not fulfill the convergence criteria until 2001.

Furthermore, we extracted trade flows data between the years 1980 and 2019 of Sweden's biggest non-euro trading partners as reported in 1999, to see how Swedish trade would have evolved with non-euro countries if Sweden adopted the euro. We add this second sample to be able to make a more comprehensive study, as it might be misleading to only present results

of countries sharing the same currency in the synthetic treatment. Sweden's seven biggest non-euro trading partners in 1999 as reported by Statistiska Centralbanken (SCB) were Australia, Denmark, Great Britain, Japan, Norway, the United States, and Switzerland. From this list, the Russian Federation and Czech Republic are excluded because of missing data before 1991 when the Soviet Union was dissolved. China, Turkey and Poland are also excluded because of missing data. To avoid the outbreak of the coronavirus, the year 2020 has been excluded.

Our first sample contains ten countries: Sweden and the nine countries that adopted the euro in 1999, observed over a 40-year period from 1980 to 2019. This will give us 81 country pairs, nine of which are Sweden-euro member pairs.

Our second sample contains 17 countries: Sweden, the nine countries that adopted the euro in 1999, and Sweden's seven biggest non-euro trading partners in 1999, observed over a 40-year period from 1980 to 2019. Nine of these country pairs are Sweden- non-euro trading partner pairs.

Predictor variables

Our model consists of various demographic and economic predictor variables at country level. These variables could potentially have an effect on our outcome variable of interest, and they are used to create a control unit that is as similar to Sweden as possible. Following Saia (2017) we use the logarithm of real GDP in 1980-1998, measured in current U.S dollars and trade flows between 1980 and 1998 as economic indicators. These are considered pre-euro characteristics, along with three demographic indicators. The demographic indicators we have included are dummy variables for sharing a common border and sharing a common ethnological language, which is in line with Saia (2017). Furthermore, we also include the logarithm of geographical distance between a country pair.

Data on geographical distance, common ethnological language, and geographical contiguity are retrieved from the Gravity Dataset at CEPII. Gross domestic product in current US dollars has been extracted for each country between 1980 and 2019 from the World Bank database World Development Indicators.

Treatment variable

Our treatment is to not adopt the euro, and instead continue using the sovereign currency the Swedish Krona.

The donor pool

The donor pool in sample 1 consists of the European countries that adopted the euro in 1999. Austria, Finland, France, Germany, Ireland, Italy, the Netherlands, Portugal, and Spain are the countries that constitute the donor pool. They are constructed as country pairs, such that we end up with 72 euro country pairs in the donor pool.

The donor pool in sample 2 consists of country pairs made out of euro countries and Sweden's seven biggest non-euro trading partners. Sweden's seven biggest non-euro trading partners in 1999 were Australia, Denmark, Japan, Norway, Switzerland, the United Kingdom, and the United States. The donor pool consists of trade between the euro countries and the non-euro countries, such that trade between only non-euro countries is excluded.

Predictor balances: Sample 1

Table 1 shows the predictor balance, i.e. the average of the predictor variables, of exports to Sweden from euro countries, and includes a weighted average of the euro countries sample in addition to the averages for Sweden and synthetic Sweden. The column "Sweden" provides averages of variables of actual Sweden. "Synthetic Sweden" provides us with estimates of the predictor variables of the weighted averages of countries in the donor pool. For reference, we have also included a third column, which is the average of predictor variables in the donor pool, not weighted.

By looking at the predictor balance, we can confirm that we can trust the fit of the synthetic Sweden, such that the combination of weighted averages improves the estimate of the counterfactual. Regarding the average for the common ethnological language variable, the euro countries provide better predictions than the synthetic Sweden does. However, the average for synthetic Sweden provides better predictions to all other variables. The prediction balance implies that the synthetic Sweden is a more appropriate estimate of the counterfactual Sweden than the donor pool.

	Sweden	Synthetic Sweden	Euro countries
Exports 1980-1998	2068,42632	2060,08167	5534,648679
Log of GDP 1980-1998	52,1860778	52,14151	53,54926811
MRT Common ethnological language	-0,0220385	0,05617997	0,021963115
MRT Common border	-0,009183	-0,008809	0,023434847
MRT distance	0,82832444	0,82564496	0,736680732

Table 1. Predictor balance for exports to Sweden to euro countries (sample 1). *Note:* The predictor variables are all averaged across all swe-euro country pairs.

Table 2 shows the predictor balance of imports to Sweden and includes a column for the weighted averages of the country pairs' predictor variables in the donor pool. The averages for synthetic Sweden follow the values for Sweden better than those of the donor pool. This suggests that the synthetic control better predicts the trajectory of Swedish import flows than the euro countries, and therefore provides a better estimate of the counterfactual for Sweden.

	Sweden	Synthetic Sweden	Euro countries
Exports 1980-1998	2089,43124	2095,61497	5534,648679
Log of GDP 1980-1998	46,5546904	46,54861	53,54926811
MRT Common ethnological language	-0,0376492	-0,0361846	0,021963115
MRT Common border	0,13502599	0,11952822	0,023434847
MRT distance	0,78498175	0,74551428	0,736680732

Table 2. Predictor balance for imports to Sweden to euro countries (sample 1). *Note:* The predictor variables are all averaged across all swe-euro country pairs.

Predictor balances: Sample 2

Table 3 displays the predictor balance of Swedish exports to its biggest non-euro trading partners. We can confirm that the values for synthetic Sweden's variables have a good fit, as they are similar to the values for actual Sweden. For reference, there is a third column that consists of averages of the donor pool. The donor pool in sample 2 is made out of euro-non euro country pairs. Synthetic Sweden also provides a better fit than the average of the donor pool does, suggesting that creating a weighted average will give us more accurate results.

	Sweden	Synthetic Sweden	Donor pool
Exports 1980-1998	2847,62656	2850,95369	5055,43546
Log of GDP 1980-1998	52,8869243	52,6341086	53,6690563
MRT Common ethnological language	0,15112166	0,16729751	-0,0119375
MRT Common border	0,15820541	0,14503309	0,00293845
MRT distance	6,14145286	5,692011	0,75228632

Table 3. Predictor balance for exports from Sweden to non-euro countries (sample 2). *Note:* The predictor variables are all averaged across all swe-non-euro country pairs.

Table 4 shows the predictor balance of imports to Sweden from non-euro countries, illustrated by the columns for Sweden (actual values) and synthetic Sweden (weighted averages of donor pool). For reference, the column to the right is also included, which shows the average of variables for the donor pool. The averages for synthetic Sweden follow the

values for Sweden better than those of the donor pool. This suggests that the synthetic control better predicts the trajectory of Swedish import flows than the euro countries, and therefore provides a better estimate of the counterfactual for Sweden.

	Sweden	**Synthetic Sweden**	**Euro countries**
Exports 1980-1998	2229,33837	2231,88665	5534,648679
Log of GDP 1980-1998	52,8869243	52,8074229	53,54926811
MRT Common ethnological language	0,08618659	0,08303899	0,021963115
MRT Common border	0,08028333	0,07585714	0,023434847
MRT distance	0,3468121	0,5219315	0,736680732

Table 4. Predictor balance for imports to Sweden from non-euro countries (sample 2). *Note:* The predictor variables are all averaged across all swe-non-euro country pairs.

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4. Results

In this section, we will present our main results from the synthetic control method. First, the results from the first sample are presented, where we investigate the trade flows between Sweden and the euro countries. Following that, we present the results of the second sample, where trade flows between Sweden and its biggest non-euro trading partners are analyzed.

4.1 Sample 1: Trade flows with euro countries

Export flows from Sweden to the euro countries

Figure 1 plots the evolution of export flows between Sweden and the nine euro member states over the period 1980 to 2019. The solid lines represent actual export flows between Sweden and its euro member trade partners, while the dashed lines display the synthetic export flows between Sweden and its euro member trade partners. The dashed lines present how Swedish export flows would have looked like if Sweden would have joined the euro in 1999. As for the pre-intervention period from 1980 to 1998, the synthetic counterfactuals depict a good approximation of the units, as the synthetic export flows (dashed line) and actual export flows (solid line) behave similarly before the intervention date. From the adoption of the euro in 1999, the dashed lines present how export flows would have developed over time if Sweden would have joined the euro.

In most cases, the synthetic export flows outperform the actual export flows from Sweden. Swedish exports in 2019 to Austria, France and Italy would have doubled if Sweden had adopted the euro, as can be seen in Table 5. Exports to Finland and Germany are 82 % and 71% higher respectively if Sweden had adopted the euro. Synthetic exports to Germany in 2019 are approximately 29.000 million USD, compared to actual exports which is about 17.000 million USD.

	SWE-AUT	SWE-DEU	SWE-ESP	SWE-FIN	SWE-FRA	SWE-IRL	SWE-ITA	SWE-NLD	SWE-PRT
Percentage difference in 2019	100%	71%	0%	82%	100%	20%	100%	25%	-3%

Table 5. Percentage difference as of 2019 between actual and synthetic exports from Sweden to euro countries. A negative result implies that actual imports are larger than synthetic imports.

Exports to Ireland and the Netherlands show a smaller difference between synthetic and actual exports, although the synthetic unit performs better in both cases. Swedish exports to the Netherlands would have been approximately 2000 million USD larger if Sweden had

adopted the euro. Swedish exports to Spain and Portugal would have been approximately similar to actual export flows.

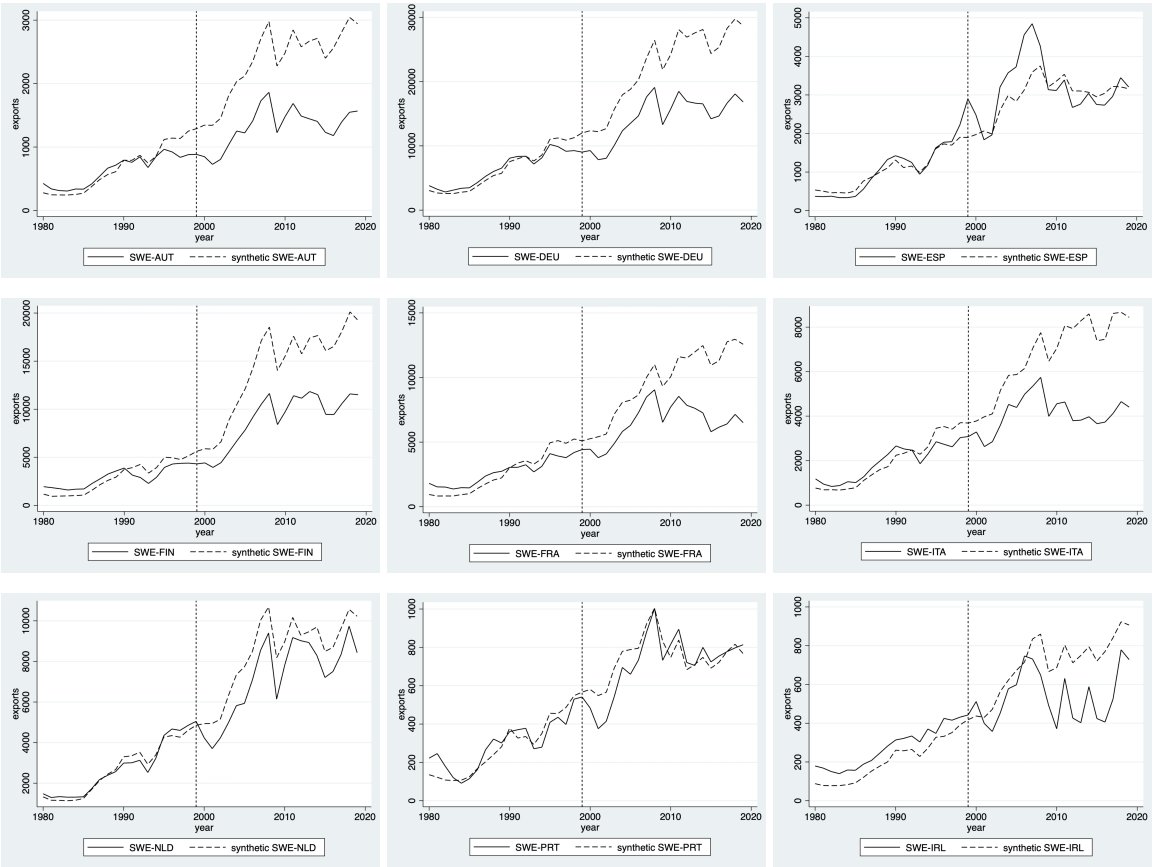

Figure 1. Export flows between Sweden and euro members vs synthetic counterfactuals.

Note: The y axis represents export flows in millions of USD. Solid lines: actual export flows (in millions of USD) between Sweden and euro partners. Dashed lines: average synthetic export flows. The vertical dashed line indicates the time of the treatment.

Departing from the theory that an individual country might not be an optimal currency area and keeping this in mind while looking at Figure 1, it is justifiable to discuss whether it is optimal for Sweden to prevail with their current currency. Following Alesina and Barro's (2002) arguments, countries that trade more with each other will benefit from adopting the currency. As several of Sweden's biggest trading partners today are euro countries[3], it is not controversial to state that these countries might trade even more with each other if they adopted the same currency. Moreover, as Frankel and Rose (2002) argue that a country would benefit more from adopting a large neighboring country's currency than adopting a more remote, smaller nation's, it is reasonable to argue that Sweden, being geographically close to Germany (a large country) indeed benefits from adopting the euro.

[3] Germany, Finland, France, the Netherlands, Belgium, Italy, Spain, Austria, and the Czech Republic are among Sweden's top 20 trading partners.

Import flows to Sweden from the euro countries

Figure 2 plots the evolution of import flows to Sweden from the nine euro member states over the period 1980 to 2019. The dashed lines present how Swedish import flows would have looked like if Sweden had joined the euro in 1999. Looking at the pre-intervention period from 1980 to 1998, the synthetic counterfactuals also depict a good approximation of the units, as they behave similarly to the actual import flows before the intervention date. The results for imports in Figure 2 differ from the results for exports shown in Figure 1, suggesting that adopting the euro would not be as beneficial for Swedish imports as for exports. Actual imports outperform synthetic imports from Austria, Italy, Ireland, the Netherlands, and Spain, while synthetic imports from Portugal, France, and Finland would have been substantially higher. Swedish imports from Finland in 2019 are approximately 167% higher with the euro, and imports from France are more than 83 % higher as seen in Table 6. On the other hand, imports from Spain are 8 % lower when they have a common currency.

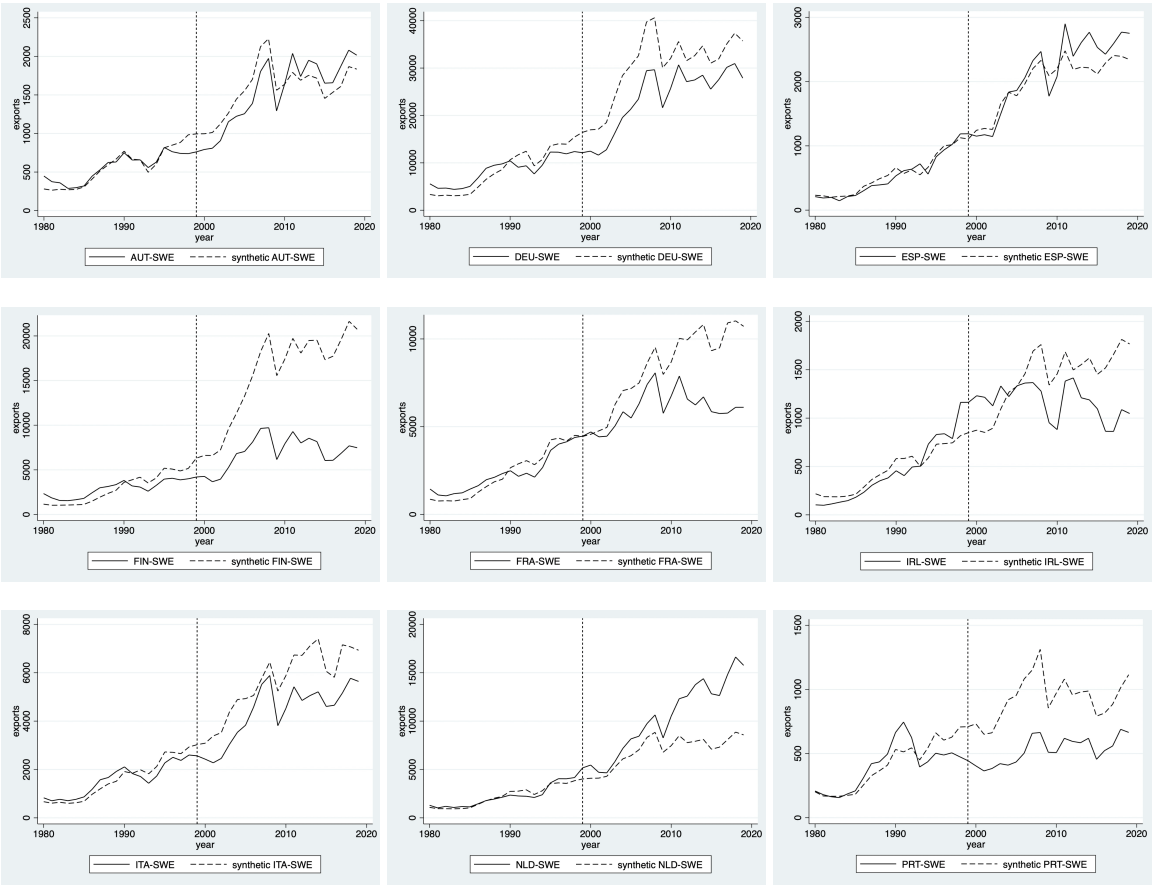

Figure 2. Import flows between Sweden and euro members vs synthetic counterfactuals.

Note: Solid lines: actual export flows (in millions of USD) between Sweden and euro partners. Dashed lines: average synthetic trade flows. The vertical dashed line indicates the time of the treatment.

	AUT-SWE	DEU-SWE	ESP-SWE	FIN-SWE	FRA-SWE	IRL-SWE	ITA-SWE	NLD-SWE	PRT-SWE
Percentage difference in 2019	-10%	25%	-8%	167%	83%	75%	17%	-40%	57%

Table 6. Percentage difference as of 2019 between actual and synthetic imports to Sweden from euro countries. A negative result implies that actual imports are larger than synthetic imports.

The small magnitude of results for imports from Spain may have to do with competitiveness. Spain is among the least competitive countries in the euro area, indicating that the countries have a technological disadvantage and a not-so-favorable institutional framework. Portugal is also among the countries with inadequate competitiveness, but the synthetic results suggest that Portuguese imports to Sweden would increase if both countries had the euro, such that competitiveness cannot explain these results. However, Portugal's unit labor cost growth rates have been increasing considerably since the introduction of the euro, with a cumulative growth of 27,6 percentage change between the years 1999 and 2007 (di Mauro and Forster, 2007). A high unit labor cost is often associated with low productivity and/or distinct wage growth. This is since production will be more costly because of higher unit labor costs which will disadvantage exports since the products are more expensive. If both Sweden and Portugal had had the euro, they would have traded more with each other, since the expenses would have been smaller due to no transaction cost and more price transparency. This could explain why synthetic imports from Portugal, as well as synthetic results overall, perform much better than actual imports, as a common currency removes transaction costs and increases price transparency, which instigates trade.

Ireland is an exceptional case in this analysis, as the country has gone through a period of specific high growth rates in the 1990s and 2000s. This high growth may be associated with extensive foreign direct investment and many foreign multinational enterprises that settled down in Ireland. The estimated effects for Ireland should therefore be considered largely overestimated according to Verstegen et al. (2017).

The results for Austria, indicating that exports to Austria would have increased and imports from Austria would have been somewhat unaffected if Sweden had joined the euro in 1999, are understandable considering that Austria has had a relatively low unit labor cost growth, and at the same time they are averagely competitive in the euro area (di Mauro and Forster, 2007). The low unit labor cost growth rate indicates a higher productivity growth rate, which could explain why synthetic Swedish imports from Austria do not differ so much from actual imports, as the effect of sharing a common currency would not have a significant effect in

this case. As for Swedish exports to Austria, the benefit of having the euro could imply that Sweden becomes more competitive compared to other countries trading with Austria, such that Austria would prefer to import Swedish goods over competitive countries outside of the euro area.

Aggregate trade flows

Figure 3 plots the evolution of aggregate trade flows between Sweden and the euro countries. As can be seen, synthetic export flows are significantly higher than actual export flows, showing an 80% difference as of 2019, while synthetic import flows follow approximately the same trajectory as actual import flows, with a 16% difference in 2019. The fact that Sweden would export more to the euro countries if they shared the same currency can be explained by the theory that a country trades more with its partners within a currency union. This could mean that, if Sweden adopted the euro, trade with euro member states would increase at the cost of trade with non-euro member states. Joining the currency union implies the loss of transaction costs, meaning that a euro member country might become more competitive against a previously important Swedish trading partner, such that it becomes more favorable for Sweden to trade with a euro member country.

Furthermore, as shown in Figure 3, the effect of EMU membership appears to begin sooner than 1999 for the majority of EMU countries. These so-called anticipation effects may occur as consumers, businesses, and even governments anticipate the euro's adoption and begin to act accordingly.

Sweden's import and export increase with the euro aligns with McKinnon's (1963) theory. He claims that the more open a country is, the more it can benefit from lower trade transaction costs inside the union. Sweden's trade openness (measured by the sum of exports and imports as a percentage of GDP) is almost 90 percent reported by The Global Economy in 2019. Thus, Sweden’s trade openness is higher than most countries in the donor pool[4], where only Ireland and the Netherlands are more open. McKinnon (1963) also argues that giving up independent monetary policy is less costly for more open economies, as the aggregate price level is to a larger extent determined by international prices of tradables. So, a small open country like Sweden is more likely to gain from a fixed exchange rate as the country is likely to be a more open economy, according to McKinnon’s theory.

[4] The donor pools’ trade openness. Irland 217%, Netherlands 158%, Germany 88%, Portugal 86%, Finland 78%, Spain 67%, France 64%, Italy 60%

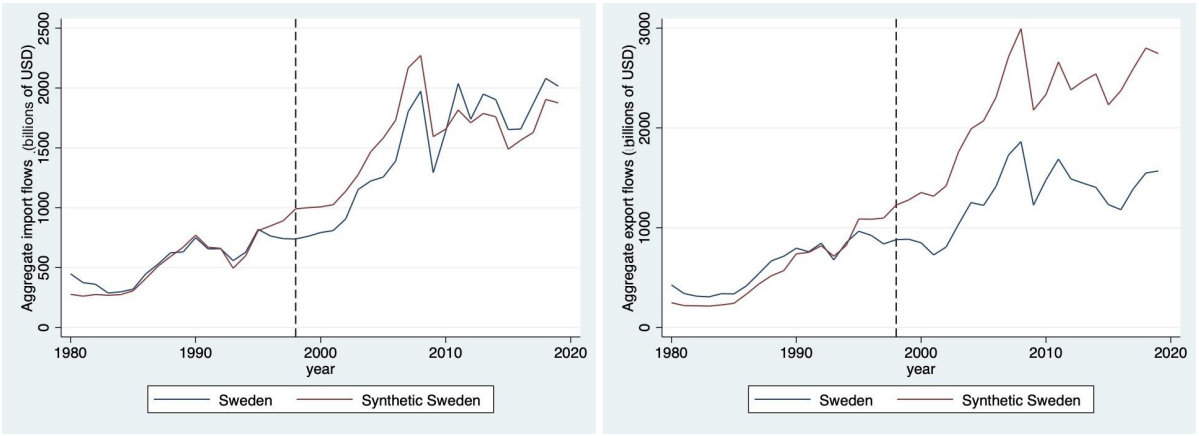

Figure 3. Aggregate trade flows between Sweden and the euro countries.

Notes: Blue line: actual trade flows (in millions of USD). Red line: synthetic trade flows (in millions of USD). Black vertical line: time of treatment. Left graph: aggregate import flows to Sweden. Right graph: aggregate export flows from Sweden.

4.2 Sample 2: Trade with non-euro countries

In this section, we will present the results of sample 2, to see how Sweden's adoption of the euro could have affected trade with other countries outside of the euro area.

Export flows from Sweden to non-euro countries

Figure 4 displays export flows from Sweden to its seven biggest trading partners outside of the euro area. By analyzing this, one can evaluate how Swedish trade flows with other countries than the euro members would have evolved if Sweden had adopted the common currency in 1999. Before the intervention date in 1999, depicted by the dotted vertical line, synthetic Sweden and actual Swedish trade flows follow the same trajectory, meaning that the synthetic counterfactual is a good approximation of Swedish export flows. Swedish exports to the USA would have been approximately 10.000 million USD higher in 2019, which corresponds to a 173 % increase, as can be seen in Table 7. Furthermore, exports to the United Kingdom and Switzerland more than double in 2019 if Sweden would have joined the euro in 1999, and exports to Japan also increases by an astonishing 467 %. On the other hand, exports to Denmark decreases by 25 % and exports to Norway are unaffected in 2019.

Figure 4. Export flows between Sweden and its biggest non-euro trading partners. *Note:* Solid line: Actual export flows (in millions of USD). Dashed line: synthetic export flows (in millions of USD). Dotted vertical line: time of treatment.

	SWE-USA	SWE-NOR	SWE-DNK	SWE-GBR	SWE-JPN	SWE-CHE	SWE-AUS
Percentage difference in 2019	173%	0%	-25%	163%	467%	128%	167%

Table 7. Percentage difference as of 2019 between actual and synthetic exports to Sweden from non-euro countries. A negative result implies that actual exports are larger than synthetic exports.

Import flows to Sweden from non-euro countries

Comparing the results of export flows to Sweden's biggest non-euro trading partners in Figure 4, to those of import flows in Figure 5, it is clear that Sweden would benefit from adopting the euro, even when trading with countries outside of the euro area. Only imports from Denmark would be lower with the euro as Swedish currency, 17 % lower as can be seen in Table 8. This is interesting because they are both small, neighboring countries that have been members of the EU for over twenty years, meaning that they are both parts of the single market. Perhaps the adoption of the euro would make imports from Denmark less competitive compared to other countries.

Swedish imports from the UK would be twice as large in 2019 if Sweden had adopted the euro, whereas imports from the USA would have been 37 % higher in 2019. Imports from Japan would be 167 % higher, and imports from Switzerland would have been 122 % higher, as described in Table 8. On the other hand, imports from Australia would be 43 % lower if Sweden had joined the euro. Remarkably, imports from Norway only increase by 7 %. Sweden and Norway are neighboring countries that already trade a lot with each other despite having different currencies. Thus, these results suggest that imports from Norway do not change much if Sweden adopts the euro.

	USA-SWE	NOR-SWE	DNK-SWE	GBR-SWE	JPN-SWE	CHE-SWE	AUS-SWE
Percentage difference in 2019	38%	7%	-17%	100%	167%	122%	-43%

Table 8. Percentage difference as of 2019 between actual and synthetic imports to Sweden from non-euro countries. A negative result implies that actual imports are larger than synthetic imports.

These results suggest that Swedish trade is not diverted from non-euro trading partners to euro countries in the event of an adoption of a common currency, as one might have suspected intuitively. Thus, even though Sweden would trade more with countries within the euro area if Sweden had adopted the euro, it does not imply that Sweden trades less with countries outside of the euro area. A reason for this might be that Sweden becomes more competitive with the euro as a currency, such that countries are more willing to trade certain goods and services with Sweden than another competing country. Sweden is among the most competitive countries in Europe in terms of producer competitiveness, implying a strong technological advantage and a good institutional environment, according to di Mauro and Forster (2007). This suggests that being geographically located in the periphery does not necessarily have to be a problem.

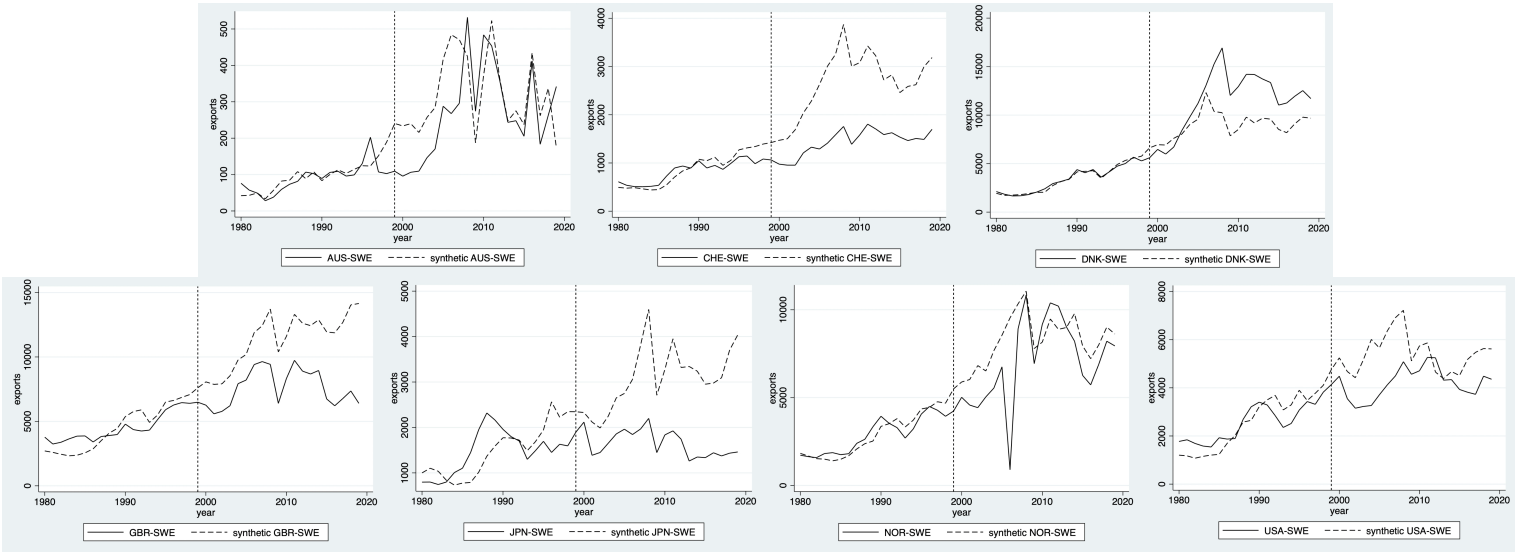

Figure 5. Import flows to Sweden from its biggest non-euro trading partners. *Note:* Solid line: Actual import flows (in millions of USD). Dashed line: synthetic import flows (in millions of USD). Dotted vertical line: time of treatment.

Aggregate trade flows

Figure 6 shows the aggregate export and import flows between Sweden and its biggest non-euro trading partners. The aggregate results for trade with non-euro countries are not as substantial as the country pair results. This implies that Swedish aggregate trade flows to non-euro countries are not as affected by the adoption of the euro as the individual country pair trade flows might be. As of 2019, aggregate export flows between Sweden and its biggest non-euro trading partners would have been 30% higher if Sweden had adopted the euro. Aggregate import flows would have been 25% higher, such that overall, Swedish trade with non-euro countries would have increased if Sweden had adopted the euro.

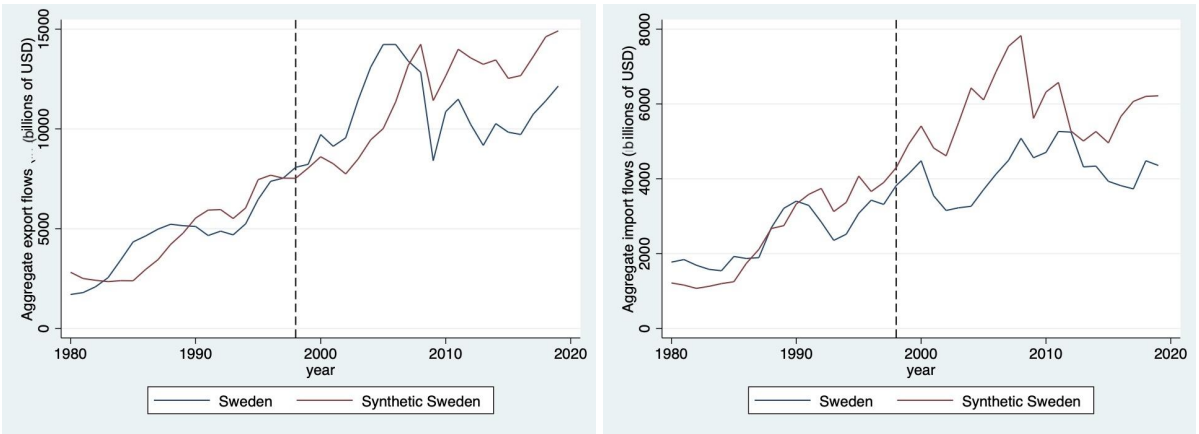

Figure 6. Aggregate trade flows between Sweden and its biggest non-euro trading partners. *Notes:* Blue line: actual trade flows (in millions of USD). Red line: synthetic trade flows (in millions of USD). Black vertical line: time of treatment. Left graph: aggregate import flows to Sweden. Right graph: aggregate export flows from Sweden.

5. Inference

Using traditional statistical inference approaches in comparative case studies has proven to be difficult because of small and non-random samples. Moreover, one does not apply probabilistic sampling when selecting sample units, which further complicates the application of traditional techniques to statistical inference. However, following Abadie et al. (2015), one can systematize the process of estimating a counterfactual such that it is possible to perform a range of different falsification exercises, which are also referred to as placebo studies. The idea of placebo tests is that the estimate representing the treatment effect, which is obtained by comparing the posttreatment outcomes in the synthetic control and the treated unit, would be less credible if we were to find estimated effects for a unit of similar or greater magnitude in periods where the treatment did not take place (Abadie et al., 2015).

In the following sections, we will perform two different placebo tests instead of performing traditional inference. First, we perform an "in-time" placebo test by changing the time period. Second, we carry out an "in-space" placebo test by changing the treated unit. We will then proceed by performing robustness checks.

5.1 Placebo tests

5.1.1 In-time placebo test

In line with Abadie et al. (2015), we perform an in-time placebo test by changing the treatment period. This test can be executed if there is data available for a sufficiently large period of time and if no structural shock has occurred during that period in the outcome variable (Abadie et al., 2015). We simply rerun the model but change the treatment period to 1992. If we receive large treatment effects from this test, it would mean that the estimated treatment effects from our synthetic control are the results of insufficient counterfactuals, rather than being caused by the treatment of implementing the euro (Abadie et al., 2015).

Figure A1 and A2 in the appendix display the results of the in-time placebo test for exports and imports between Sweden and the nine euro states (sample 1). The trends for actual trade and synthetic trade show similar progress before the placebo treatment and seem to continue to do so up until the actual treatment date in 1999. This implies that the placebo treatment in 1992 gives no significant effect for sample 1.

Figure A3 and A4 in the appendix show the results of the in-time placebo test for exports and imports between Sweden and its seven biggest non-euro trading partners (sample 2). The synthetic and actual trade flows follow the same trajectory both before the placebo treatment in 1992, and they continue to have the same development up until the time of the actual treatment date in 1999. This implies that the placebo treatment in 1992 gives no significant effect for sample 2.

The results for the in-time placebo tests indicate that the treatment effects found in the synthetic results in section 4 are driven by the actual treatment of adopting the euro since there is no indication of any large placebo treatment effects. We can then conclude that the in-time placebo results provide our main results with credibility.

5.1.2 In-space placebo test

For the in-space placebo test, we follow Abadie et al. (2015) and move Sweden to the donor pool while iteratively allowing each country from the donor pool to perform as the treated unit. We can then evaluate the placebo effects for all countries and compare them with the estimated effect for Sweden. The estimated effect for Sweden should be similar to or larger than the placebo treatment effects, otherwise, our main results are undermined.

In Figure 6, the results for the in-space placebo test of sample 1 are presented. The lines represent the gap between the treated variable and the synthetic variable for each country pair. Overall, the gaps of the euro-euro country pairs in the graph to the right are close to zero, with the exception of a few gaps of the euro country pairs showing sufficiently large gaps. Comparing the two graphs and the gaps in both ratios in the post-treatment period, one can see that there are placebo treatments that result in similar or larger effects than does the actual effect for Sweden. These results question the credibility of the estimated treatment effect.

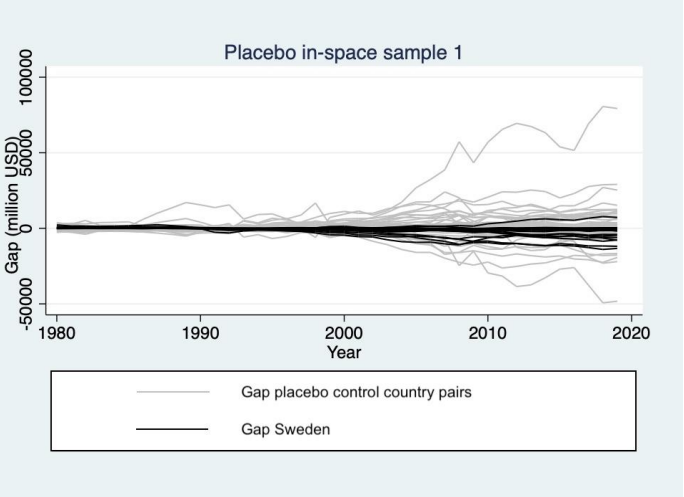

Figure 6. Placebo in-space results. The left graph displays the gaps in all swe-euro country pairs. In the right graph, Sweden is placed in the donor pool and the graph displays the gaps in all euro-euro country pairs.

The same goes for the results for the in-space placebo test of sample 2, displayed in Figure 7. There are placebo effects that have similar or larger effects than the actual effect for Sweden. The lines represent the gap between the treated variable and the synthetic variable for each country pair. Overall, the graphs for Sweden lie consistently well within the spectrum of the placebo donor pool country pairs, such that there is reason to believe that our original analysis does not capture any significant treatment effect.

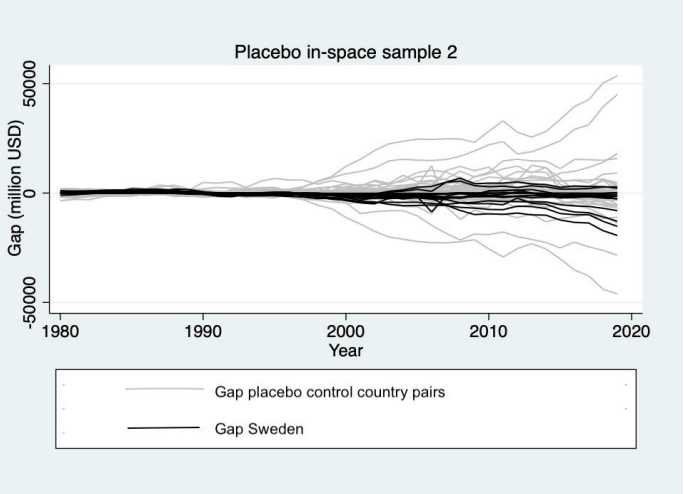

Figure 7. Placebo in-space results for sample 2. The left graph displays the gaps in all swe-non-euro country pairs. In the right graph, Sweden is placed in the donor pool and the graph displays the gaps in all euro-non-euro country pairs.

However, as each of the donor pool countries can only be composed of a combination of the other remaining donor pool countries, there may be a reason to believe that the donor pool is not large enough to capture the treatment effects. The limited donor pool is due to the fact

that there were only 11 countries that adopted the euro in 1999, and we only included nine of them due to missing data. Likewise, we include seven of Sweden's biggest non-euro trading partners in sample 2, because there were a lot of missing data for other countries that otherwise would have been included. Thus, the restricted donor pool makes it statistically challenging to form a synthetic control for some donor pool countries according to Gyoerk (2017), resulting in poorly fitted synthetic controls and very high RMSPEs, which can explain the distortions and the very large treatment effects in Figures 6 and 7. A large RMSPE and large deviations from the actual control are not indications of large treatment effects if the RMSPE before the treatment is large as well. This holds for a lot of countries in the placebo test, as their RMSPEs are much larger than the ones for Sweden. We can therefore focus on the gaps that are not as extreme, and we see that the gaps between the synthetic and actual Sweden lie mostly at the boundary of the donor country plots. This adds validity to our main synthetic results suggesting that Sweden, undergoing treatment, displays greater treatment effects than the donor pool countries that did not undergo any treatment. Furthermore, it might be more suited to rely on the results of the in-time placebo results than the in-space results as the in-time results are better suited for this study.

5.2 Robustness checks

In this section, we will perform a robustness test to examine the sensitivity of our results to changes in the country weights. We will perform one robustness test for each of the samples to make our analysis more complete. In the test, we iteratively remove one of the countries from the donor pool to see how our synthetic control changes.

Robustness test of sample 1

For sample 1, synthetic Sweden is created as a weighted average of trade flows between Austria, Finland, France, Germany, Ireland, Italy, the Netherlands, Portugal, and Spain. We will perform the robustness checks by iteratively re-estimating the model, each time creating a new synthetic Sweden by removing one of the countries with positive weights. All weights can be seen in Tables A1 and A2 in the appendix. By excluding countries that received a positive weight we give up some goodness of fit, but this robustness check allows us to analyze to what extent our results are driven by any particular country.

Figure 8 displays the results of all robustness checks, where we iteratively excluded one country (colored lines). We performed the synthetic control method each time we removed

one country from the dataset and received results of synthetic trade for all country pairs. Then, we computed an average of the synthetic trade for each country we left out. We computed the robustness check this way as we find it the most intuitive and easy to understand. Instead of iteratively removing a country pair from the data set, we believe that removing one country at a time will provide us with the results we need.

We compare the results to the trajectory of our main results for synthetic Sweden (dashed line) and the treated unit, the actual trade flows of Sweden (black solid line). The leave-one-out results all follow the same path as the main synthetic control, although the levels differ. This implies that the results of the main analysis are fairly robust to the exclusion of a certain country from our donor pool. The country that seems to be the most important for the main synthetic control is Germany. Excluding Germany results in the leave-one-out synthetic control that deviates the most from the actual synthetic control. This is reasonable, as Germany is an important trading partner to Sweden, and it is also geographically close to Sweden.

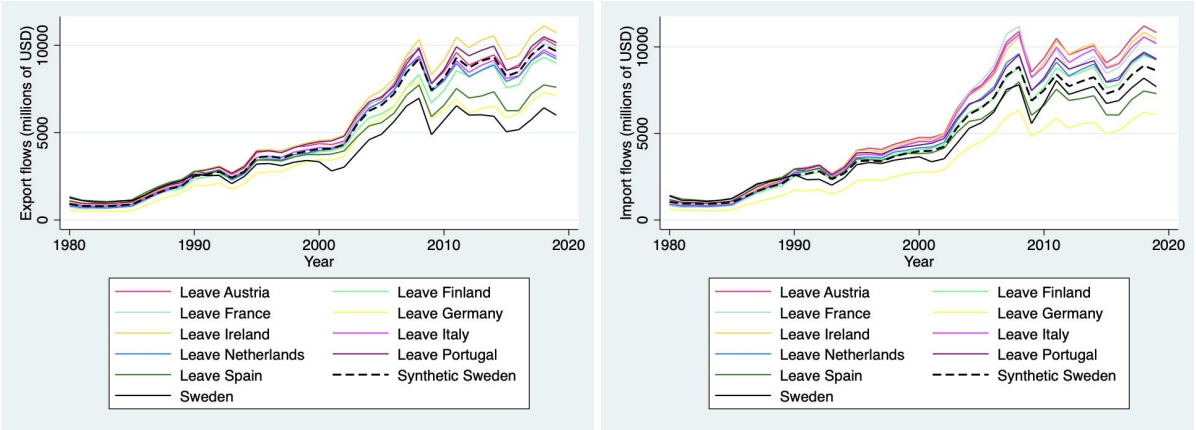

Figure 8. Robustness test results for sample 1.

Notes: The left graph displays average export flows, the right graph displays average import flows. Each country was iteratively left out of the model.

Robustness test of sample 2

For sample 2, synthetic Sweden is created as a weighted average of trade flows between Australia, Denmark, Japan, Norway, Switzerland, the UK, and the USA. We will perform the robustness checks by iteratively re-estimating the model, each time creating a new synthetic Sweden by removing one of the countries with positive weights. All weights can be seen in Tables A3 and A4 in the appendix. By excluding countries that received a positive weight we give up some goodness of fit, but this robustness check allows us to analyze to what extent our results are driven by any particular country.

Figure 9 displays the results of all robustness checks, where we iteratively excluded one country (colored lines). We performed the synthetic control method each time we removed one country from the dataset and received results of synthetic trade for all country pairs. Then, we computed an average of the synthetic trade for each country we left out. We computed the robustness check this way as we find it the most intuitive and easy to understand. Instead of iteratively removing a country pair from the data set, which would have given us a tremendous amount of data to analyze, we believe that removing one country at a time will provide us with the results we need.

We compare the results to the trajectory of our main results for synthetic Sweden (dashed line) and the treated unit, the actual trade flows of Sweden (black solid line). The leave-one-out results all follow the same path as the main synthetic control, although the levels differ. This implies that the results of the main analysis are fairly robust to the exclusion of a certain country from our donor pool. Both Denmark and Norway are important to the results. As can be seen in tables A3 and A4, the country pairs Denmark-Finland and Norway-Finland receive a lot of weight when creating the synthetic trade between Sweden and Denmark, and Sweden and Norway, respectively. This makes sense because they are all geographically close, similar in economic characteristics, and are important trading partners to one another. Thus, when removing Denmark or Norway from the dataset, we do not see any big changes. Perhaps it could be because when we exclude Denmark, we still have Norway in the dataset, receiving a big weight so that the synthetic trade still performs well. The same thing can be true when excluding Norway as well.

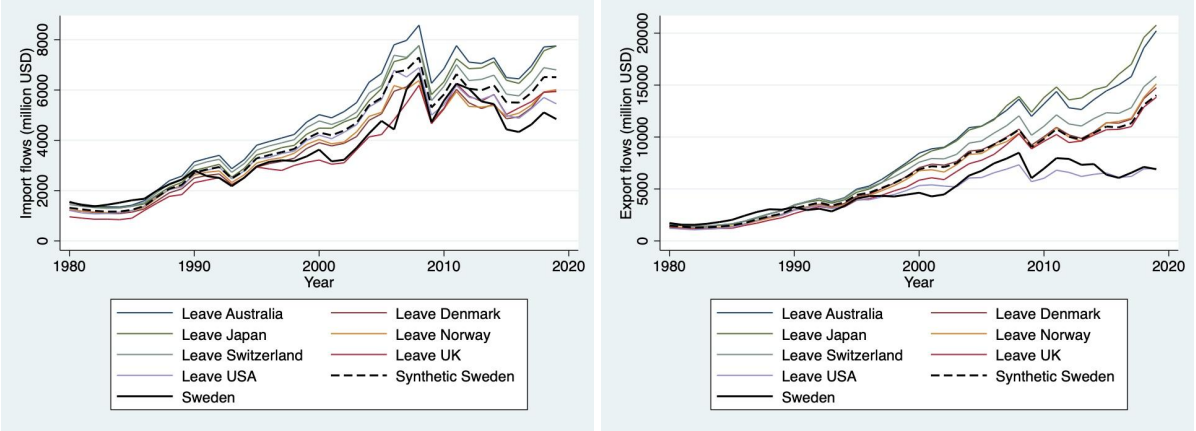

Figure 9. Robustness test results for sample 2.

Notes: The left graph displays average export flows, and the right graph displays average import flows. Each country was iteratively left out of the model.

6. Discussion

In this paper, we investigate the effects of Sweden's choice not to adopt the euro in 1999. Using the synthetic control method, we constructed a synthetic Sweden, i.e. an estimate of a hypothetical Sweden that adopted the euro in 1999. We create a synthetic Sweden for import and export flows in two different samples: exports and imports between Sweden and euro countries, and exports and imports between Sweden and its seven biggest non-euro trading partners. To estimate the effect that the adoption of the euro could have had on Swedish trade, we compare the results of the counterfactual to those of actual Sweden.

Evaluating the effect of Sweden not imposing the euro in 1999, we find that actual Swedish trade flows are lower than they would have been if Sweden had adopted the euro. Hence, not adopting the euro has had a negative effect on Swedish trade. The synthetic results show that aggregate export flows would have increased, both to euro countries (sample 1) and to Sweden's biggest non-euro trading partners (sample 2). Thus, adopting the euro would not have distorted trade away from non-euro countries. Our results are robust with regards to the placebo in-time test and the robustness test. Although the placebo in-space test may question the validity of our results, the high RMSPEs before the treatment date of some of the donor pool countries explain the treatment effects' magnitude. The reader should keep in mind that a larger dataset may have provided different results, as discussed in relation to the placebo in-space test.

We find that Swedish trade increased with almost all trading partners when Sweden adopted the euro. This applies to both euro countries and other big trading partners outside of the euro area. Sweden is a small, relatively open country that would benefit from joining a currency union. As many of Sweden's biggest trading partners already have adopted the euro, our results suggest that trade with many of these countries would be further enhanced if they shared a common currency. This is in line with theory, such as the one by Alesina and Barro (2002) who found that countries that trade more with each other would benefit even more from adopting the same currency.

As of the time of writing, 19 out of the 27 EU countries have adopted the euro. This number will most likely increase in the upcoming years. With the adoption of the euro, European economic integration started to grow increasingly, further enhancing trade between member states. The question is whether it was the adoption of the euro that triggered the increase in

trade, or if increased trade is the result of a long-going, enhanced European economic integration.

Currency unions eliminate transaction costs and remove nominal exchange rate volatility, which further enhances trade among member countries. But no definitive conclusions can be drawn from this, as there are many other aspects that need to be taken into consideration. Furthermore, not all countries will benefit from joining a currency union. Although results suggest that Swedish trade flows, both with euro member states and with other trading partners, would be enhanced through joining the currency union, trade is not the only determinant of the adoption of the euro. Inflation, income, and the loss of control of monetary policy are examples of aspects that need to be taken into consideration in order to provide a complete analysis of the benefits and advantages of joining a currency union.

Avenues For Future Research

Firstly, the reader should bear in mind that this study has tried to examine what effect the euro would have had on Swedish exports if Sweden would have joined the common currency. Future research could examine whether similar conclusions can be drawn for other EU countries that still haven't joined the euro. Secondly, our thesis has focused on aggregated export and import flows. Future research could be directed toward examining a more asymmetrical effect of joining the euro. Meaning which sectors would have benefited from joining the euro. This is since there is a big difference between large companies and small/medium-sized companies. Large companies can have entire departments that handle currency issues and they have to a greater extent financial muscle to hedge. Small and medium-sized enterprises do not have the same conditions. Therefore future research could try to differentiate how the common currency would have affected companies of different sizes. Finally, a similar study can be done examining what the effects would be of adopting the euro in 2003, when Sweden held the referendum.

7. References

Abadie, A., Diamond, A. and Hainmueller, J, 2015. Comparative politics and the synthetic control method, *American Journal of Political Science*, vol. 59, no.2, pp. 495–510

Abadie, A., Diamond, A., Hainmueller, J., 2010. Synthetic Control Methods for Comparative Case Studies: Estimating the Effect of California's Tobacco Control Program. *Journal of the American Statistical Association*, vol.105, no. 490, pp. 493-505

Abadie, A. and Gardeazabal, J., 2003. The Economic Costs of Conflict: A Case Study of the Basque Country. *American Economic Review*, 93 (1), pp. 113–132.

Andersson, J. J. (2019). Carbon Taxes and CO 2 Emissions: Sweden as a Case Study. *American Economic Journal: Economic Policy*, vol.11, no.4, pp.1-30

Alesina, A. and Barro, R. J., 2002. "Currency unions", *The Quarterly Journal of Economics*, May 2002, pp. 409-436.

Alesina, A., Barro R. J., and Tenreyro S., 2002. "Optimal Currency Areas", *Harvard Institute of Economic Research Working Papers,* No 1958 pp. 302–345.

Campos, N. F. and Macchiarelli, C., 2020, The United Kingdom and the Stability of the Euro Area: From Maastricht to Brexit, *The World Economy,* Vol 43, nr. 7, s. 1792–1808.

Campos, Nauro F., Fabrizio Coricelli and Luigi Moretti, 2016. "Sweden and the Euro: The Neglected Role of EU Membership", *European Policy Analysis,* November 2016:15.

Centre d'Etudes Prospectives et d'Informations (CEPII). Gravity Database. Available at: CEPII - Gravity Database Retrieved: [2022-03-25]

De Grauwe, P., 2009. "The Euro at Ten: Achievements and Challenges". *Empirica* 36, 5–20.

Eichengreen, B., 2014, "The Eurozone Crisis: The Theory of Optimum Currency Areas Bites Back", March 2014, University of California, Berkley.

Ekonomifakta, "Export och import över tid". Updated: 2022-03-07. Available at: Export och import över tid - Ekonomifakta Retrieved: [2022-05-24]

Eriksson, J. and Ljungkvist, M., 2021. "Sverige och euron under 25 års EU-medlemskap". *Svenska Institutet för Europapolitiska Studier,* Rapport nr. 1 Maj 2021.

European Commission, “Convergence criteria for joining”. Available at: Convergence criteria for joining | European Commission Retrieved: [2022-04-29]

European Commission, “How the Economic and Monetary Union works”. Available at: How the Economic and Monetary Union works | European Commission Retrieved: [2022-04-28]

Flam, H., 2009, The Impact of the Euro on International Trade and Investment: A Survey of Theoretical and Empirical Evidence, *Svenska Institutet för Europapolitiska Studier,* Rapport nr. 8, 2009.

Frankel, J. A., 2010. “The Estimated Effects of the Euro on Trade: Why Are They Below Historical Effects of Monetary Unions Among Smaller Countries?”. *Europe and the Euro.* University of Chicago Press, pp. 169-212.

Frankel, J. A. and Rose, A. K., 2002. “An Estimate of the Effect of Common Currencies on Trade and Income”. *Quarterly Journal of Economics,* Vol. 117 (2) pp. 437-466.

Gyoerk, E., 2017. “Economic Costs and Benefits of EMU Membership from the Perspective of a Non-member”. *Open Economic Review,* Vol 28, pp. 893–921.

International Monetary Fund, Direction of Trade Statistics Database (DOTS). Available at: Direction of Trade Statistics - IMF Data Retrieved: [2022-03-25]

Johansson, T. and Ljungberg, J., 2010. Euron - frälsarkrans eller kvarnsten i krisens Europa? in L Oxelheim, L Pehrson & T Persson (eds), *EU och den globala krisen. Europaperspektiv 2010.* Santérus förlag, pp. 85-112.

McKinnon, R. (1963), “Optimum Currency Areas”, *American Economic Review*, Vol. 52, pp. 717-725.

Melioris, L. and Žúdel, B., 2016. Five years in a balloon: Estimating the effects of euro adoption in Slovakia using the synthetic control method. *OECD Economics Department Working Papers No. 1317.*

Micco, A., Stein, E., Ordoñez, G., Midelfart, K. H., and Viaene, J-M., 2003. “The Currency Union Effect on Trade: Early Evidence from EMU.” *Economic policy,* Vol.18 No. 37 pp. 315-356. Published by Oxford University Press.

Mundell, R., 1961. “A Theory of Optimum Currency Areas”. *The American Economic Review,* September, Vol. 51, pp. 657- 665.

Polák, P., 2019, The Euro’s Trade Effect: A Meta-Analysis, *Journal of Economic Surveys,* Vol. 33, No. 1, pp. 101–124.

Rose, A. K., 2000. “One money, one market: the effect of common currencies on trade. *Economic Policy 15 (30),* pp. 7-46.

The World Bank, World Development Indicators. Available at: World Development Indicators | DataBank Retrieved: [2022-05-11]

The global economy. Trade openness in Europe Database. Available at: Trade openess in Europe Retrieved: [2022-05-23]

Verstegen, L., van Groezen, B., & Meijdam, L., 2017. Benefits of EMU Participation: Estimates using the Synthetic Control Method, *CentER Discussion Paper;* Vol. 2017-032.

8. Appendix

Table A1. Synthetic control unit weights for each Swe-euro pair exports from Sweden.

Notes: Table A1 reports the list of potential counterfactual units for each Swe-euro member country pair, together with the corresponding average weights obtained using the synthetic algorithm.

	SWE-AUT	SWE-DEU	SWE-ESP	SWE-FIN	SWE-FRA	SWE-IRL	SWE-ITA	SWE-NLD	SWE-PRT
AUT-DEU	.001	0	.02	0	0	0	0	.006	0
AUT-ESP	.002	0	0	0	0	.003	0	.021	0
AUT-FIN	.399	0	0	0	0	.009	0	.026	0
AUT-FRA	.003	.304	0	0	.426	.001	.418	.015	0
AUT-ITA	.001	0	0	0	0	.001	0	.008	0
AUT-NLD	.004	0	0	0	0	.001	0	.015	0
AUT-PRT	.002	0	0	0	0	.007	0	.01	0
DEU-AUT	.001	0	0	0	0	0	0	.005	0
DEU-ESP	.001	0	0	0	0	0	0	.007	0
DEU-FIN	.001	0	0	0	0	.001	0	.01	0
DEU-FRA	0	0	0	.002	0	0	0	.004	0
DEU-ITA	.001	0	0	0	0	0	0	.005	0
DEU-NLD	.001	0	0	.053	0	0	0	.005	0
DEU-PRT	.001	0	0	0	0	.001	0	.01	0
ESP-AUT	.353	0	0	0	0	.012	0	.001	0
ESP-DEU	.001	.335	0	0	.235	0	.107	.008	0
ESP-FIN	.003	0	0	0	0	.141	0	.04	.167
ESP-FRA	.001	0	0	0	0	0	0	.007	0
ESP-ITA	.001	.057	0	0	0	.001	0	.009	0
ESP-NLD	.001	0	0	0	0	.001	0	.011	0
ESP-PRT	.001	0	0	0	0	.001	0	.009	0
FIN-AUT	0	0	0	0	0	.048	0	.016	0
FIN-DEU	.001	0	0	0	0	.001	0	.01	0
FIN-ESP	.101	0	0	0	0	.005	0	.056	0
FIN-FRA	.003	0	0	0	0	.001	0	.016	0
FIN-ITA	.001	0	0	0	0	.003	0	.018	0
FIN-NLD	.002	0	0	0	0	.001	0	.013	0
FIN-PRT	.002	0	0	0	0	.117	0	.007	.622
FRA-AUT	.002	0	.074	0	.075	.001	.161	.012	.045
FRA-DEU	0	0	0	0	0	0	0	.004	0
FRA-ESP	.001	0	0	0	0	0	0	.006	0
FRA-FIN	.002	0	.803	0	.263	.003	.314	.018	.1
FRA-ITA	.001	0	0	0	0	0	0	.005	0
FRA-NLD	.001	.131	0	0	0	0	0	.007	0
FRA-PRT	.002	0	0	0	0	.001	0	.01	0
ITA-AUT	.001	0	0	0	0	.001	0	.01	0
ITA-DEU	.001	0	0	0	0	0	0	.005	0
ITA-ESP	.001	0	0	0	0	.001	0	.008	0
ITA-FIN	.015	0	0	0	0	.002	0	.191	0
ITA-FRA	.001	0	0	0	0	0	0	.005	0
ITA-NLD	.001	0	0	0	0	.001	0	.009	0
ITA-PRT	.002	0	0	0	0	.001	0	.012	0
NLD-AUT	.002	0	0	0	0	.001	0	.011	0
NLD-DEU	0	0	0	0	0	0	0	.004	0
NLD-ESP	.001	0	0	0	0	.001	0	.01	0
NLD-FIN	.002	0	0	0	0	.002	0	.014	0
NLD-FRA	.001	.173	0	0	0	0	0	.006	0
NLD-ITA	.001	0	0	0	0	.001	0	.008	0
NLD-PRT	.002	0	0	0	0	.001	0	.012	0
PRT-AUT	0	0	0	0	0	.028	0	.011	0
PRT-DEU	.002	0	0	0	0	.001	0	.011	0
PRT-ESP	.012	0	0	.814	0	.001	0	.008	0
PRT-FIN	.002	0	.103	0	0	.029	0	.01	.047
PRT-FRA	.002	0	0	0	0	.001	0	.012	0
PRT-ITA	.001	0	0	0	0	.004	0	.034	0
PRT-NLD	.002	0	0	0	0	.002	0	.013	0
IRL-AUT	.002	0	0	0	0	.004	0	.007	0
IRL-DEU	.002	0	0	0	0	.001	0	.009	0
IRL-ESP	.002	0	0	0	0	.002	0	.014	0
IRL-FIN	.001	0	0	0	0	0	0	.006	0
IRL-FRA	.002	0	0	0	0	.001	0	.011	0
IRL-ITA	.002	0	0	0	0	.002	0	.014	0
IRL-NLD	.002	0	0	0	0	.001	0	.01	0
IRL-PRT	0	0	0	.131	0	.006	0	.004	0
AUT-IRL	.019	0	0	0	0	.358	0	.007	0
DEU-IRL	.003	0	0	0	0	.001	0	.012	0
ESP-IRL	.001	0	0	0	0	.007	0	.014	0
FIN-IRL	.001	0	0	0	0	0	0	.007	0
FRA-IRL	.005	0	0	0	0	.002	0	.015	0
ITA-IRL	.002	0	0	0	0	.004	0	.02	.013
NLD-IRL	.004	0	0	0	0	.001	0	.012	0
PRT-IRL	.002	0	0	0	0	.172	0	.004	.002

Table A2. Synthetic control unit weights for each Swe-Euro pair imports to Sweden.

Notes: Table A2 reports the list of potential counterfactual units for each swe-euro country pair, together with the corresponding average weights obtained using the synthetic algorithm.

	AUT-SWE	DEU-SWE	ESP-SWE	FIN-SWE	FRA-SWE	IRL-SWE	ITA-SWE	NLD-SWE	PRT-SWE
AUT-DEU	0	.003	0	0	0	0	0	.005	0
AUT-ESP	0	.002	0	0	0	.003	0	.013	0
AUT-FIN	.453	.002	0	0	0	.048	0	.067	0
AUT-FRA	0	.254	0	0	.488	.002	.611	.013	0
AUT-ITA	0	.002	0	0	0	.001	0	.006	0
AUT-NLD	0	.002	0	0	0	.002	0	.016	0
AUT-PRT	0	.002	0	0	0	.007	0	.005	0
DEU-AUT	0	.005	0	0	0	0	0	.004	0
DEU-ESP	0	.38	0	0	0	.001	0	.005	0
DEU-FIN	0	.002	0	0	0	.001	0	.007	0
DEU-FRA	0	.024	0	.007	0	0	0	.003	0
DEU-ITA	0	0	0	0	0	0	0	.004	0
DEU-NLD	0	.006	0	0	0	0	0	.004	0
DEU-PRT	0	.002	0	0	0	.001	0	.007	0
ESP-AUT	0	.001	.487	0	0	.076	0	.098	0
ESP-DEU	0	.119	0	0	.166	.001	.031	.006	0
ESP-FIN	0	.001	.086	0	0	.133	0	.073	.015
ESP-FRA	0	.009	0	0	0	.001	0	.005	0
ESP-ITA	0	.001	0	0	0	.001	0	.008	0
ESP-NLD	0	.002	0	0	0	.001	0	.007	0
ESP-PRT	0	.003	0	0	0	.001	0	.008	0
FIN-AUT	0	.002	0	0	0	.007	0	.007	0
FIN-DEU	0	.002	0	0	0	.001	0	.008	0
FIN-ESP	0	.002	0	0	0	.02	0	.034	0
FIN-FRA	.095	.001	0	0	0	.001	0	.022	.042
FIN-ITA	0	.001	0	0	0	.003	0	.006	.124
FIN-NLD	0	.002	0	0	0	.002	0	.01	0
FIN-PRT	0	.002	0	0	0	.001	0	.003	0
FRA-AUT	0	.001	0	0	.126	.001	.151	.007	.09
FRA-DEU	0	.001	0	0	0	0	0	.003	0
FRA-ESP	0	.004	0	0	0	.001	0	.005	0
FRA-FIN	0	.001	.427	0	.22	.002	.207	.003	0
FRA-ITA	0	.007	0	0	0	0	0	.004	0
FRA-NLD	0	.031	0	0	0	.001	0	.006	0
FRA-PRT	0	.002	0	0	0	.001	0	.008	0
ITA-AUT	0	.003	0	0	0	.001	0	.008	0
ITA-DEU	0	.008	0	0	0	0	0	.004	0
ITA-ESP	0	.003	0	0	0	.001	0	.006	0
ITA-FIN	.318	0	0	0	0	.002	0	.237	0
ITA-FRA	0	.004	0	0	0	0	0	.004	0
ITA-NLD	0	.001	0	0	0	.001	0	.007	0
ITA-PRT	0	.002	0	0	0	.001	0	.009	0
NLD-AUT	0	.002	0	0	0	.001	0	.01	0
NLD-DEU	0	.007	0	.038	0	0	0	.003	0
NLD-ESP	0	.002	0	0	0	.001	0	.008	0
NLD-FIN	0	.002	0	0	0	.002	0	.01	0
NLD-FRA	.001	.039	0	0	0	0	0	.005	0
NLD-ITA	0	.004	0	0	0	.001	0	.006	0
NLD-PRT	0	.002	0	0	0	.002	0	.009	0
PRT-AUT	0	.002	0	0	0	.036	0	.005	0
PRT-DEU	0	.002	0	0	0	.001	0	.01	0
PRT-ESP	0	.002	0	.813	0	.001	0	.007	0
PRT-FIN	0	.002	0	0	0	.246	0	.004	.729
PRT-FRA	0	.002	0	0	0	.001	0	.009	0
PRT-ITA	0	.001	0	0	0	.004	0	.017	0
PRT-NLD	0	.002	0	0	0	.002	0	.008	0
IRL-AUT	0	.002	0	0	0	0	0	.004	0
IRL-DEU	0	.003	0	0	0	.001	0	.008	0
IRL-ESP	0	.002	0	0	0	.003	0	.01	0
IRL-FIN	0	.002	0	0	0	.003	0	.003	0
IRL-FRA	0	.002	0	0	0	.001	0	.01	0
IRL-ITA	0	.002	0	0	0	.002	0	.009	0
IRL-NLD	0	.002	0	0	0	.001	0	.01	0
IRL-PRT	0	.002	0	.142	0	.215	0	.002	0
AUT-IRL	0	.002	0	0	0	.036	0	.003	0
DEU-IRL	0	.002	0	0	0	.001	0	.011	0
ESP-IRL	0	.002	0	0	0	.005	0	.008	0
FIN-IRL	0	.002	0	0	0	.001	0	.003	0
FRA-IRL	0	.002	0	0	0	.002	0	.016	0
ITA-IRL	0	.002	0	0	0	.003	0	.012	0
NLD-IRL	.133	.002	0	0	0	.002	0	.015	0
PRT-IRL	0	.002	0	0	0	.1	0	.001	0

Table A3. Synthetic control unit weights for each swe-non euro pair imports to Sweden.

Notes: Table A3 reports the list of potential counterfactual units for each swe-non euro country pair, together with the corresponding average weights obtained using the synthetic algorithm.

	SWE-USA	SWE-NOR	SWE-DNK	SWE-GBR	SWE-JPN	SWE-CHE	SWE-AUS
AUS-AUT	0	0	0,002	0	0	0,005	0
AUS-FIN	0	0	0,002	0	0	0,001	0
AUS-FRA	0	0	0,002	0	0	0,002	0
AUS-DEU	0	0	0,002	0	0	0,003	0
AUS-ITA	0	0	0,002	0	0	0,002	0
AUS-NLD	0	0	0,002	0	0	0,001	0
AUS-PRT	0	0	0,002	0	0	0	0
AUS-ESP	0	0	0,002	0	0	0,001	0
DNK-AUT	0	0	0,003	0	0	0,002	0
DEU-IRL	0	0	0,003	0	0	0,002	0
ESP-IRL	0	0	0,003	0	0	0,002	0
FIN-IRL	0	0	0,004	0	0	0,002	0
FRA-IRL	0	0	0,003	0	0	0,002	0
ITA-IRL	0	0	0,003	0	0	0,002	0
NLD-IRL	0	0	0,003	0	0	0,001	0
PRT-IRL	0	0	0,004	0	0	0,001	0
IRL-DNK	0	0,247	0,016	0	0	0,009	0
CHE-AUT	0	0	0,002	0	0	0,001	0
IRL-NOR	0	0	0,345	0	0	0,027	0,07
CHE-FIN	0	0	0,003	0	0	0,101	0
IRL-JPN	0,479	0,093	0,007	0,467	0,642	0,397	0,706
CHE-FRA	0	0	0,002	0	0	0,001	0
CHE-DEU	0	0	0,004	0	0	0,001	0
IRL-CHE	0	0	0,011	0	0	0,006	0
CHE-ITA	0	0	0,002	0	0	0,001	0
IRL-GBR	0	0,407	0,026	0	0	0,001	0
CHE-NLD	0	0	0,002	0	0	0,002	0
IRL-USA	0,289	0	0,002	0,149	0,28	0,003	0
CHE-PRT	0	0	0,003	0	0	0,002	0
CHE-ESP	0	0	0,002	0	0	0,003	0
IRL-AUS	0	0	0,288	0,099	0	0,312	0,213
DNK-IRL	0	0	0,003	0	0	0,001	0
NOR-FRA	0	0	0,002	0	0	0,004	0
NOR-IRL	0	0	0,003	0	0	0,001	0
NOR-DEU	0	0	0,003	0,074	0	0,013	0
JPN-IRL	0	0	0,002	0	0	0,001	0
NOR-ITA	0	0	0,002	0	0	0,002	0
NOR-NLD	0	0	0,003	0	0	0,002	0
CHE-IRL	0	0	0,003	0	0	0,002	0
NOR-PRT	0	0	0,003	0	0	0,001	0
GBR-IRL	0	0	0,003	0	0	0,001	0
NOR-ESP	0	0	0,002	0	0	0,002	0
USA-IRL	0	0	0,002	0	0	0,001	0
AUS-IRL	0	0	0,002	0	0	0,007	0
JPN-FRA	0	0	0,002	0	0	0,002	0
JPN-DEU	0	0	0,004	0	0	0,003	0
JPN-ITA	0	0	0,002	0	0,043	0,002	0
JPN-NLD	0	0	0,002	0	0	0,002	0
JPN-PRT	0	0	0,002	0	0	0,001	0
JPN-ESP	0	0	0,002	0	0	0,001	0
NOR-AUT	0	0	0,003	0	0	0,002	0
NOR-FIN	0	0,135	0,003	0	0	0,001	0
GBR-FIN	0	0	0,002	0	0	0,002	0
GBR-FRA	0	0	0,006	0	0	0,003	0
GBR-DEU	0	0	0,127	0,211	0	0,009	0,011
GBR-ITA	0	0	0,003	0	0	0,002	0
GBR-NLD	0	0	0,005	0	0	0,002	0
GBR-PRT	0	0	0,002	0	0	0,001	0
GBR-ESP	0	0	0,003	0	0	0,002	0
USA-AUT	0	0	0,002	0	0,036	0,002	0
USA-FIN	0	0	0,002	0	0	0,002	0
USA-FRA	0	0	0,003	0	0	0,003	0
USA-DEU	0,232	0	0,005	0	0	0,003	0
USA-ITA	0	0	0,002	0	0	0,002	0
USA-NLD	0	0	0,004	0	0	0,002	0
USA-PRT	0	0	0,002	0	0	0,001	0
USA-ESP	0	0	0,002	0	0	0,001	0
DNK-FIN	0	0	0,003	0	0	0,001	0
DNK-FRA	0	0	0,002	0	0	0,003	0
DNK-DEU	0	0,118	0,003	0	0	0,001	0
DNK-ITA	0	0	0,002	0	0	0,002	0
DNK-NLD	0	0	0,002	0	0	0,001	0
DNK-PRT	0	0	0,003	0	0	0,001	0
DNK-ESP	0	0	0,002	0	0	0,002	0
JPN-AUT	0	0	0,002	0	0	0,002	0
JPN-FIN	0	0	0,002	0	0	0,001	0
GBR-AUT	0	0	0,002	0	0	0,003	0

Table A4. Synthetic control unit weights for each swe-non euro pair exports from Sweden.

Notes: Table A4 reports the list of potential counterfactual units for each swe-non euro country pair, together with the corresponding average weights obtained using the synthetic algorithm.

	USA-SWE	NOR-SWE	DNK-SWE	GBR-SWE	JPN-SWE	CHE-SWE	AUS-SWE
AUS-AUT	0	0	0	0,007	0	0,001	0,201
AUS-FIN	0	0	0	0,009	0	0	0
AUS-FRA	0,001	0	0	0,007	0	0	0
AUS-DEU	0	0	0	0,01	0	0	0
AUS-ITA	0,001	0	0	0,009	0	0,001	0
AUS-NLD	0,001	0	0	0,006	0	0	0
AUS-PRT	0	0	0	0,007	0	0	0,086
AUS-ESP	0,001	0	0	0,007	0	0	0,497
DNK-AUT	0	0	0	0,011	0	0,001	0
DEU-IRL	0,001	0	0	0,007	0	0,001	0
ESP-IRL	0,001	0	0	0,006	0	0	0
FIN-IRL	0,001	0	0	0,006	0	0	0
FRA-IRL	0,001	0	0	0,007	0	0,001	0
ITA-IRL	0,001	0	0	0,006	0	0	0
NLD-IRL	0,001	0	0	0,007	0	0	0
PRT-IRL	0,001	0	0	0,006	0	0	0
IRL-DNK	0,001	0	0	0,003	0	0	0
CHE-AUT	0,002	0	0	0,006	0	0,001	0
IRL-NOR	0,001	0	0	0,003	0	0	0
CHE-FIN	0	0	0	0,009	0	0,515	0
IRL-JPN	0,009	0	0	0,003	0	0	0
CHE-FRA	0,003	0	0	0,008	0	0,001	0
CHE-DEU	0,002	0	0	0,011	0	0,001	0
IRL-CHE	0,001	0	0	0,003	0	0	0
CHE-ITA	0,004	0	0	0,008	0	0,001	0
IRL-GBR	0,005	0	0	0,005	0	0	0
CHE-NLD	0,001	0	0	0,013	0	0,001	0
IRL-USA	0,002	0	0	0,003	0	0	0
CHE-PRT	0,001	0	0	0,011	0	0,001	0
CHE-ESP	0,001	0	0	0,021	0	0,174	0
IRL-AUS	0,001	0	0	0,002	0	0	0
DNK-IRL	0,001	0	0	0,007	0	0	0
NOR-FRA	0,001	0	0	0,014	0	0,003	0
NOR-IRL	0	0	0	0,008	0	0	0
NOR-DEU	0,001	0	0	0,015	0	0,002	0
JPN-IRL	0,002	0	0	0,007	0	0,001	0
NOR-ITA	0,001	0	0	0,015	0	0,185	0
NOR-NLD	0,001	0	0	0,01	0	0,001	0
CHE-IRL	0	0	0	0,009	0	0	0
NOR-PRT	0	0	0	0,008	0	0	0
GBR-IRL	0,003	0,196	0,085	0,008	0	0,001	0
NOR-ESP	0,001	0	0	0,009	0	0,001	0
USA-IRL	0,002	0	0,023	0,024	0	0,002	0
AUS-IRL	0	0	0,046	0,015	0,004	0	0,215
JPN-FRA	0,004	0	0	0,01	0	0,001	0
JPN-DEU	0,002	0	0	0,017	0	0,001	0
JPN-ITA	0,651	0	0	0,013	0	0,002	0
JPN-NLD	0,003	0	0	0,009	0	0,001	0
JPN-PRT	0,001	0	0	0,008	0,279	0,001	0
JPN-ESP	0	0	0	0,009	0	0,001	0
NOR-AUT	0	0	0	0,01	0	0,022	0
NOR-FIN	0,002	0,673	0	0,004	0	0	0
GBR-FIN	0,001	0	0	0,01	0	0,001	0
GBR-FRA	0,002	0	0,137	0,022	0	0,001	0
GBR-DEU	0,002	0	0	0,067	0	0,001	0
GBR-ITA	0,002	0	0	0,013	0	0,001	0
GBR-NLD	0,002	0	0	0,015	0	0,001	0
GBR-PRT	0,001	0	0	0,008	0	0,001	0
GBR-ESP	0,002	0	0	0,011	0	0,001	0
USA-AUT	0,01	0	0	0,008	0	0	0
USA-FIN	0,003	0	0	0,01	0,519	0,001	0
USA-FRA	0,003	0	0	0,013	0	0,001	0
USA-DEU	0,003	0	0	0,018	0	0,001	0
USA-ITA	0,005	0	0	0,012	0	0,001	0
USA-NLD	0,003	0	0	0,011	0	0,001	0
USA-PRT	0,203	0,003	0	0,009	0	0,001	0
USA-ESP	0,002	0	0	0,136	0,198	0,029	0
DNK-FIN	0,001	0	0,709	0,093	0	0,022	0
DNK-FRA	0,001	0	0	0,011	0	0,002	0
DNK-DEU	0,027	0,128	0	0,007	0	0	0
DNK-ITA	0,001	0	0	0,011	0	0,002	0
DNK-NLD	0,001	0	0	0,009	0	0,001	0
DNK-PRT	0,001	0	0	0,006	0	0	0
DNK-ESP	0,001	0	0	0,007	0	0,001	0
JPN-AUT	0,001	0	0	0,009	0	0,001	0
JPN-FIN	0,001	0	0	0,015	0	0,003	0
GBR-AUT	0,001	0	0	0,009	0	0,001	0

Figure A1. In-time placebo results for exports from Sweden to nine euro member countries. Sample 1.

Notes: The placebo treatment date is 1992. Dashed lines: synthetic exports from Sweden. Solid lines: actual exports from Sweden.

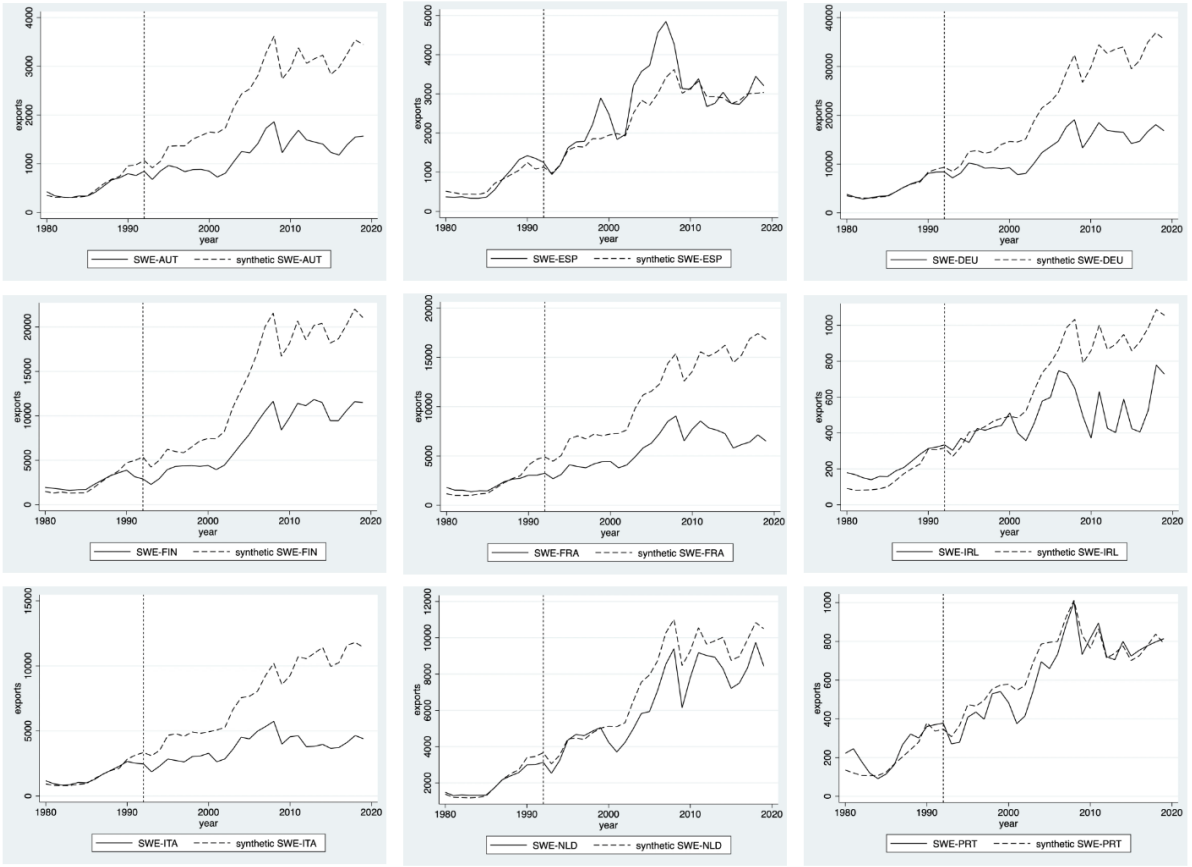

Figure A2. In-time placebo results for imports to Sweden to nine euro countries. Sample 1.

Notes: The placebo treatment date is 1992. Dashed lines: synthetic imports to Sweden. Solid lines: actual imports to Sweden.

Figure A3. In-time placebo results for exports from Sweden to its seven biggest trading partners. Sample 2.

Notes: The placebo treatment date is 1992. Dashed lines: synthetic exports from Sweden. Solid lines: actual exports from Sweden.

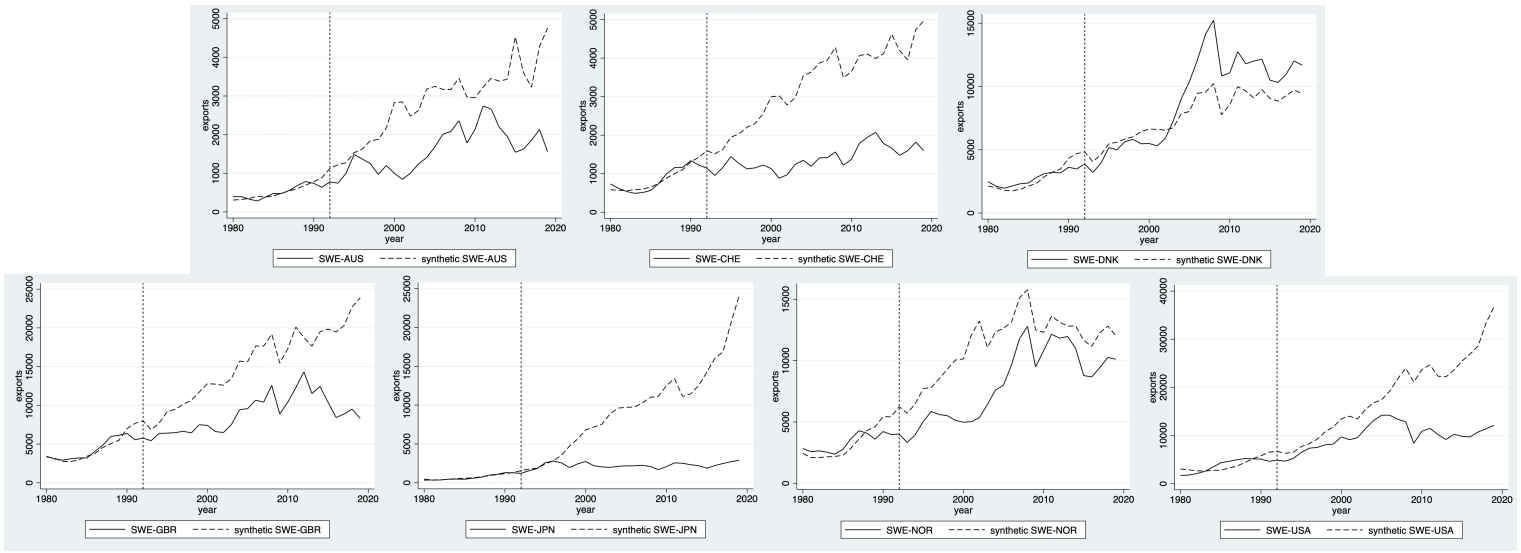

Figure A4. In-time placebo results for imports to Sweden from its seven biggest trading partners. Sample 2.

Notes: The placebo treatment date is 1992. Dashed lines: synthetic imports to Sweden. Solid lines: actual imports to Sweden.