No Pay, No Debt: Domestic Costs of Sovereign Defaults

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Abstract

This paper investigates the domestic economic consequences of sovereign defaults by analyzing their impact on key macroeconomic variables, including GDP per capita, consumption, government expenditure, investment, exports, imports, unemployment, and inflation. Using the Synthetic Control Method (SCM), the study constructs counterfactual scenarios for defaulting countries to estimate the effect of defaults on economic outcomes. The results indicate that sovereign defaults generally have persistent negative effects, especially on GDP per capita, investment, and trade, with the adverse impacts often starting before the default due to anticipation effects. However, some countries experienced effects that challenge standard intuition. Results for unemployment are mixed and effects on inflation are inconclusive. These findings highlight complex and heterogeneous dynamics around sovereign defaults. While SCM is valuable, anticipation effects and data limitations motivate further methodological refinements and country–specific analyses.

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1 Introduction

In recent years, governments and political leaders have elevated public expenditure levels in an effort to mitigate the costs associated with economic recessions. In turn, the amount of public debt has suffered a high increase during these years, turning it into a new wave of debt accumulation (Kose, 2021). According to Kose, this wave is characterised by a deep increase of global and government debts, which in 2019 reached 233% and 84% of GPD, respectively. This phenomenon has been tremendously accelerated since the Covid-19 pandemic. In fact, during these chaotic period, global government debt increased to 99% of GDP in 2020, reaching one of the highest levels in 50 years (Kose, 2021). Despite a decrease in global public debt levels in 2021 and 2022, they still remain elevated when compared to the pre-pandemic years.

Previous debt waves ended with financial crisis. However, this time the risks of high debt levels are even more dangerous because of the consequences of the economic policies taken during the pandemic, which may have had a negative effect on the fiscal, monetary and financial structure of the countries (Kose, 2021). Then, given that an elevated level of public debt and a financial crisis can culminate in sovereign defaults, it is once again crucial in policy-making discussions to understand the associated costs with these events.

The main objective of this thesis is to evaluate the effects of sovereign defaults on the domestic economy. Specifically, we are going to analyse the impact of defaulting on the following variables: consumption and government expenditure, investment, exports and imports. That is to say, our variables of interests are the main components of the GDP. In addition, we will assess the effects on inflation and unemployment rates, as these variables are closely linked to the real economy.

To assess the effects of defaulting, we employ the Synthetic Control Method (SCM) as introduced by Abadie et al. (2003, 2010). Initially, we construct a synthetic control for each defaulting country in our dataset. It allows us to evaluate the impact of sovereign defaults on each variable of interest for each country. Subsequently, we utilise an aggregation method to move from individual effects to average effects, enabling us to draw general conclusions.

It is important to mention that these topics have been extensively studied both theoretically and empirically. Thus, we find ourselves within a well-explored literature, indicating its relevance in understanding the challenges governments face when formulating policies and making decisions.

Unlike previous works, this thesis project considers defaults as a government policy decision.

The study's findings indicate that sovereign defaults typically have prolonged negative consequences for the domestic economy. Specifically, defaults were found to reduce GDP per capita, consumption, government expenditure, investment, and trade (both exports and imports). These declines often began before the default event, likely due to anticipation or preceding negative economic shocks. While these effects were consistent in most cases, certain anomalies were observed. In some countries, the outcomes contradicted general economic expectations. Unemployment showed mixed results, while the impact on inflation remained inconclusive.

Since the rise of the causal inference approach in economic literature, efforts to estimate the causal effects of sovereign defaults on output have been made, particularly by Kuvshinov and Zimmermann (2019). They applied an inverse propensity score weighting technique, concluding that defaults have a negative, albeit temporary, effect on output. Other attempts to estimate causal effects within the literature have increasingly utilized the SCM, a relatively new approach in this field. Recent studies by Marchesi and Masi (2020) and Reinhart et al. (2024) employ SCM to analyze the impact of sovereign defaults on GDP and various development indicators related to poverty and living standards, respectively. To the best of my knowledge, these papers, along with Jorra (2011), are among the first to apply SCM in evaluating the consequences of sovereign defaults.

This thesis not only contributes to the extensive body of research on sovereign defaults but also adds to the emerging literature that employs the Synthetic Control Method (SCM) to examine the costs of such events. While building on this line of research, as will be discussed, achieving unbiased results remains challenging due to persistent endogeneity issues. With these limitations in mind, this thesis seeks to deepen our understanding of how sovereign defaults affect domestic economic variables that have not yet been examined using the SCM. On the empirical side, it introduces an improved aggregation method, expanding on the approach used by Reinhart et al. (2024). Lastly, this work highlights critical limitations of the SCM, issuing a caution to recent studies in macroeconomics that rely on this methodology, as these weaknesses must be carefully considered in future studies.

The rest of this work is organised as follows. Section 2 provides a brief literature review analysing

the most significant works in the literature of sovereign defaults. Section 3 describes the data used in this thesis project. Section 4 presents the SCM and explain the theory behind this empirical methodology. Section 5 and 6 show the main results, together with some robustness checks. Finally, Section 7 concludes and suggests new avenues of research.

2 Literature Review

Literature on the costs of defaults began to emerge triggered by the fact that governments could access to credit markets, borrow money and had incentives to repay their debts even when legal enforcement for countries to repay was limited and weak. In this context, economists delved into the study of the costs of sovereign defaults, as they seemed to be the main responsible for shaping the incentives for countries to honour their obligations (Panizza et al., 2009).

Classic papers about the effects of sovereign defaults argue that the main channels through which defaults may result costly are financial market exclusion, reputation effects and trade sanctions. Eaton and Gersovitz (1981) construct a theoretical framework to argue that, in general, governments are not one-time borrowers, and if they fail to repay their debts, markets exclude them, preventing access to credit during bad times. This may shift the incentives for governments to repay their debts during good economic periods, creating a good reputation as a borrower. In opposition to this idea, Bulow and Rogoff (1989) argue that it is possible for small countries to access to credit markets even if they cannot guarantee a good reputation. It is possible only if creditors can impose on countries sanctions to punish them, such as preventing international trade or limiting the use of their financial assets. That is, creditors have legal means to impose sanctions on countries that do not repay their debts. More recently, Sandleris (2008) developed a model in which repayment is maintained in equilibrium because investors perceive it as a signal of the robust fundamentals of the economy, and this creates incentives to invest and extend credit within the domestic economy. Then, as governments wants to attract foreign investments and facilitate the access to credit markets, they have incentives to repay their debts. Under these circumstances, credit can emerge without the need for potential sanctions.

Then, using different econometrics techniques, literature started to focus on the impact of defaulting on output levels. In general, it was found that sovereign defaults have a negative effect on output. Sturzenegger (2004, as cited in Marchesi and Masi, 2021) expose that defaulting has

a negative but not persistent effect on GDP growth. These results are supported by Borensztein and Panizza (2009), who find that, on average, defaulting reduces annual GDP growth by 1.2 percentage points. Additionally, defaulting has a negative impact on reputation, international trade, politicians' expected time in office and may induce banking crisis. These costs seem to be short-lived. In the same line, Esteves et al. (2021) found that the drop in output ranges between 1.6% and 3.3%, reverting to the previous-default trend after five years. De Paoli et al. (2009) also estimate that sovereign defaults are associated with an annual drop in economic output of around 5%. In opposition to Borensztein and Panizza, they demonstrate that this decrease in GDP is long-lived, persisting for approximately 10 years following the default. By employing higher frequency data than previous studies (quarterly data on GDP growth), Levi-Yeyati and Panizza (2011) demonstrate that the quarter in which a default occurs marks the beginning of the recovery in output growth. Additionally, they argue that the negative effects associated with defaulting may be attributable to the anticipation of the default.

Other authors not only estimated a negative effect of sovereign defaults on the level of output but also explored the impact of defaulting on other relevant variables. Medas et al. (2018) observe that, during a financial crisis, economic growth begins to decline, and this decline appears to be persistent. Additionally, in the periods leading up to the crisis, fiscal policy is more lenient, whereas during the crisis, it tightens. Public debt also tends to increase during financial crises. Rewilak (2018) estimates that banking crisis harm the income of the poor by 10.6%, currency crisis by 14.9% and debt crisis only have significant effects on the richest countries. Kuvshinov and Zimmermann (2019) show that the negative and persistent decline on output is characterised by other falls in the level of investment and gross trade. Arellano et al. (2018) argue that default risk prolongs recessions, as negative shocks increase the likelihood of defaulting. This, in turn, reduces capital inflows and leads to a decline in investment levels.

Also, different authors have explored additional types of effects associated with defaults and the mechanisms through which they can interact with the real economy. These include effects on investor losses, access to foreign credit, foreign direct investment (FDI) flows and trade. Sturzenegger and Zettelmeyer (2008) explore how defaults impact investor losses. Their estimations reveal that, during the restructuring of sovereign debts, average net present value losses exhibit significant heterogeneity across defaulting countries, with values ranging between 13%

and 73%. Arteta and Hale (2008) find that debt crises have a negative and significant impact on foreign credit to private domestic firms. The magnitude of this effect varies across the exporting and non-exporting sectors, as well as across the types of debt restructuring agreements. In the same line, Sandleris (2014) finds that sovereign defaults negatively affect the domestic private sector's access to both foreign and domestic credit. Fuentes and Saravia (2010) conduct an empirical analysis to assess the hypothesis suggesting that countries experiencing defaults observe a decrease in their FDI flows. Their findings indicate that this reduction in FDI flows is more pronounced for those flows originating from the creditor countries of defaulters, especially for countries that have defaulted more times. Martinez and Sandleris (2011) examine the hypothesis suggesting that declines in trade associated with defaults are a result of trade sanctions. Through empirical analysis, they find evidence that contradicts this trade sanctions argument. Zymek (2012) argues that the drop in trade associated with sovereign defaults may be mainly driven by difficulties for exporters to access foreign credit markets.

As mentioned, a new set of literature started to use the SCM to explore the effects and costs of sovereign defaults. The first approach was conducted by Jorra (2011), who used SCM to identify a negative effect of defaulting on GDP. He studied only a reduced sample of defaulting countries (Pakistan, Ecuador, Argentina, Uruguay, and the Dominican Republic) and evaluated two channels through which defaults can affect the level of product: exports and FDI inflows. Overall, the impact on foreign trade (represented by exports) is small and there is no statistically significant effect on FDI inflows. Then, Marchesi and Masi (2020) evaluate the impact of sovereign defaults on GDP constructing a synthetic control. They distinguish between defaulting on private creditors and public creditors (the latter includes only defaults to the Paris Club). Their findings reveal that defaulting on private creditors indeed has a negative and enduring impact on GDP, whereas defaults on public creditors do not exhibit such a negative and lasting effect on GDP. This difference can primarily be attributed to the fact that public defaults often involve a greater degree of consensus with the Paris Club, while private defaults may occur in a more confrontational environment. Reinhart et al. (2024), in their working paper for World Bank, employ a SCM to study the impacts of sovereign defaults as well, but this time the variables of interest are related to social outcomes. Authors find that defaulting has a negative impact on the level of product in a the economy. Beyond GDP per capita, they find that sovereign defaults

have a lasting negative impact on poverty headcounts, standards of living (measured by proxy variables such as access to nutrition, energy and health outcomes) and life expectancy.

We can observe that the literature on sovereign defaults and debt crises has been extensively explored, not only examining the impact of defaults on output but also studying the effect on other variables and mechanisms that could affect the domestic economy. Moreover, the methods employed vary, ranging from theoretical frameworks to diverse econometric techniques. Thus, this work contributes to this literature by both exploring the mechanisms through which defaults can impact the domestic economy and utilising the SCM, a technique that has recently started to be employed in this literature.

3 Data

To assess the impact of sovereign defaults on the domestic economy, data on GDP per capita, investment, government expenditure, consumption expenditure, exports, imports, unemployment, and inflation is necessary. This data is sourced from the World Bank database, covering 266 countries. Additionally, information about "sovereign foreign currency selective defaults" between 1999 and 2021 is obtained from the *2021 Annual Global Sovereign Default And Rating Transition Study* by S&P Global. This study encompasses 25 countries, some of which have experienced multiple defaults. In this study, we understand a sovereign foreign currency default as the failure of a government to meet its external debt obligations by the specified due date.

We use GDP per capita in constant U.S. dollars to measure economic output, with government expenditure represented by general government final consumption expenditure. Final consumption expenditure is used to capture consumption, and investment levels are measured using gross fixed capital formation. Additionally, we include data on exports and imports. All these variables are calculated in constant 2015 prices and expressed in U.S. dollars. According to the World Bank, the dollar figures for each variable are converted from domestic currencies using the official 2015 exchange rates. Unemployment is measured as a percentage of the total labor force, and inflation is determined by the annual percentage change in consumer prices.

It is important to mention that we have included only 17 out of the 25 available sovereign defaults due to various reasons. In certain instances, the default had a duration that was

too short, making it impractical to analyse the effect of that particular type of default. In other cases, data on the variables of interest was not available. Additionally, for countries with multiple defaults, we consider only their first default in the database.[1] So, the sovereign defaults included are the following: Argentina (2001), Belize (2008), Cyprus (2013), Dominican Republic (2005), Ecuador (2008), Greece (2012), Indonesia (2000), Jamaica (2010), Mali (2012), Mozambique (2017), Pakistan (1999), Paraguay (2003), Russian Federation (1999), El Salvador (2017), Seychelles (2008), Ukraine (2015), Uruguay (2003).

To construct the synthetic control for each variable and country, it is crucial to choose appropriate predictors for each variable of interest. The selected covariates should encompass the best variables predicting the outcome of our variable of interest in the period post-treatment, where the treatment is the sovereign default. The next Table 1 includes the covariates used for the synthetic controls of each variable of interest.

Data measured in percentage of GDP, population and broad money were also extracted from the World Bank database. Terms of trade data is sourced from the IMF's commodity terms of trade database.

To ensure consistency across all cases and account for data limitations in certain countries, the analysis focuses on the 15 years preceding the default for each specific country. With annual data, this approach yields 15 distinct observations for each variable of interest and its covariates in the period leading up to the treatment, forming the foundation for constructing the synthetic control for each country. However, in instances where a country lacks data for the full 15-year pre-default period, the pre-treatment window is adjusted accordingly.

It's also important to note that the construction of synthetic controls requires balanced panel data. Therefore, to construct the synthetic control of each defaulting country, we limit the donor pool to only those countries with no missing value for both the outcome variable and the predictors in the period before and after the treatment. So, due to data limitations, which vary depending on the defaulting year occurring at different times for each country, the donor pool for each defaulter is comprised of different countries. Additionally, following Reinhart et al. (2024), to ensure that countries affected by similar external shocks are included, the donor

[1] Except for the case of Indonesia, for which we consider the 2000 default instead of 1999 because this was only a 1-day default.

Variable of interest	Predictors
GDP per capita (constant dollars)	Pre-treatment average GDP per capita, consumption (% GDP), government expenditure (% GDP), investment (% GDP), exports (% GDP), imports (% GDP), population and terms of trade.
Consumption (constant dollars)	Pre-treatment average consumption expenditure, GDP per capita (constant dollars), government expenditure (% GDP), investment (% GDP), exports (% GDP), imports (% GDP), population and terms of trade.
Government Expenditure (constant dollars)	Pre-treatment average government expenditure, GDP per capita (constant dollars), consumption expenditure (% GDP), investment (% GDP), exports (% GDP), imports (% GDP), population and terms of trade.
Investment (constant dollars)	Pre-treatment average investment, GDP per capita (constant dollars), government expenditure (% GDP), consumption expenditure (% GDP), exports (% GDP), imports (% GDP), population and terms of trade.
Exports (constant dollars)	Pre-treatment average exports, GDP per capita (constant dollars), government expenditure (% GDP), consumption expenditure (% GDP), investment (% GDP), imports (% GDP), population and terms of trade.
Imports (constant dollars)	Pre-treatment average imports, GDP per capita (constant dollars), government expenditure (% GDP), consumption expenditure (% GDP), investment (% GDP), exports (% GDP), population and terms of trade.
Unemployment	Pre-treatment average unemployment, GDP per capita (constant dollars), investment (% GDP), consumption (% GDP), government expenditure (% GDP), exports (% GDP), imports (% GDP), and population.
Inflation	Pre-treatment average inflation rate, GDP per capita, investment (% GDP), consumption (% GDP), government expenditure (% GDP), exports (% GDP), imports (% GDP), population and broad money.

Table 1: Variables of interest and their predictors

pool for each defaulting country is restricted to those within the same continent.[2] Finally, all defaulting countries are excluded from the donor pool in every case, as they are part of the treatment group. Table 2 lists the potential donors for each defaulting country. It is important to note that, for some outcomes of interest, certain potential donors are excluded due to data limitations, and in some cases, the synthetic control algorithm assigns them a weight of zero.

In some cases, data on the variable of interest or its predictors were unavailable for the defaulting

[2]We categorize the countries into four groups based on their geographic location: Europe, the Americas (including North, Central, and South America), Asia and Oceania, and Africa. We classify the countries this way to avoid losing too many potential donors for the defaulting countries.

countries. For example, investment data for Russia is missing, making it impossible to construct a synthetic control for that country. This issue arises in several instances, leading to a situation where synthetic controls could be constructed for some variables in certain countries, but not for others. As a result, the availability of synthetic controls varies by variable and country.

4 Empirical Strategy: Synthetic Control Method (SCM)

4.1 Why employ the SCM?

In order to evaluate the impact of a policy, we need to have the counterfactual scenario where that policy is not applied. However, it is not possible to observe the same unit under both the treatment and the control condition at the same time. Then, it emerges the necessity of creating methodologies to build the counterfactual scenario that will allow us to estimate the effect of a specific treatment. This issue becomes even more important when it is not possible to find relevant comparable units with which to compare the treatment unit against those unaffected by the policy.

In this context, the Synthetic Control Method emerges as a data-driven process to construct a control for the treated unit by selecting a combination of potential control units from the donor pool. The objective is to ensure that the synthetic control accurately replicates the pre-treatment trends of the treated unit. In this scenario, the method creates a comparable unit to the treated one, allowing us to attribute the differences between them in the post-treatment period to the effect of the treatment. Specifically, Abadie et al. (2010) show that the SCM estimates the treatment effect as the difference between the treatment unit and its synthetic control in the period after the treatment, under the condition of a good pre-treatment adjustment of the trends. In addition, the SCM addresses omitted variable bias by considering the presence of unobservable time-varying confounders (Marchesi and Masi, 2022).

Finding comparable countries to assess the effect of a treatment in a specific region is challenging, as countries vary significantly across multiple dimensions, including culture, language, religion, population, and so on. If we want to estimate the effect of an extreme policy such as incurring in sovereign default, it is even more difficult to find comparable units. It is because sovereign defaults takes place in countries that find themselves under exceptional economic and political

circumstances, which increase the difficulty to find countries with similar characteristics. Then, in a context where there is no fully comparable unit to the defaulting country, SMC emerges as a methodology that could help bridge the gap between finding an appropriate counterfactual and identifying the impact of sovereign defaults.

4.2 Theory on SCM

In this section, following Abadie and Gardeazabal (2003) and Abadie et al. (2010), we describe the empirical methodology used in this thesis. It is important to mention that we also follow Reinhart et al. (2024), Marchesi and Masi (2021) and Billmeier and Nannicini (2013) to explain this methodology.

Formally, the Synthetic Control Method needs to make an assumption: in a $I+1$ units panel with T periods, there is only one unit i that is treated (in this case, the treatment is represented by the sovereign default) at time $T_0 < T$. Then, the impact of defaulting for country i at time T_0 on the outcome Y is given by:

$$\delta_{it} = Y_{it}(1) - Y_{it}(0) = Y_{it} - Y_{it}(0),$$

Where $Y_{it}(1)$ and $Y_{it}(0)$ are the potential outcome of Y in the presence and absence of the treatment, respectively. The main issue is that, if country i receives the treatment, we cannot observe the outcome of i in the absence of the treatment at the same time. That is, we do not observe the counterfactual $Y_{it}(0)$. Then, the main objective of this methodology is to estimate the vector $(\delta_{i,T_0}, \delta_{i,T_1}, ..., \delta_{i,T})$, which represents the effects of the treatment over the periods after being treated. Based on the following general model for the potential outcomes, Abadie et. al (2010) develops a way to estimate the treatment effects mentioned.

Defining $J = 1, 2, ..., I_{control} + 1$, then:

$$Y_{jt}(0) = \pi_t + \varepsilon_{jt}$$

$$Y_{jt}(1) = \delta_{jt} + \pi_t + \varepsilon_{jt}$$

Where δ_{jt} are the dynamic treatment effects, π_t is a common factor across the two potential

outcomes and ε_{jt} is the error term. This last error term is assumed to be represented by the next factor model:

$$\varepsilon_{jt} = Z_j\theta_t + \lambda_t\mu_j + \epsilon_{jt}$$

Where Z_j is a vector that includes all the covariates (which are not affected by the intervention),[3] θ_t is a vector of time specific parameters, λ_t is an unknown common factor, μ_j is a country-specific observable and ϵ_{jt} is a zero-mean transitory shock.

It is important to mention that there is no restriction in the number of covariates that can be included on the vector Z_j. However, in order to obtain an unbiased estimation of the treatment effects, it is necessary to assume that covariates are not affected by the treatment.

It is necessary to define a generic vector of weights $W = (w_1, ..., w_{I_{Controls}})$ such that $w_j >= 0$ and $\sum w_j = 1$. Then, defining a general linear combination of outcomes before treatment $\sum_{s=1}^{T_0} k_s Y_{js}$, the SCM chooses w^* in a way that the outcome of interest and the covariates of the treated unit in the pre-treatment period are well replicated through a linear combination of outcomes and covariates from the control countries:

$$\bar{Y}_i^k = \sum_{j=1}^{I_{Controls}} w_j^* \bar{Y}_j^k$$

and

$$Z_i = \sum_{j=1}^{I_{Controls}} w_j^* Z_i$$

Then, the estimation of the treatment effect is given by:

$$\hat{\delta}_{it} = Y_{it} - \sum_{j=1}^{I_{Controls}} w_j^* Y_{jt},$$

Now define X_1 and X_0 as the treated country's vector of pre-treatment characteristics and the matrix containing the vectors of pre-treatment characteristics for the untreated countries, respectively. Then, w^* minimise the distance $||X_1 - X_0 w|| = \sqrt{(X_1 - X_0 w)' V (X_1 - X_0 w)}$, with V being a $(k \times k)$ symmetric and positive semi-definite matrix that reflects the relative

[3] It is important to mention that the covariates used in this study may not fully satisfy the assumption of being unaffected by the intervention. This, along with the anticipation effect—discussed later—represents a limitation of this methodology in providing unbiased results, especially in the context of phenomena like sovereign defaults, which simultaneously impact numerous key economic variables.

importance of each covariate to predict the outcome of interest.

Finally, these weights minimise the mean square predictor error (MSPE), which is the the squared distance between the treated country's outcome and the synthetic control's outcome in the pre-event period:[4]

$$MSPE = \frac{1}{T_0} \sum_{t<T_0} (Y_{it} - \sum_{i=2}^{I+1} Y_{it} w_i)^2$$

This theory forms the basis for constructing the synthetic control for each defaulting country and each variable of interest. To derive averafe results, we must aggregate the country-specific effects across individual default events. Using the aggregation method proposed by Cavallo et al. (2013) and applying the weighted average approach from Reinhart et al. (2024), we define the weights ω_i:

$$\omega_i = \frac{1}{\sigma_i},$$

where σ_i is:

$$\sigma_i = \frac{\sqrt{\frac{\sum_t^{T_0-1}(Y_{i,t} - Y_{k,t}^i)^2}{\overrightarrow{T_{0-1}}}}}{\frac{\sum_t^{T_0-1} Y_{i,t}}{\overrightarrow{T_{0-1}}}}$$

where $\overrightarrow{T_{0-1}}$ represents the number of years in the pre-treatment period for synthetic control i. Note that $Y_{i,t}$ represents the outcome of the treated unit at time t, while $Y_{k,t}^i$ corresponds to the synthetic control for that outcome. Then, the weighted average treatment effect at time t (τ_t) proposed by Reinhart et al. (2024) is:

$$\tau_t = \sum_{i=1}^{I} \omega_i \left(Y_{i,t} - Y_{k,t}^i\right)$$

As defined by the authors, ω_i is the inverse of the normalized root mean square prediction error for the synthetic control of each defaultinc country i (denoted as σ_i). This weighted aggregation method allows us to assign greater weight to synthetic control units with a better pre-treatment fit, and less weight to those with poorer pre-treatment fit, without making arbitrary decisions about which synthetic controls are "good" or "bad".

Building on this, we apply an additional normalization to enhance and simplify the interpretation

[4] In Stata, in order to obtain a lower $MSPE$, we use the command *allopt*. This runs the nested optimisation module using three starting points: the regression based V, equal V-weights, and a third procedure that uses Stata's maximum likelihood search procedure. It often returns better results than using only the *nested* option.

of the results. First, we normalize the evolution of both the outcomes of interest and their synthetic counterfactuals by dividing them by the value of the outcome in the period of the default. Additionally, we weight the inverse of the normalized root mean square prediction error for each defaulting country by the sum of all the ω_i values. Therefore, in this case, the weighted average treatment effect at time t is given by:

$$\tilde{\tau}_t = \sum_{i=1}^{I} \tilde{\omega}_i \left(\tilde{Y}_{i,t} - \tilde{Y}^i_{k,t} \right) \quad \text{where} \quad \tilde{\omega}_i \equiv \frac{\omega_i}{\sum_{i=1}^{I} \tilde{\omega}_i}, \quad \tilde{Y}_{i,t} \equiv \frac{Y_{i,t}}{Y_{i,0}} \quad \text{and} \quad \tilde{Y}^i_{k,t} \equiv \frac{Y^i_{k,t}}{Y_{i,0}}$$

It is also useful to define $\tilde{Y}_t$ as the weighted average value of the outcome of interest in period t, and $\tilde{Y}_{k,t}$ as the weighted average value of its corresponding synthetic control in the same period. Formally, this can be expressed as:

$$\tilde{Y}_t = \sum_{i=1}^{I} \tilde{\omega}_i \tilde{Y}_{i,t} \quad \text{and} \quad \tilde{Y}_{k,t} = \sum_{i=1}^{I} \tilde{\omega}_i \tilde{Y}^i_{k,t}$$

This definition is important because, in the figures presented in Section 5, we plot $\tilde{Y}_t$ and $\tilde{Y}_{k,t}$ for each variable of interest. These plots form the basis for deriving the main results and conclusions of this thesis.

It is important to address the issue of anticipation effects. A key assumption for correctly identifying the impact of a sovereign default announcement is the absence of anticipation, as any foresight of the event could bias our results. To mitigate this, we apply a small adjustment to the synthetic controls by backdating the matching pre-treatment trends to a period before the default announcement. This approach, as suggested by Abadie (2021) and implemented by Reinhart et al. (2024), provides a way to account for potential anticipation effects.

As we will discuss, the anticipation effect may be a significant limitation in this analysis. We will address this concern in the robustness check section by constructing synthetic controls that adjust for and match trends from only a short period before the intervention. Given that sovereign defaults may result from a series of negative shocks affecting the defaulting country, our objective with this alternative approach is to identify countries in the donor pool that experienced similar negative shocks but did not default on their debts.

5 Results

In this section, we present the main results on the impact of sovereign defaults on the outcomes of interest. Each graph shows the weighted average evolution of the outcome and its synthetic counterpart, allowing us to interpret the average effect of defaulting on various economic variables. We discuss these results and offer potential explanations for our findings. Additionally, in Appendix 2, we provide further commentary on the synthetic controls for each defaulting country, highlighting the heterogeneous effects of defaulting across different nations.

To better understand the results presented in this section, it is important to clarify a detail in the figures. In the average results, the year labeled as 0 corresponds to the year we set as the default year in Stata, which is one period before the actual default to account for potential anticipation effects. The vertical dotted line, however, marks the year the default actually occurred. In the figures showing the individual synthetic controls for each country, the dotted line represents the year we designated as the treatment period in Stata.

Table 4 presents the differences between each outcome of interest and its synthetic counterpart. All analyses in this section will be based on the figures and the quantification of the treatment effects presented in this table.

In the discussion, we also highlight some country-specific results that contradict the general findings and challenge the prevailing economic intuition. These cases may warrant closer examination in future research.

It is important to clarify how the results should be interpreted for the majority of cases examined in this study. In most of the aggregated results on the impact of sovereign defaults on the specified variables, we observe that the actual outcome levels begin to diverge from their synthetic counterparts before the period in which the treatment is applied. This suggests the presence of some form of anticipation regarding the sovereign defaults, or that defaulting countries experience a series of negative shocks in the years leading up to the default that the matching algorithm cannot fully capture. This anticipation effect is likely the primary limitation of this methodology when analyzing the impact of defaults on the economy. It prevents us from isolating the effects of default from other concurrent factors that could influence our results, which in turn prevents us from interpreting the outcomes as the direct causal impact of sovereign default.

However, as mentioned earlier, this study is one of the first to apply the synthetic control methodology to assess the effects of sovereign defaults. This is just the beginning of a growing body of literature that employs this promising tool. Future research will need to refine and improve this methodology to apply it with greater precision and rigor in order to accurately identify the causal impact of defaults.

Finally, in Table 3, we present the weights (ω_i) generated by the aggregation method described above for the average synthetic control of each outcome of interest. As previously discussed, synthetic controls with a better pre-treatment fit of the trends receive greater representation (i.e., a higher weight) in the aggregate results.

5.1 GDP per capita

Figure 1 illustrates that average GDP per capita remains consistently below its synthetic control, indicating that, in the absence of a default, output levels would be higher on average. Table 4 quantifies the impact of sovereign defaults in percentage terms.

Specifically, one year after the default, GDP per capita is, on average, 16.97% lower than its synthetic control. However, this decline does not appear to begin immediately after the default announcement. Typically, the decrease in output starts before the default year. On average, two periods prior to the default, GDP per capita is 4.12% lower than the synthetic control. One year before the default, this gap widens to approximately 10.7%. By the year of the default, the GDP per capita of the defaulting country is 14.7% lower than its synthetic counterpart.

Our findings align with the literature suggesting that defaults have a long-term impact on GDP levels. Specifically, our results are consistent with studies that also use the synthetic control methodology to assess the effects of defaults, such as Marchesi and Masi (2021) and Reinhart et al. (2004). We observe that approximately five years after the sovereign default, the gap between GDP per capita and its synthetic counterpart begins to narrow, resulting in a long-term level of GDP per capita that is still 6% below its synthetic control. Despite this reduction in the gap, the impact is persistent, with economies that experience sovereign defaults facing lasting negative effects from their decision to default on payment obligations.

Interestingly, in some cases of sovereign defaults, the observed impact contradicts initial expecta-

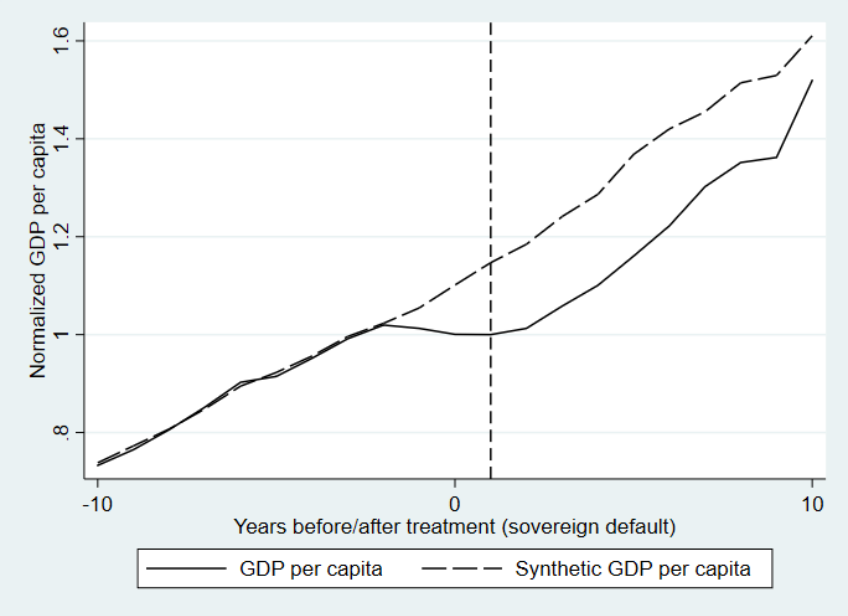

Figure 1: Average effects of defaults on GDP per capita.

tions: the synthetic counterfactual trend falls below the actual GDP per capita after the default announcement. This indicates that, for certain countries—such as the Dominican Republic, as detailed in the Appendix 2—defaulting may have had a positive impact on GDP per capita, challenging the prevailing literature on sovereign defaults. These unexpected outcomes could be attributed to unique political or economic circumstances within these countries and warrant further research.

It is important to highlight that our findings align with the literature suggesting that defaults result from a series of negative shocks to a country's economy. Specifically, the figure shows that the average output trend begins to diverge from its synthetic counterpart before the treatment, which may indicate anticipation of the default or reflect that defaults occur after a sequence of adverse events affecting GDP per capita. In this context, Uribe and Schmitt-Grohé (2017) provide empirical evidence showing that countries tend to default on their sovereign debt following prolonged and severe economic contractions. To arrive at this conclusion, the authors compute the median output, period by period, across various sovereign default events. They demonstrate that output starts to deviate negatively from its trend a few periods before the default. Consistent with our results, Uribe and Schmitt-Grohé also find that, three years after the default, output remains below trend while the percentage deviation from it stabilizes. From this, they conclude that while defaults may mark the beginning of a recovery in output growth, they do

not signify a recovery in the level of economic output. This finding is mirrored in our thesis, where we observe that after the default, the average GDP per capita trend starts to recover and grows at approximately the same rate as its synthetic counterpart. However, it never fully catches up, indicating that even 10 years after the sovereign default, output levels remain below where they would have been had the default not occurred.

To rationalize these results and demonstrate them theoretically, Uribe and Schmitt-Grohé (2017) build on the model developed by Eaton and Gersovitz (1981) and its extension by Arellano (2008). They propose a model where sovereign defaults become optimal in the context of economic recessions. In this model, the authors rationalize two key outcomes consistent with the stylized facts observed in the data. First, they conclude that given a certain level of income and debt, if a country chooses to default, it will also default if the level of debt remains the same but income decreases. This explains why countries tend to default during economic downturns. Second, they demonstrate that the probability of default increases with higher debt levels.

Uribe and Schmitt-Grohé then extend the Eaton-Gersovitz reputational model to provide a quantitative analysis. They enrich the model with serial correlation in the endowment process, a finite exclusion period from international credit markets, and output costs associated with defaults. Calibrating the model for Argentina, they generate quantitative predictions about the dynamics surrounding default episodes. Consistent with what we mentioned, they find that defaults typically follow contractions in output, represented by a series of negative shocks starting three quarters before the sovereign default and, in line with Levy-Yeyati and Panizza (2011), the model captures that the default coincides with the lowest point of the output recession. These results align with the findings from the synthetic control analysis conducted in this thesis. Then, anticipation observed in Figure 1 could be explained by consecutive negative shocks to output that culminate in the sovereign default.

Finally, the work of Uribe and Schmitt-Grohé not only accounts for the decline in output leading up to a sovereign default but also offers insights into the observed patterns of consumption and investment, which we will explore in the following sections.

5.2 Consumption Expenditure

As shown in Figure 2, which compares the average level of consumption expenditure to its synthetic counterfactual, consumption consistently lags behind the synthetic average in the periods following the default. Similar to the trend observed for GDP per capita, the decline in consumption does not coincide with the default itself but begins to diverge from the synthetic counterpart a few periods prior to the default announcement.

In the year following the default, consumption expenditure is 14.3% lower than its synthetic counterpart. Notably, this decline starts approximately one year earlier, with consumption already 7.31% below the synthetic control at that point. As with output, consumption expenditure fails to converge with the synthetic counterpart in the long run, indicating that defaults have persistent negative effects on consumption. Moreover, in the years following the default, the gap widens, reaching a 17.2% difference between actual consumption and the synthetic control four years after the default. As with previous results, in countries like the Dominican Republic,

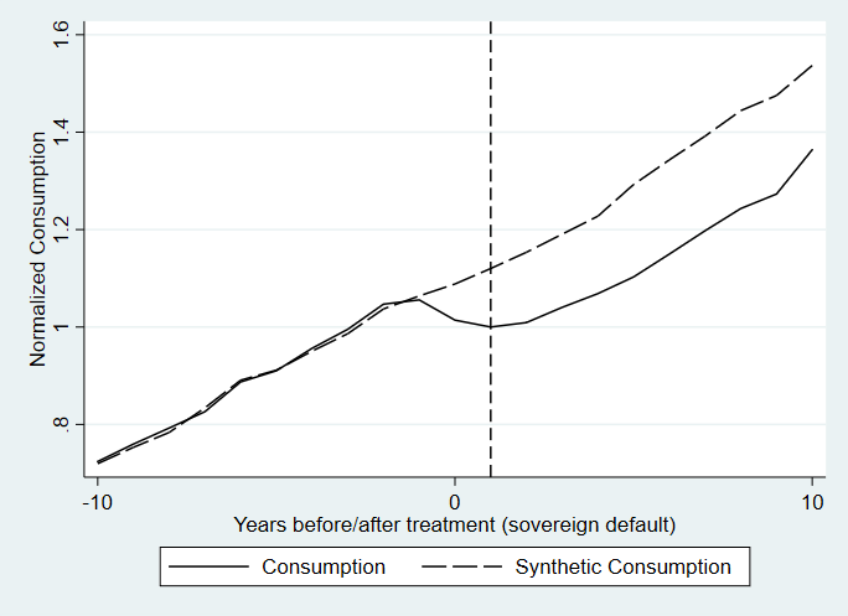

Figure 2: Average effects of defaults on consumption expenditure.

sovereign defaults appear to have a positive effect on consumption expenditure. This finding contradicts our hypothesis and prevailing theories on sovereign defaults, indicating that further research may be necessary to explore this discrepancy.

As with GDP per capita, we observe a similar anticipation effect in consumption leading up to

defaults, which aligns with the findings of Uribe and Schmitt-Grohé (2017). Their empirical analysis shows that sovereign defaults are typically preceded by declines in consumption relative to the trend, consistent with the divergence observed in Figure 2. Additionally, their quantitative analysis of the Eaton-Gersovitz model explains this pro-cyclical behavior of consumption. In the context of the model, the intuition is that, prior to a default, foreign lenders raise the interest-rate premium, which increases the cost of borrowing and leads agents to postpone consumption. Finally, we can conclude that the results on consumption expenditure obtained in this thesis using the synthetic control methodology are consistent with other empirical approaches and theoretical findings in the literature on sovereign defaults.

5.3 Government Expenditure

Figure 3 illustrates the impact of a sovereign default on the average level of government expenditure, as compared to its synthetic counterpart. Similar to previous cases, government expenditure never fully recovers to match the synthetic control, supporting the argument that defaulting has a long-lasting negative effect on public spending. Moreover, the trends between actual government expenditure and the synthetic control begin to diverge before the default announcement, suggesting the presence of anticipation effects.

According to Table 4, government expenditure starts to fall below its synthetic counterpart approximately one year prior to the default. In the year before the default announcement, government expenditure is 6.8% lower than the synthetic level. By the year of the default announcement, this gap widens, with actual public expenditure being, on average, 11.42% lower than the synthetic scenario. The gap continues to increase in the post-default period, reaching a 22.2% difference eight years after the default.

These results are consistent with the prevailing economic intuition surrounding sovereign defaults. When a government chooses to default on its debt obligations, it loses access to credit markets to finance its expenditures, as suggested by the literature discussed earlier. In such a situation, governments are forced to raise revenue (for instance, through higher taxes), but in the context of a recession, the only viable option to balance public finances is to cut expenditures. Thus, the decline in government spending following a default reflects the public sector's financial constraints and its inability to either increase revenues or access credit markets to finance its

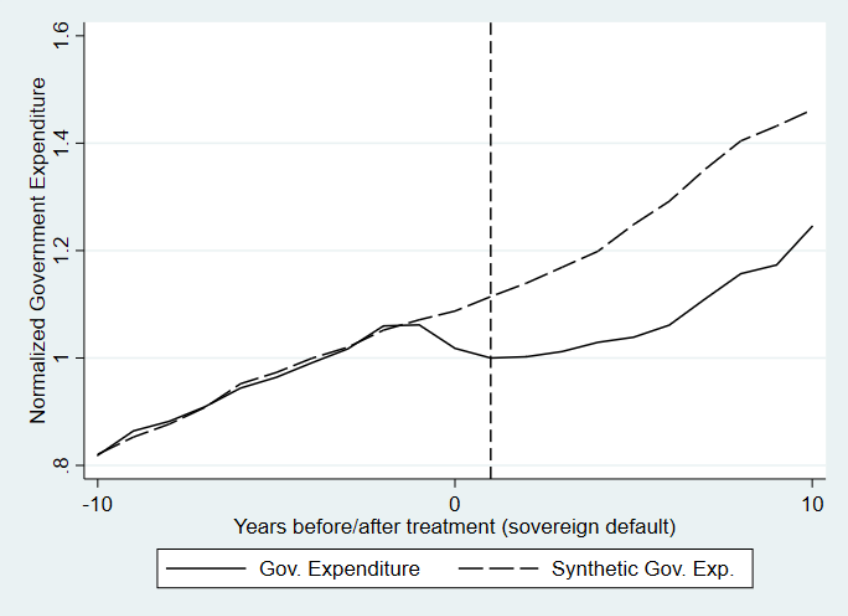

Figure 3: Average effects of defaults on government expenditure.

expenditures.

Focusing on specific cases that deviate from the main economic intuition, the case of Mozambique stands out. In this country, sovereign default appears to have a positive impact on government expenditure. The detailed results can be found in the Appendix 2 of this work.

5.4 Investment

Figure 4 presents the average impact of sovereign defaults on the level of investment. On average, investment remains below its synthetic control in the period following the default, indicating that sovereign defaults negatively affect gross capital formation in the defaulting country. Similar to previous cases, the decline in gross capital formation begins before the default announcement, with the synthetic control consistently outperforming actual investment throughout the post-treatment period. However, unlike other variables, the gap between these two trends narrows significantly in the long run, suggesting that while defaults have a negative impact on investment, there are signs of recovery over time.

According to Table 4, investment is 32.5% lower than its synthetic counterpart in the year following the default. As previously noted, the divergence begins approximately three years before the default announcement, possibly reflecting anticipation of the default or a response to

negative shocks experienced by the defaulting country. By nine years after the default, the gap between actual gross capital formation and its synthetic control narrows to just 2.83%.

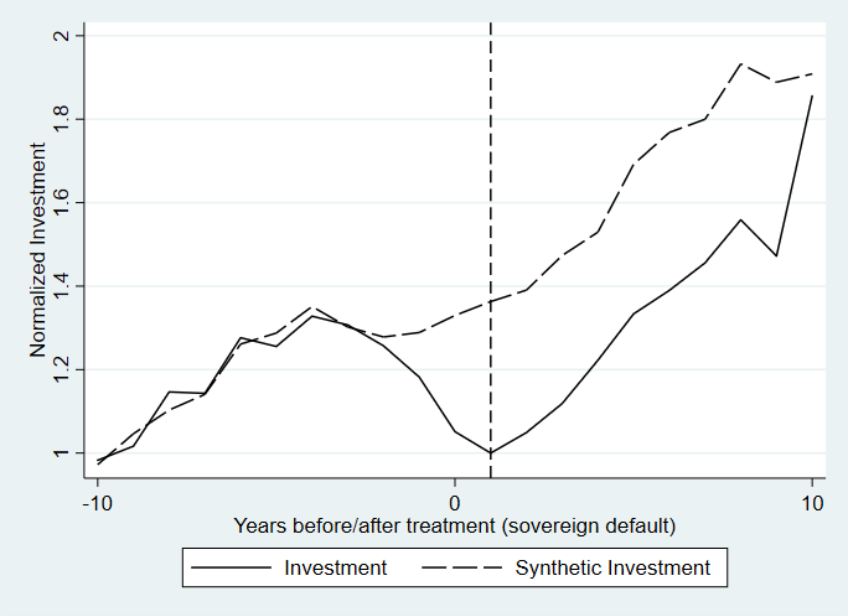

Figure 4: Average effects of defaults on investment.

A key contribution of this work is the use of gross capital formation to represent the overall level of investment in the economy. Much of the previous literature on the effects of sovereign defaults focuses primarily on foreign direct investment. This study, however, highlights that sovereign defaults not only impact foreign direct investment but also cause lasting damage to a country's broader capital formation, with some signs of recovery in the long run.

As with GDP per capita and consumption expenditure, the decline in investment observed in our results can also be explained by the findings of Uribe and Schmitt-Grohé (2017). Specifically, their work demonstrates that the decline in investment deviates from its trend earlier and more sharply than the deviations observed in output and consumption. This is consistent with the results of our synthetic control methodology, where the drop in average investment relative to its synthetic control is more pronounced compared to the declines in GDP per capita and consumption expenditure.[5]

[5]While this comparison between the synthetic controls for output, consumption, and investment offers valuable insight, it should be interpreted with caution. The synthetic controls for GDP per capita, consumption, and investment are not directly comparable due to two key reasons. First, at the aggregate level, the synthetic controls assign different weights to each defaulting country for each variable. Second, on an individual level, the composition of the synthetic controls for each defaulting country varies across outcomes. For example, the synthetic control for Argentina's GDP per capita differs in its composition from that for consumption or

5.5 Exports

Figure 5 shows that the average effect of a sovereign default on exports is both negative and long-lasting. Exports begin to decline relative to their synthetic control a few years before the default announcement, indicating an anticipation effect. This negative impact persists over time, with exports never catching up to the synthetic trend, and the gap remains relatively stable in the years following the default.

Table 4 reveals that export levels start to decrease compared to their synthetic counterpart two years before the default, with a 1.16% decline at that point. By the time of the default, the gap widens significantly, reaching 13.62%. In the year of the default, the gap between actual exports and the synthetic trend grows to 29.47%, and this difference increases further to 36.54% in the year following the default. Nine years later, the gap remains large, at approximately 33.6%. Exceptions to the general result include countries like Russia and Uruguay, where sovereign

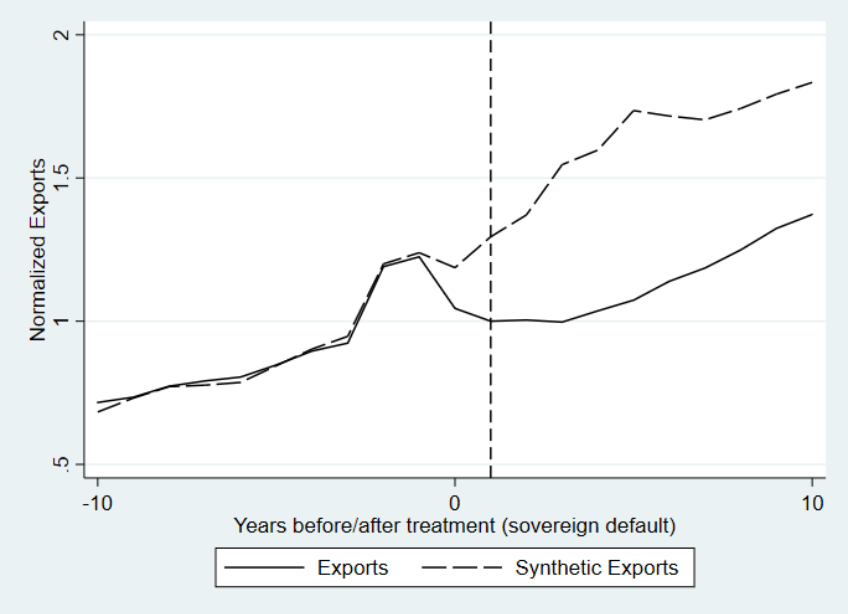

Figure 5: Average effects of defaults on exports.

defaults appear to positively impact exports, contradicting our initial expectations. In contrast, in cases such as Mozambique, Seychelles, and El Salvador, defaults seem to have no significant effect on export levels.

investment, reflecting the distinct weights assigned to countries in the donor pool for each outcome.

5.6 Imports

Figure 6 illustrates that, on average, sovereign defaults have a negative impact on the level of imports in defaulting countries. Similar to the effect on exports, there is a strong pre-default alignment between actual imports and their synthetic counterpart. However, the trends begin to diverge around three periods before the default announcement, suggesting anticipation effects. This negative impact persists over time, indicating a long-lasting effect. Compared to exports, the gap between the weighted average level of imports and its synthetic counterpart narrows in the long run.

Table 4 shows that imports begin to decline relative to the synthetic trend two years before the default, with imports 3.9% below the synthetic control. This difference continues to grow, reaching a gap of 39.16% in the year of the sovereign default. In the year following the default, the gap widens further to 41.87%. However, over the long run, the gap decreases, with imports 12.53% below their synthetic counterpart nine years after the default.

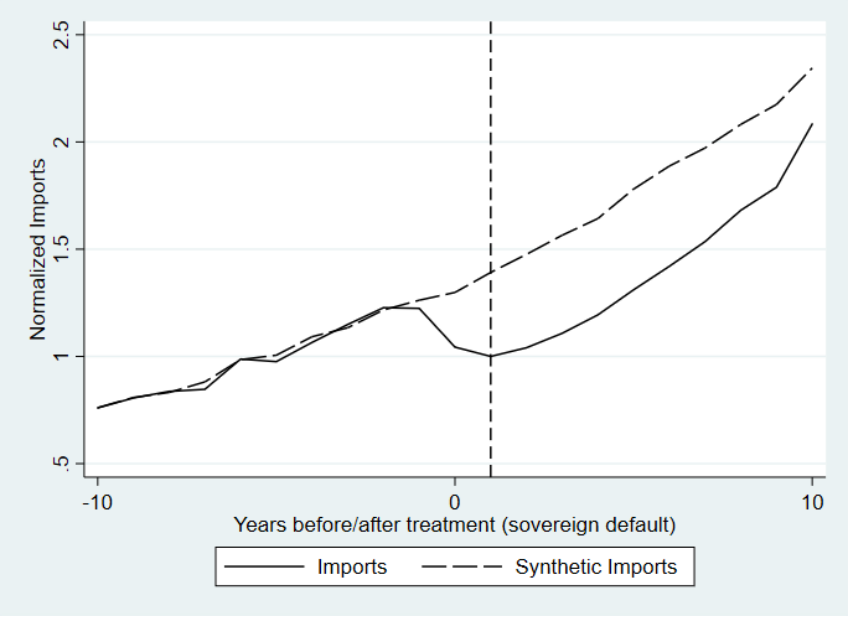

Figure 6: Average effects of defaults on imports.

This intuition and the results concerning exports and imports can be contextualized within the literature review by Martinez et al. (2022). In the sovereign defaults literature, some costs associated with defaults are linked to the restrictions on access to external borrowing, a phenomenon both theoretically rationalized and empirically observed. Specifically, sovereign

default often leads to temporary exclusion from credit markets (Cole et al., 1995; Kletzer & Wright, 2000; Wright, 2002; Cruces & Trebesch, 2013, as cited in Martinez et al., 2022). Another category of default-related costs stems from trade sanctions that discourage international trade (Mitchener & Weidenmier, 2005; Rose, 2005; Asonuma et al., 2016, as cited in Martinez et al., 2022). These theories regarding the costs of sovereign defaults provide a framework for interpreting the effects on exports and imports. During a sovereign default, not only is the government cut off from credit markets, but the private sector also faces greater difficulties in accessing financing. As a result, private firms encounter obstacles in securing credit from abroad, hindering international trade. Since a substantial portion of global trade relies on financing to bridge payment gaps between exporters and importers, a reduction in credit availability results in a decline in trade between domestic and foreign firms.

5.7 Unemployment Rate

Figure 7 shows the average impact of sovereign defaults on unemployment. Initially, sovereign defaults appear to reduce the unemployment rate in the short term, as the actual unemployment rate consistently remains below its synthetic counterpart after the default announcement. This decline in unemployment relative to the synthetic control begins approximately one year before the default. However, several years after the default, this trend reverses, with the synthetic control falling below the actual unemployment rate, suggesting that sovereign defaults may increase unemployment in the long run.

In the year of the default, the unemployment rate is approximately 1.43% lower than that of the synthetic control. This difference widens to 6.79% in the year following the default. Over the next few years, the gap fluctuates, with unemployment reaching 22.8% lower than the synthetic control three years after the default. However, six years post-default, the trend reverses, and the actual unemployment rate surpasses the synthetic control. By the ninth year, the unemployment rate is 5.84% higher than its synthetic counterpart.

This result goes in line with the model developed by Na, Schmitt-Grohé, Uribe, & Yue (2018), which explains that in an economy with downward nominal wage rigidity, a sovereign default accompanied by a devaluation may be the government's optimal response to avoid the involuntary unemployment that would occur if the currency were not devalued. Given that sovereign

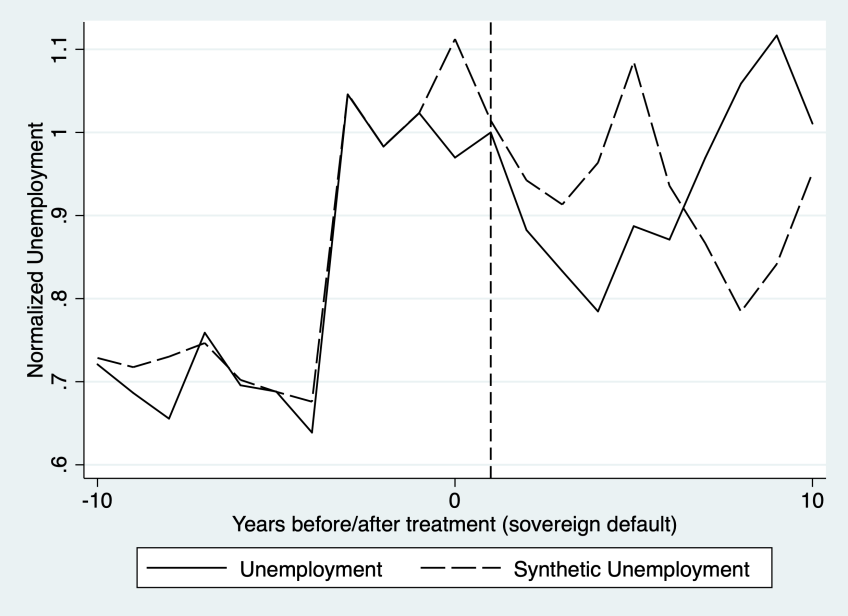

Figure 7: Average effects of defaults on unemployment.

defaults often coincide with highly depressed aggregate demand, the lower unemployment rate relative to the synthetic counterpart during the default period, as seen in Figure 7, can be attributed to governments' efforts to prevent involuntary unemployment through devaluations in a depressed economy.

5.8 Inflation

The results in Figure 8 display the average effect of sovereign defaults on inflation. However, identifying a clear impact is challenging. Inflation begins to rise relative to its synthetic counterpart a few years before the default, and in the periods following the default, inflation trends fluctuate. In some periods, inflation is higher than the synthetic control, while in others, this trend reverses.

Although the impact of sovereign defaults on inflation is inconclusive, it is noteworthy that, on average, periods involving a default tend to be characterized by higher inflation rates. This observation warrants further investigation, as the rise in inflation may be driven by fiscal and monetary imbalances that typically precede a default. In such cases, elevated inflation could be a strategic decision by governments to erode the real value of their local currency obligations. Nonetheless, based on the findings of this study, there is no clear evidence that sovereign defaults directly affect the inflation rate.

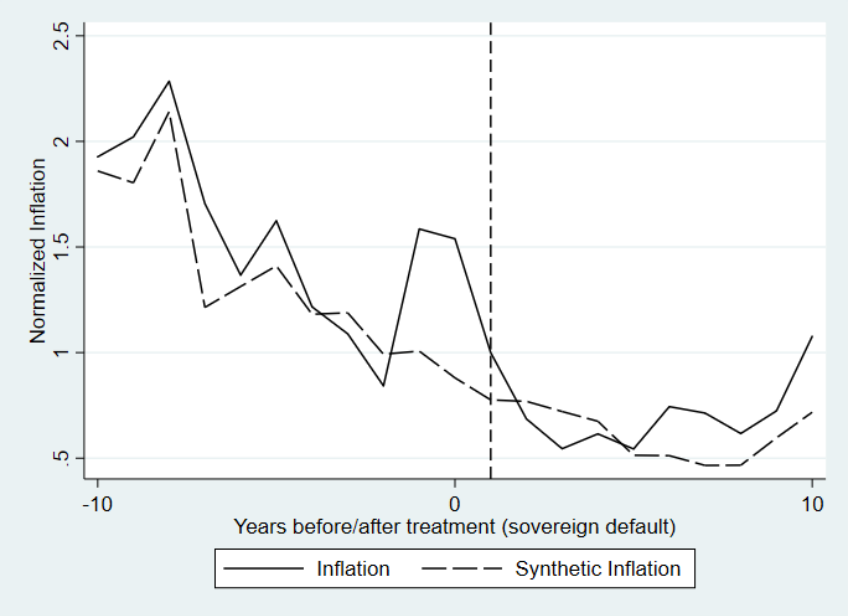

Figure 8: Average effects of defaults on inflation.

This ambiguous result regarding inflation can be understood in the context of Na et al. (2018). In scenarios where devaluation is an optimal policy response by governments, such as during a sovereign default, changes in the nominal exchange rate (NER) may have uncertain effects on the price level. First, the price index should be viewed as a function that depends positively on both the price of non-tradable (P_N) goods and the NER, assuming that the price of tradables (P_T) is equal to the NER. Formally, define the Price Index as a homogeneous function of degree 1, $f(P_T, P_N)$, which depends positively on both the prices of tradable goods and non-tradable:

$$Price\,Index = f(P_T, P_N) \quad \text{with} \quad f_{P_T}(\cdot) > 0 \quad \text{and} \quad f_{P_N}(\cdot) > 0$$

where $f_y(\cdot)$ is the partial derivative of $f(\cdot)$ with respect to the argument y. By applying that $f(\cdot)$ is a homogeneous function of degree 1, and assuming that the price of tradable goods equals the nominal exchange rate, we get:

$$Price\,Index = NER \times f\left(1, \frac{P_N}{NER}\right)$$

Thus, we observe that if the government decides to devalue, the effect on the price index is ambiguous. Intuitively, when the NER rises due to a devaluation, the demand for non-tradable goods increases relative to tradable goods, which tends to push the price index upwards. How-

ever, in the context of a sovereign default, aggregate demand typically declines, which exerts downward pressure on prices. Therefore, in an environment characterized by sovereign defaults, economic downturns, and devaluations, the overall effect on inflation remains ambiguous, which is consistent with the results obtained in Figure 8.

6 Robustness checks and Inference

6.1 In-space placebos

When using SCM to estimate the effect of a treatment, it is not possible to implement statistical inference in the traditional ways. So, in this case, we should implement another methodology to make inference. If we find that the treatment has an effect on the variable of interest, we should expect that this same treatment does not have any effect on the units that were not exposed to the intervention, enabling us to construct placebo tests, which will be the basis for the inference strategy (Abadie et al., 2015).

In this thesis, we construct in-space placebos for each defaulting country and each variable of interest (figures corresponding to these placebo tests can be found in the Appendix 3 of this work). Specifically, in-space placebos refers to a way of constructing placebos in which we reassign the intervention to each country in the donor pool that potentially belongs to the control group. So, if we find a large effect of sovereign defaults in a specific defaulting country, our confidence about the results will deteriorate if we also find a large or similar effect for the rest of the untreated countries in the donor pool. Then, as explained by Abadie et al. (2015), it is possible to construct p-values "by estimating in-space placebo effects for each unit in the sample and then calculating the fraction of such effects greater than or equal to the effect estimated for the treated unit" (p. 500). To run the placebo tests and calculate the corresponding p-values, we use the *synth_runner* Stata package developed by Galiani and Quistorff (2017), which offers an automatised way to perform this task.

An important limitation of this work with regard to the placebo tests must be addressed. As previously mentioned, we employed the **allopt** command in Stata to improve the fit of each synthetic control by running three optimization methods. This process, however, is time-consuming. While it was feasible to use **allopt** to construct the main synthetic controls presented in Section

5, it was impractical to apply this method to the in-space placebo tests due to the extensive time required to run all tests. As a compromise, we opted to use the simpler optimization technique for the placebo tests. The main issue with this approach is that, in some cases, the pre-treatment trend adjustments using **allopt** differ from those using the simpler method. As a result, the p-values for certain countries may not accurately reflect the true significance of the models discussed in Section 5.

Appendix 3 presents the results of the in-time placebo tests and the corresponding p-values for each synthetic control. The findings do not reveal a clear pattern between statistical significance and the fit of pre-treatment trends, nor between statistical significance and the specific defaulting country-outcome combination. The p-values for each synthetic control are heterogeneous across countries and variables of interest, with some cases showing very high p-values, indicating low statistical significance, while others exhibit low p-values, suggesting statistically significant results. For a more detailed assessment of the significance of country-specific effects, it would be a useful exercise—though not conducted in this thesis—to compare the results from Appendix 2 and 3.

6.2 Matching the negative shocks leading to a sovereign default

The aim of this brief section is to attempt to capture the series of consecutive negative shocks that a defaulting country may experience before it decides to fail to meet its payment obligations. To do this, we use the same specification applied in constructing the main synthetic controls, but this time we focus only on matching the three years preceding the default. As in the main synthetic controls, we also set the treatment year one period before the actual default to account for potential anticipation effects.

This robustness exercise, which focuses on matching only the years preceding the sovereign default, is theoretically justified by the previous discussion on anticipation effects and the argument by Uribe and Schmitt-Grohé (2017) that sovereign defaults result from consecutive negative shocks in the periods leading up to the default. The purpose of this exercise is to match the synthetic control trends to the negative shocks experienced by defaulting countries. By accurately matching the years prior to sovereign defaults, it would become possible to separate the effect of the default itself from that of anticipation or the negative shocks preceding it. The aggregate

results of this robustness exercise can be found in Figure 9.

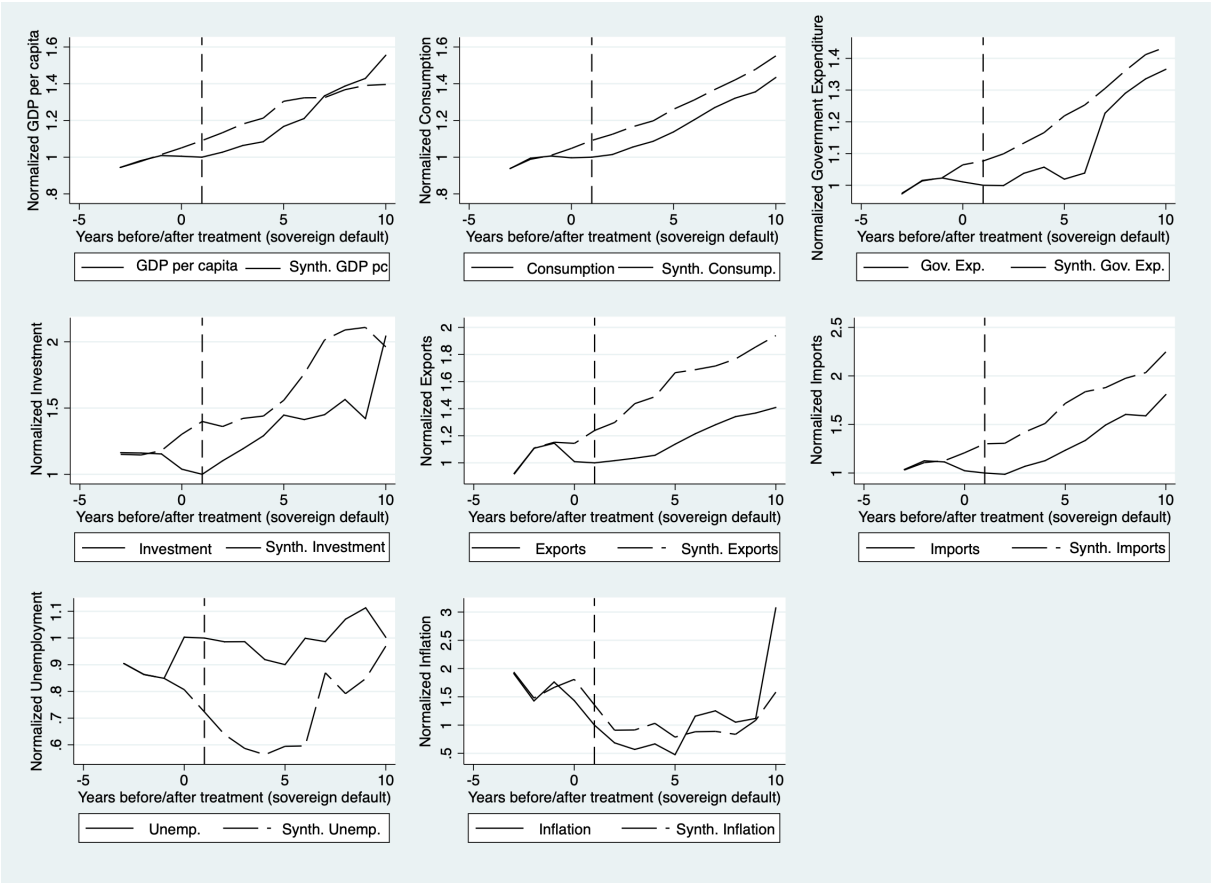

Figure 9: Average effects of defaults using a short pre-default matching period.

However, it is important to note that even when we focus on matching the years leading up to the default, the algorithm struggles to adequately capture all the negative shocks that might influence the country's decision to default. Additionally, this adjustment to the main specification does not change the direction of the sovereign default effect in most cases, with the exceptions being unemployment and inflation rates, where the results are the opposite of those obtained using the primary synthetic control specification. Moreover, the effects of defaults on GDP per capita seem to be limited to the short term, which contrasts with the more prolonged impact observed in our previous results.

The differences observed between synthetic controls that match only a few years before the sovereign default and those that match a longer period, as presented in Section 5 , suggest caution when validating and assessing the accuracy of the SCM in identifying the effects of sovereign defaults. Consequently, the results reported in recent literature on sovereign defaults

should be interpreted with an understanding that this methodology has several limitations and is sensitive to arbitrary decisions, such as the number of pre-treatment periods selected to match. More research is needed to validate the results obtained using SCM in macroeconomics. This is a promising area that warrants further attention in future studies, especially since SCM is a powerful and valuable tool in the social sciences.

7 Concluding Remarks

The main objective of this thesis was to evaluate the domestic economic impact of sovereign defaults, with a focus on key macroeconomic variables: consumption, government expenditure, investment, exports, imports, inflation, and unemployment. By using the Synthetic Control Method (SCM), we sought to estimate the counterfactual outcomes for defaulting countries, allowing us to quantify the effects of sovereign defaults on these variables. This methodology provided a robust framework for comparing defaulting countries to a synthetic counterpart that closely mirrors their pre-default economic conditions.

The findings of this research reveal that sovereign defaults generally have a long-lasting negative impact on several key economic indicators. Specifically, defaults were found to lead to a significant decline in GDP per capita, consumption expenditure, government spending, investment, and trade (both exports and imports). These effects are persistent and often begin to manifest before the default event, likely due to the anticipation of the default or preceding economic shocks. Notably, the effects on unemployment and inflation were more varied, with some countries experiencing short-term improvements in unemployment, possibly driven by macroeconomic responses such as currency devaluations, while inflation effects remained inconclusive across the sample.

However, the study also identified certain exceptions. In some countries, the impact of sovereign defaults defies conventional economic intuition. These anomalies suggest that country-specific factors, such as political or economic conditions, may influence the typical economic consequences of defaults, warranting further investigation.

There are several limitations to this study. First, the synthetic control method, while powerful, cannot fully account for all unobservable factors that may influence the outcomes. The presence

of anticipation effects, where the economic indicators begin diverging from the synthetic control prior to the default, is one of the key limitations. This makes it difficult to isolate the causal effect of defaults from other concurrent events or pre-existing negative shocks. Additionally, data limitations, particularly for some countries and variables, restricted the scope of the analysis.

Looking ahead, there are several avenues for future research. One promising direction is improving the SCM methodology to better capture pre-default shocks and reduce the impact of anticipation effects. More granular data, such as higher-frequency economic indicators, could also help refine the analysis. Moreover, exploring the political economy of sovereign defaults, including the role of international negotiations, trade relations, and the domestic policy environment, could provide deeper insights into the heterogeneity of default outcomes.

This study represents one of the early efforts to apply SCM to the analysis of sovereign defaults, and while it contributes to this growing literature on the costs of defaults, much work remains to be done. Further refinements in methodology and data collection will be crucial for advancing our understanding of the complex economic dynamics associated with sovereign debt crises.

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9 Appendix 1: Tables

Defaulter	**Potential Donors**
Argentina	BHS, BOL, BRA, CAN, CHL, COL, CRI, GTM, MEX, PER, USA, PAN
Belize	BHS, BOL, BRA, CAN, CHL, COL, CRI, GTM, MEX, PER, USA
Cyprus	ALB, ARM, AUT, BGR, BLR, CHE, CZE, DEU, DNK, ESP, EST, FIN, FRA, GBR, GRC
Dominican Republic	BHS, BOL, BRA, CAN, CHL, COL, CRI, GTM, MEX, PER, USA, CUB
Ecuador	BHS, BOL, BRA, CAN, CHL, COL, CRI, GTM, MEX, PER, USA, HND
Greece	ALB, ARM, AUT, BGR, BLR, CHE, CZE, DEU, DNK, ESP, EST, FIN, FRA, GBR, GRC
Indonesia	BGD, IND, JPN, KOR, MYS, AUS, AZE, HKG, ISR, KAZ, NZL
Jamaica	BHS, BOL, BRA, CAN, CHL, COL, CRI, GTM, HTI, MEX, PER, USA
Mali	BDI, BEN, CMR, COD, COG, COM, DZA, EGY, GAB, KEN, MAR, MDG, NAM
Mozambique	AGO, BDI, BEN, BWA, CMR, COD, COG, COM, DZA, EGY, GAB, KEN
Pakistan	BGD, IND, JPN, KOR, MYS, AUS, HKG, NZL, FJI, NPL, PHL
Paraguay	BOL, BRA, CAN, CHL, COL, CRI, GTM, MEX, PER, USA
Russia	AUT, BLR, CHE, DEU, DNK, ESP, FIN, FRA, GBR, HUN, IRL, ITA
El Salvador	BHS, BOL, BRA, CAN, CHL, COL, CRI, GTM, HTI, MEX, PER, USA
Seychelles	BEN, CMR, COG, COM, DZA, EGY, GAB, KEN, MAR, MDG
Ukraine	ALB, ARM, AUT, BEL, BGR, BIH, BLR, CHE, CZE, DEU, ESP, EST
Uruguay	BOL, BRA, CAN, CHL, COL, CRI, GTM, MEX, PER, USA

Table 2: Countries in the donor pool for each defaulting country.

Country	Code	GDP pc	Consumption	Government	Investment	Exports	Imports	Unemployment	Inflation
Argentina	10	0.114	0.093	0.171	0.141	0.023	0.089	0.002	0
Belize	27	0.001	0	0	0	0	0.001	0	0.027
Cyprus	54	0.035	0.049	0.035	0.042	0.016	0.066	0.002	0
Dominican Republic	60	0.083	0.019	0.006	0.039	0.031	0.065	0.824	0.052
Ecuador	67	0.092	0.019	0.021	0.062	0.010	0.056	0	0.033
Greece	90	0.104	0.107	0.119	0.091	0.016	0.063	0.005	0
Indonesia	107	0.086	0.059	0.066	0.012	0.025	0.064	0.153	0.030
Jamaica	118	0.009	0.286	0.317	0.051	0.731	0.217	0.002	0.243
Mali	159	0.114	0.073	0.022	0.097	0.007	0.063	0	0.042
Mozambique	166	0.113	0.060	0.011	0.032	0.009	0.021	0	0.086
Pakistan	185	0.110	0.091	0.023	0.148	0.009	0.034	0.001	0.113
Paraguay	196	0	0	0	0	0.007	0	0.002	0.154
Russia	203	0.024	0.072	0.076	0.022	0.049	0.101	0.002	0
El Salvador	212	0.009	0.006	0.029	0.086	0.029	0.047	0.002	0.099
Seychelles	227	0.008	0.011	0.009	0	0.009	0.022	0	0
Ukraine	249	0.083	0.019	0.095	0.040	0.006	0.049	0.002	0.049
Uruguay	251	0.018	0.037	0	0.139	0.023	0.043	0.003	0.072

Table 3: Weights assigned to each defaulting country in the aggregate synthetic control results for the different outcomes of interest.

Years for treatment	GDP pc	Consumption	Government Expend.	Investment	Exports	Imports	Unemployment	Inflation
-10	-0.727	0.600	-0.231	1.073	4.646	-0.115	-1.071	3.469
-9	-0.996	0.882	1.323	-2.935	0.403	-0.273	-4.519	10.750
-8	-0.177	1.143	0.588	3.781	0.185	0.594	-11.386	6.296
-7	0.429	-0.955	0.140	0.216	1.846	-4.083	1.638	28.820
-6	0.861	-0.403	-0.858	1.198	2.334	0.266	-0.930	3.945
-5	-0.890	-0.140	-0.940	-2.566	0.300	-3.066	0.040	13.150
-4	-0.476	0.609	-0.852	-1.742	-0.777	-2.507	-5.817	2.882
-3	-0.457	0.908	-0.302	0.383	-2.568	1.331	-0.076	-9.157
-2	-0.340	0.938	0.746	-1.691	-0.809	0.875	-0.027	-17.807
-1	-4.126	-0.780	-0.897	-9.032	-1.167	-3.098	-0.029	36.478
0	-10.070	-7.315	-6.819	-26.488	-13.620	-24.439	-14.711	42.781
1	-14.696	-12.012	-11.428	-36.308	-29.474	-39.162	-1.429	22.392
2	-16.973	-14.300	-13.678	-32.533	-36.545	-41.870	-6.789	-12.104
3	-17.299	-14.436	-15.509	-31.703	-55.129	-41.278	-9.620	-32.308
4	-16.885	-14.881	-16.467	-25.116	-54.165	-37.624	-22.813	-9.683
5	-17.898	-17.204	-20.210	-26.875	-61.661	-35.826	-22.318	5.469
6	-16.202	-16.821	-21.735	-27.231	-50.643	-32.917	-7.440	31.184
7	-11.743	-16.219	-21.749	-23.633	-43.624	-28.439	10.603	34.714
8	-12.043	-16.164	-21.375	-23.969	-39.541	-23.815	25.930	24.313
9	-12.297	-15.884	-22.054	-28.296	-35.406	-21.576	24.641	17.617
10	-6.000	-12.676	-17.420	-2.832	-33.610	-12.534	5.841	33.348

Table 4: Percentage gaps between the aggregate outcome of interest and its synthetic control.

10 Appendix 2: Country specific synthetic controls

In this appendix, we present the synthetic controls for each defaulting country and each outcome of interest. It is important to note that in the following figures, defaulting countries are identified by their numeric codes. The corresponding country-code references can be found in Table 3.

10.1 GDP per capita

Figures 10, 11, 12 illustrate the effects of sovereign defaults on GDP per capita for 15 defaulting countries. Generally, it can be observed that following a default, the synthetic control for each country shows a higher GDP per capita than the actual output, indicating a negative impact of default on the output level. This negative effect is evident in countries such as Argentina, Cyprus, Greece, Indonesia, Mali, Pakistan, Ukraine, and Uruguay.

Among these countries, some exhibit a decline in output even before the treatment, which may suggest a degree of anticipation of the sovereign default. In cases where output begins to decrease prior to the official default announcement, it is crucial to consider the nature of the default, as these situations might involve pre-arranged debt restructurings. In such scenarios, agents may anticipate the default, leading to a decline in output before the default is officially declared.

Moreover, the effects of defaults on GDP per capita appear to be quite heterogeneous in terms of duration. In some countries, such as Greece, Pakistan, and Ukraine, the negative impact of the sovereign default is long-lasting. However, not all defaulting countries experience prolonged effects. For instance, Argentina, Indonesia, and Mali show signs of recovery, eventually catching up to their synthetic counterfactuals a few years after the default.

In some cases, the observed impact contradicts initial expectations: the synthetic counterfactual trend falls below the actual GDP per capita after the default announcement.

Lastly, there are countries with a poor fit between the actual and synthetic pre-treatment trends. This is particularly true for Belize, El Salvador, Jamaica, Russia, and Seychelles. Due to this poor adjustment, the results for these countries under the specified model in this thesis are unreliable, and no definitive conclusions can be drawn for them.

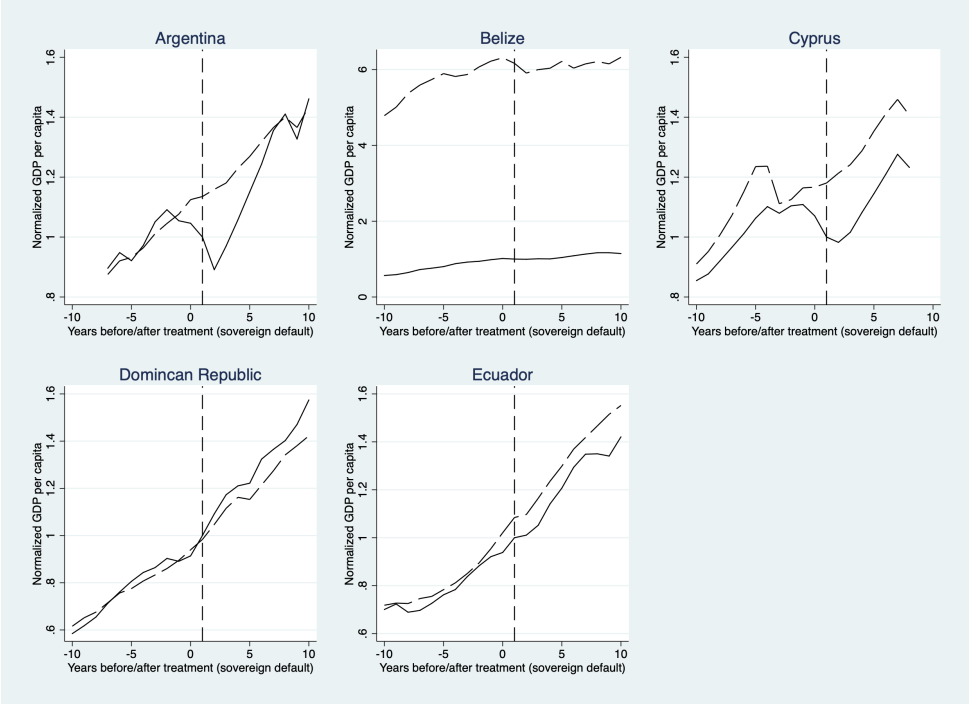

Figure 10: Effects of sovereign defaults on GDP per capita.

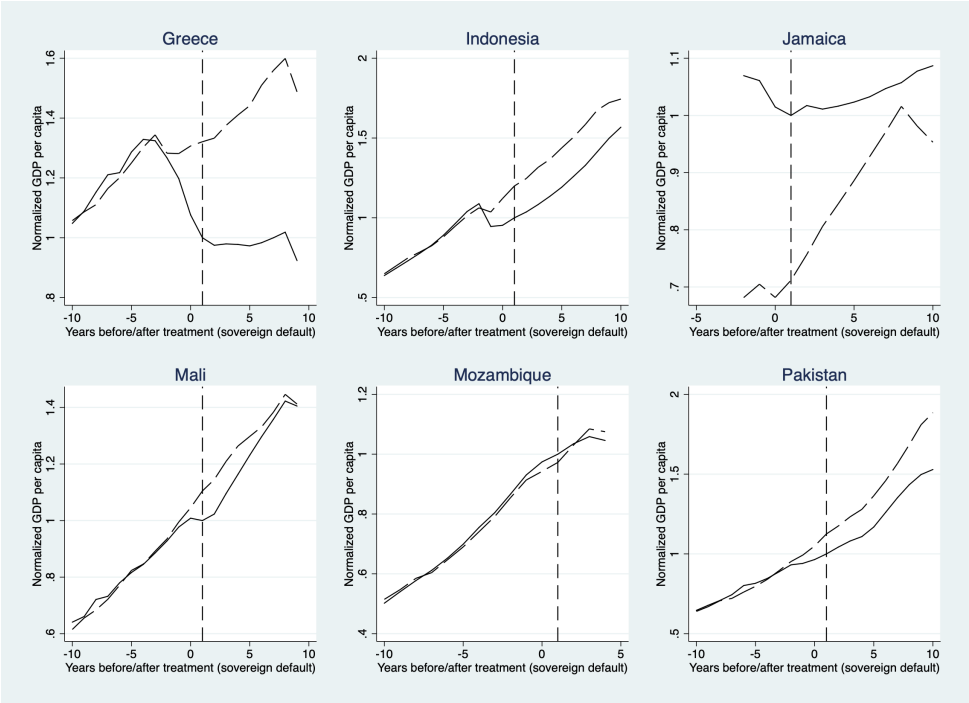

Figure 11: Effects of sovereign defaults on GDP per capita.

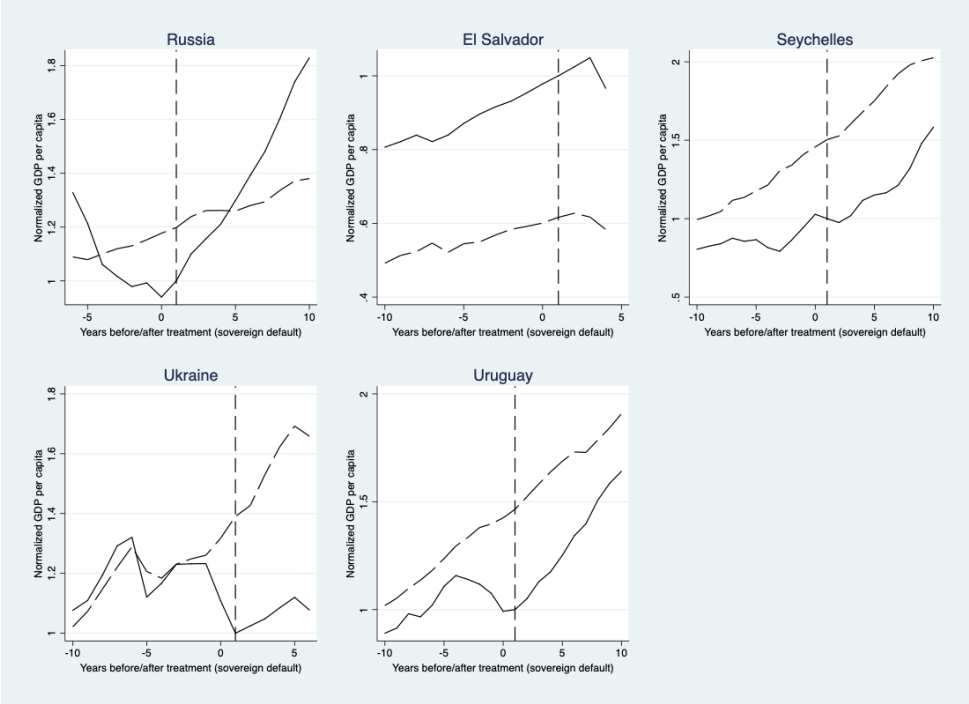

Figure 12: Effects of defaults on GDP per capita.

10.2 Consumption Expenditure

Figures 13, 14, and 15 illustrate the effects of sovereign defaults on consumption expenditure for each defaulting country. These figures show that in countries such as Argentina, Cyprus, Greece, Indonesia, Jamaica, Mali, Pakistan, Paraguay, Russia, Ukraine, and Uruguay, sovereign defaults appear to negatively impact consumption expenditure, with levels remaining below the trend of the synthetic controls. The duration of these effects, however, is heterogeneous. In some countries, consumption expenditure does not catch up with the synthetic counterpart, while in others, the consumption trend recovers from the decline during the default period and eventually catches up in the short run.

Interestingly, in countries like the Dominican Republic, sovereign defaults seem to have a positive effect on consumption expenditure. This finding contradicts our hypothesis and prevailing theories on sovereign defaults.

Finally, for countries such as Seychelles, Belize and El Salvador, it is not possible to determine the effect of sovereign defaults due to the poor fit of the pre-treatment trends.

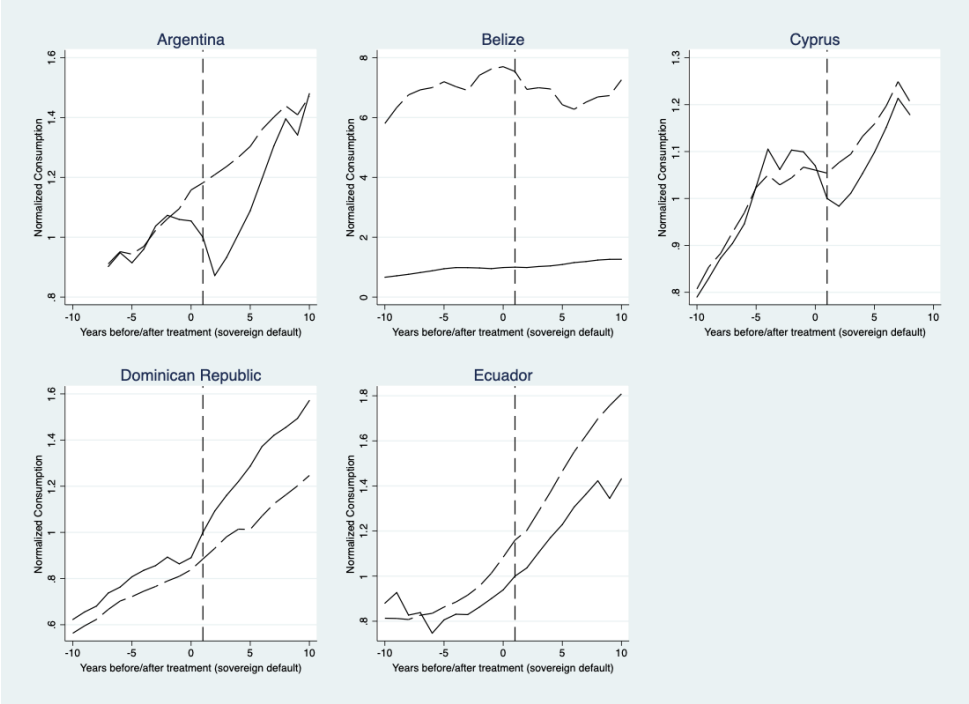

Figure 13: Effects of defaults on consumption expenditure.

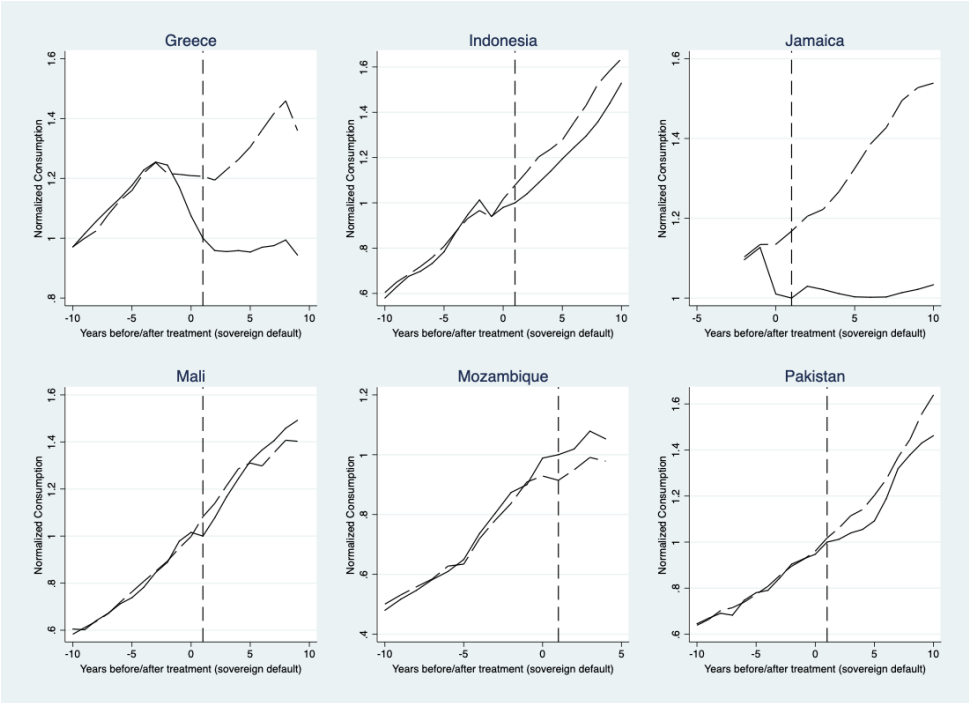

Figure 14: Effects of defaults on consumption expenditure.

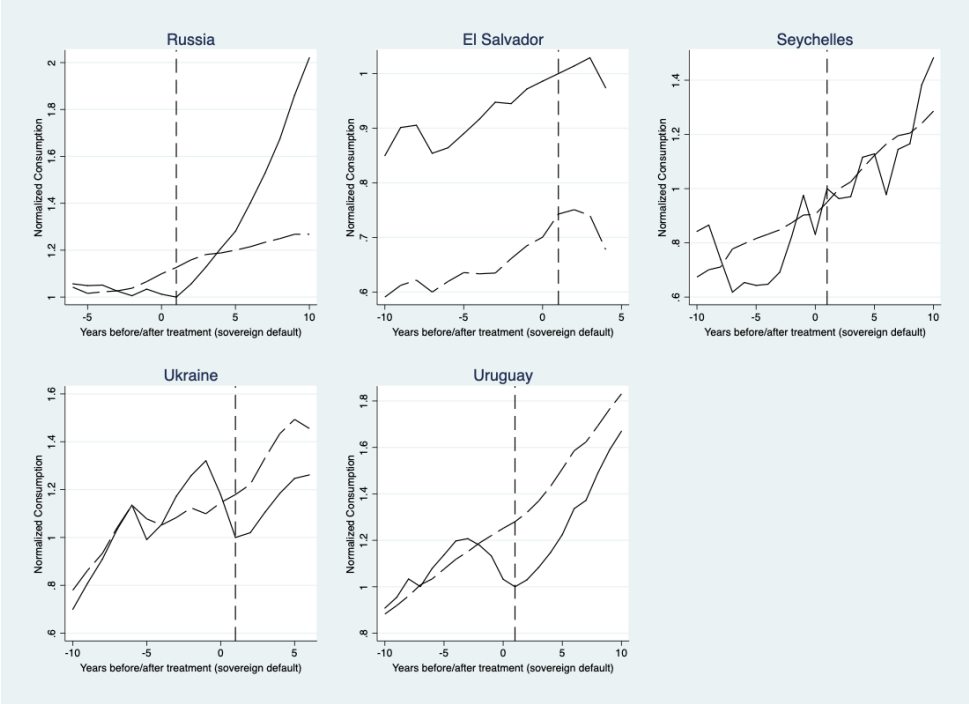

Figure 15: Effects of defaults on consumption expenditure.

10.3 Government Expenditure

Figures 16, 17, and 18 illustrate the effects of sovereign defaults on government expenditure for each country, using synthetic controls for comparison. Overall, these figures show that most countries experience a negative impact on government expenditure following a default, with actual expenditure levels falling below those of the synthetic control. This is evident in the cases of Argentina, Cyprus, Greece, Indonesia, Jamaica, Mali, Pakistan, Russia, and Ukraine.

However, there are exceptions where defaulting appears to have a positive impact on government expenditure, such as in Mozambique. Lastly, for countries like Belize, the Dominican Republic, El Salvador, and Seychelles, where the pre-treatment trends exhibit poor alignment, it is not possible to reliably determine the effect of sovereign defaults on government expenditure.

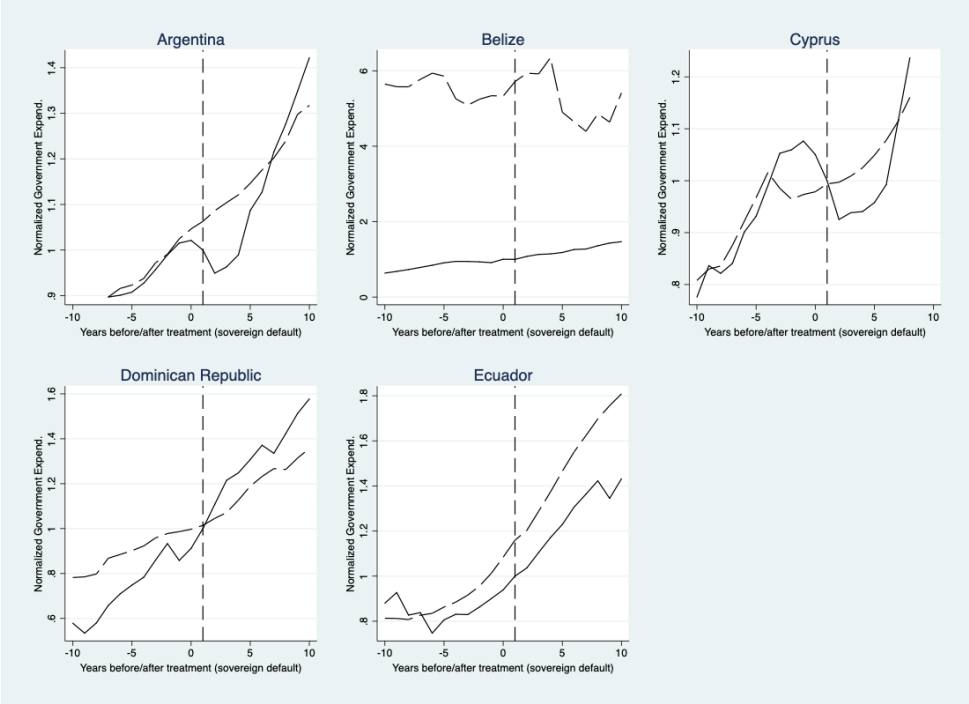

Figure 16: Effects of defaults on government expenditure.

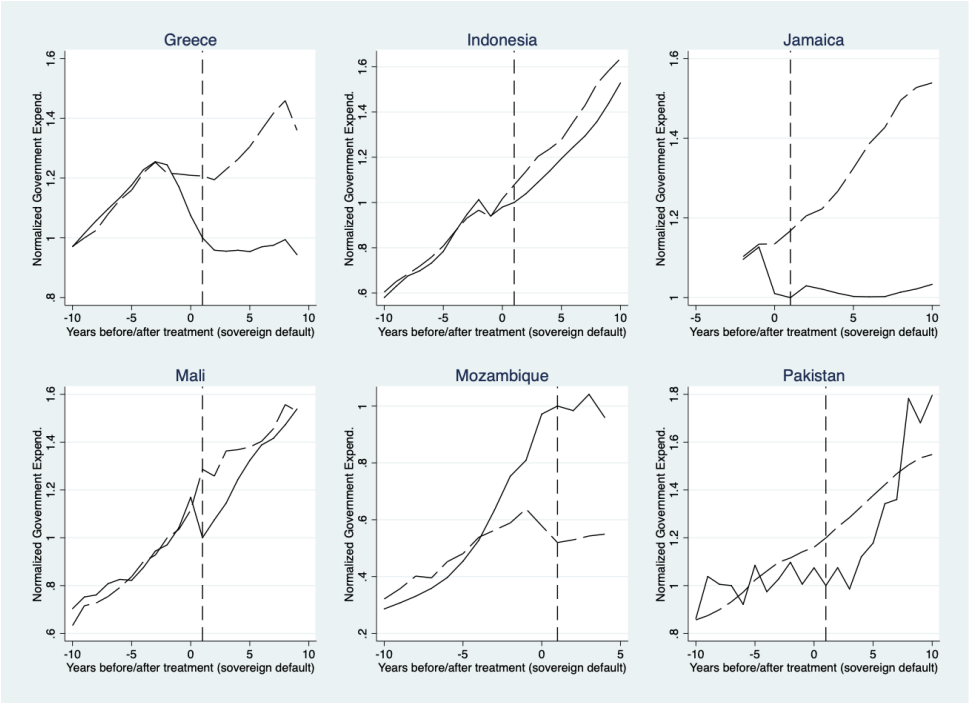

Figure 17: Effects of defaults on government expenditure.

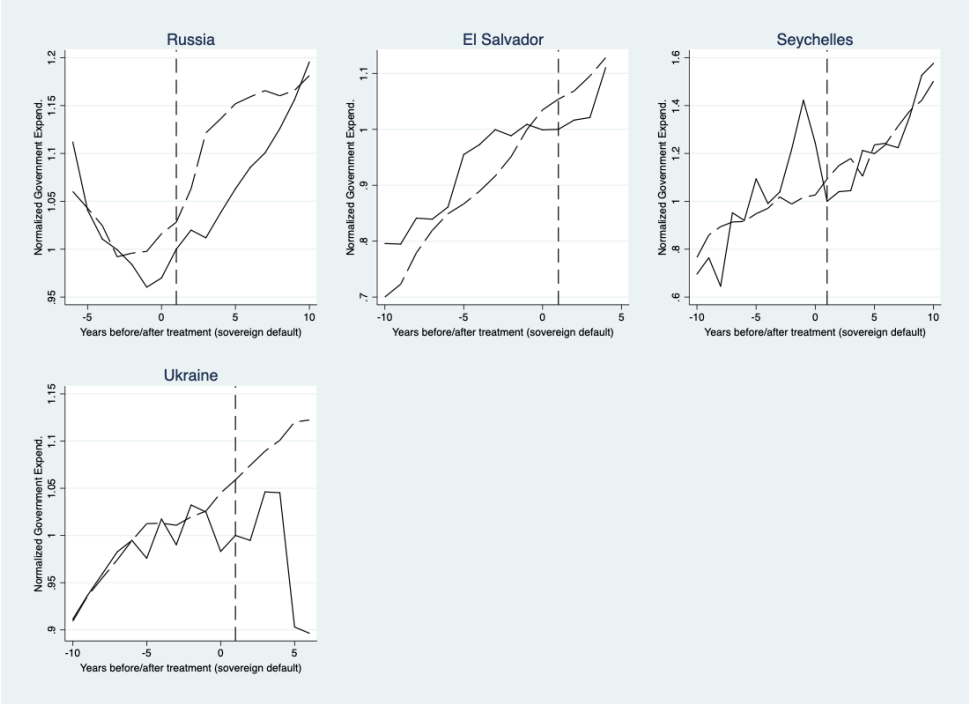

Figure 18: Effects of defaults on government expenditure.

10.4 Investment

In Figures 19, 20, and 21, we present the synthetic controls used to identify the effect of sovereign defaults on investment levels. Generally, countries display a poor pre-treatment alignment between actual investment levels and their counterfactuals, with some exceptions. As a result, in most cases, it is difficult to precisely identify the impact of sovereign defaults on investment using the synthetic control method.

However, for countries where pre-treatment trends are well-aligned, the figures indicate that defaulting has a negative impact on investment levels. This is particularly evident in Argentina, Cyprus, Greece, Mali, Pakistan, Ukraine, and Uruguay. The synthetic controls show that this negative effect on investment persists over the long term, with actual investment levels failing to converge with their synthetic counterparts. Therefore, sovereign defaults not only affect foreign direct investment, as much of the literature suggests, but also appear to have lasting, irreparable damage on a country's capital formation.

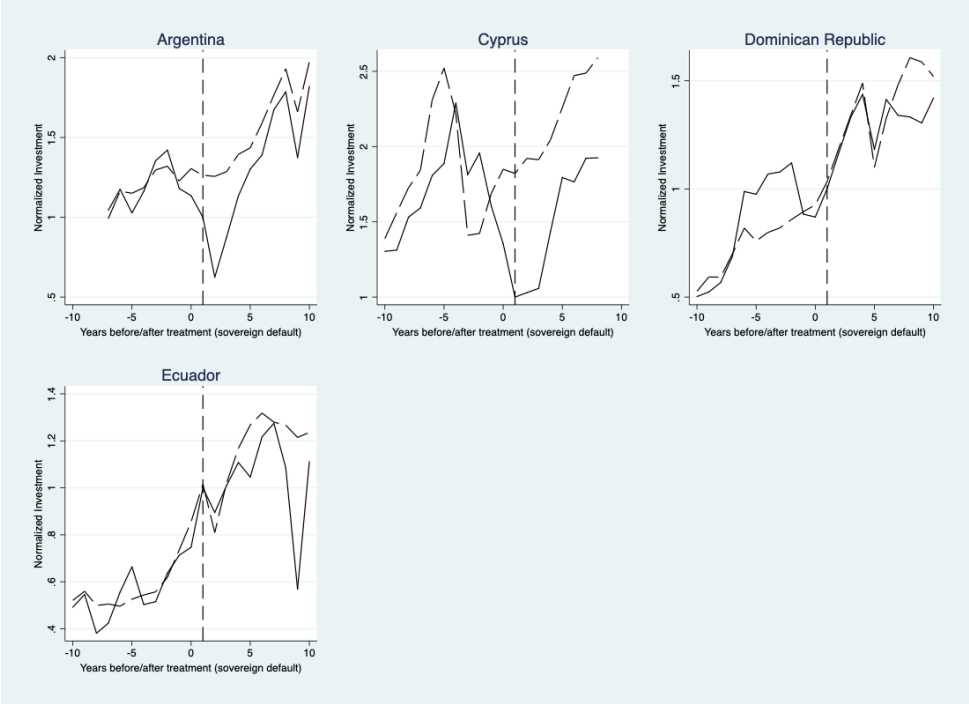

Figure 19: Effects of defaults on investment.

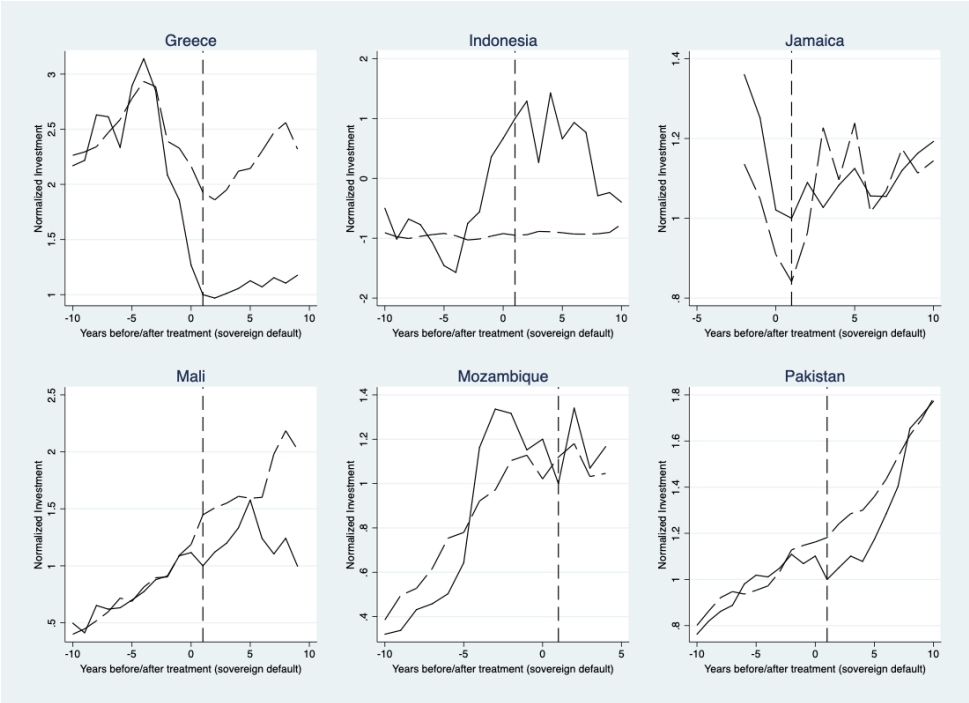

Figure 20: Effects of defaults on investment.

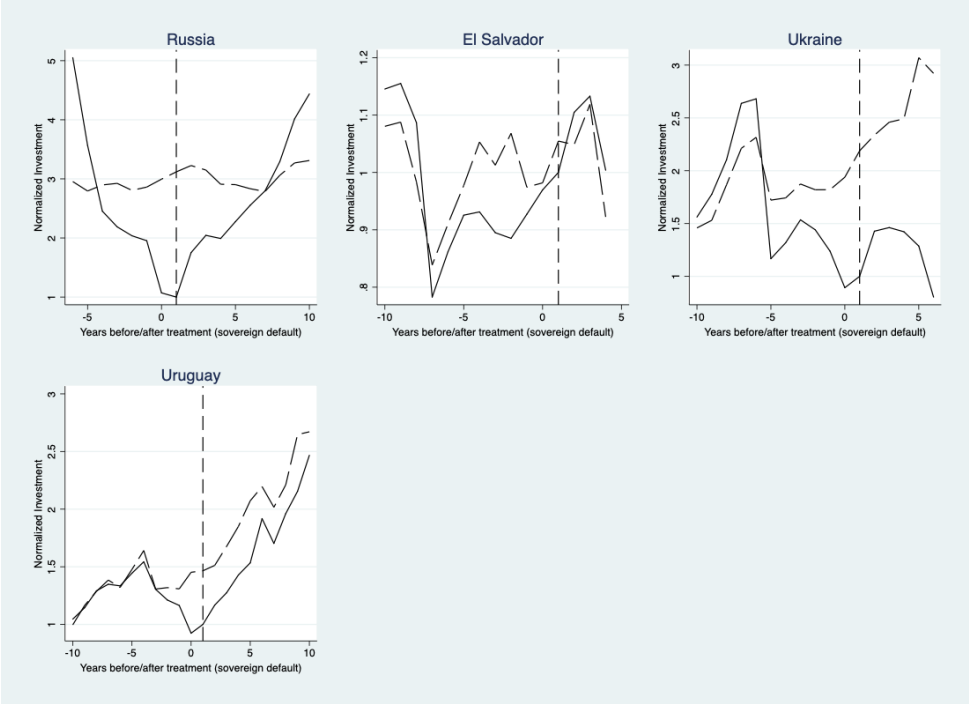

Figure 21: Effects of defaults on investment.

10.5 Exports

Figures 22, 23 and 24 present the results from the synthetic control analysis, identifying the impact of sovereign defaults on export levels. As in previous cases, the results vary across countries, and we can group them into three categories: those where defaulting has a negative effect, a positive effect, or no effect on exports.

For countries such as Argentina, Cyprus, the Dominican Republic, Greece, Indonesia, Jamaica, Mali, Pakistan, Paraguay, and Ukraine, defaulting has a negative and often long-lasting impact on exports. In contrast, for countries like Russia and Uruguay, sovereign defaults appear to have a positive effect on exports, which contradicts our initial expectations. In other cases, such as Mozambique, Seychelles, and El Salvador, defaulting seems to have no significant effect on exports. Lastly, for countries like Belize, where the synthetic control trend does not align with the actual export trend, we are unable to draw definitive conclusions about the impact of defaulting.

In conclusion, the effects of sovereign defaults on export levels are heterogeneous. Understanding the reasons behind this variation in impact should be the focus of future research.

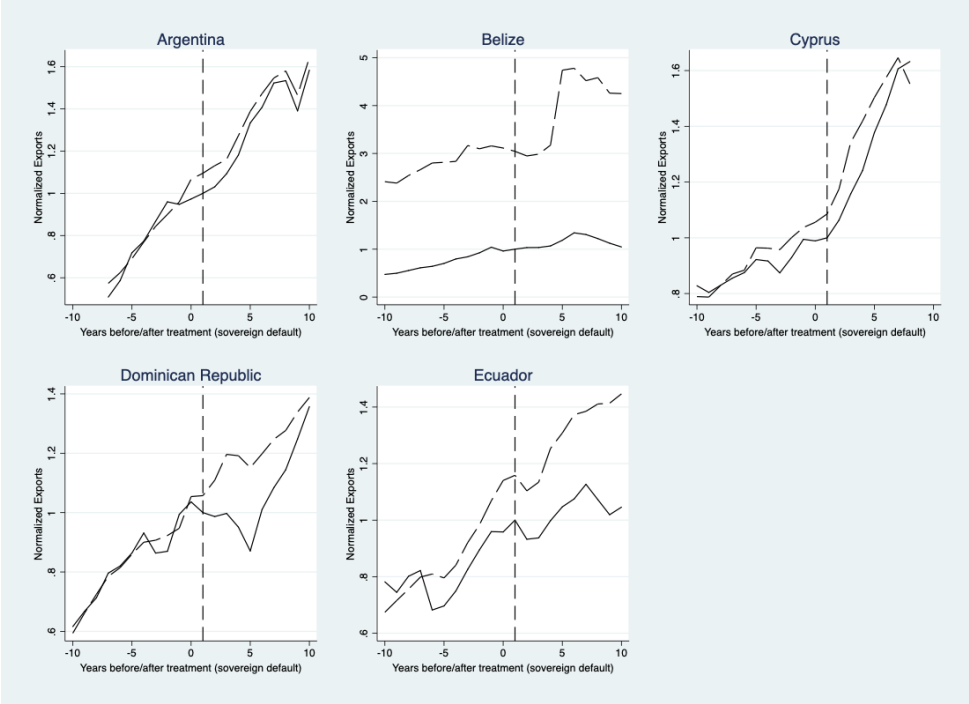

Figure 22: Effects of defaults on exports.

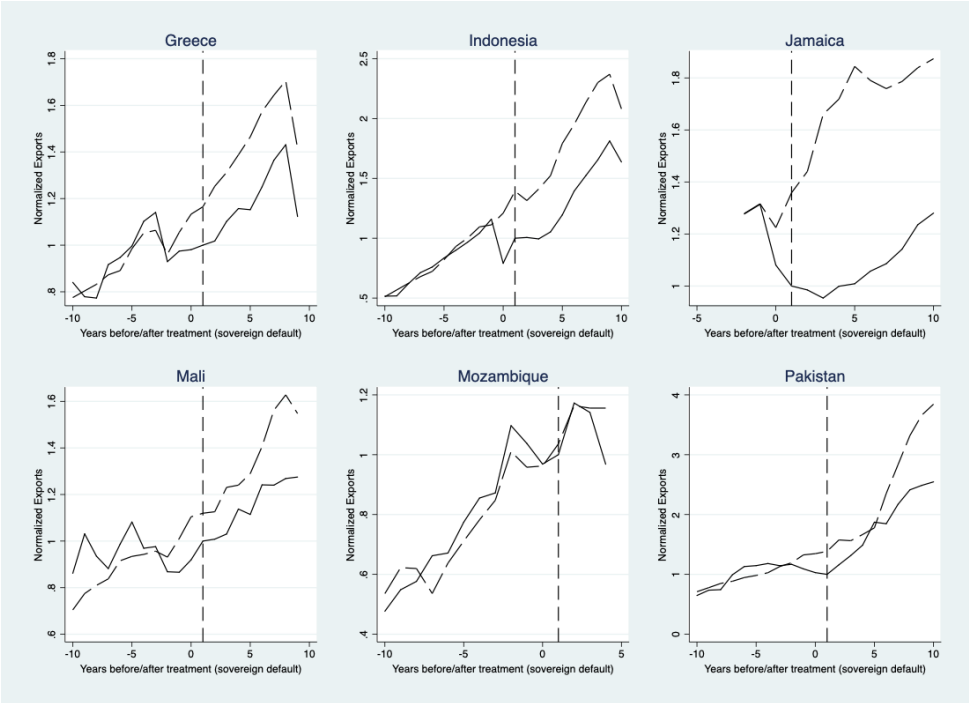

Figure 23: Effects of defaults on exports.

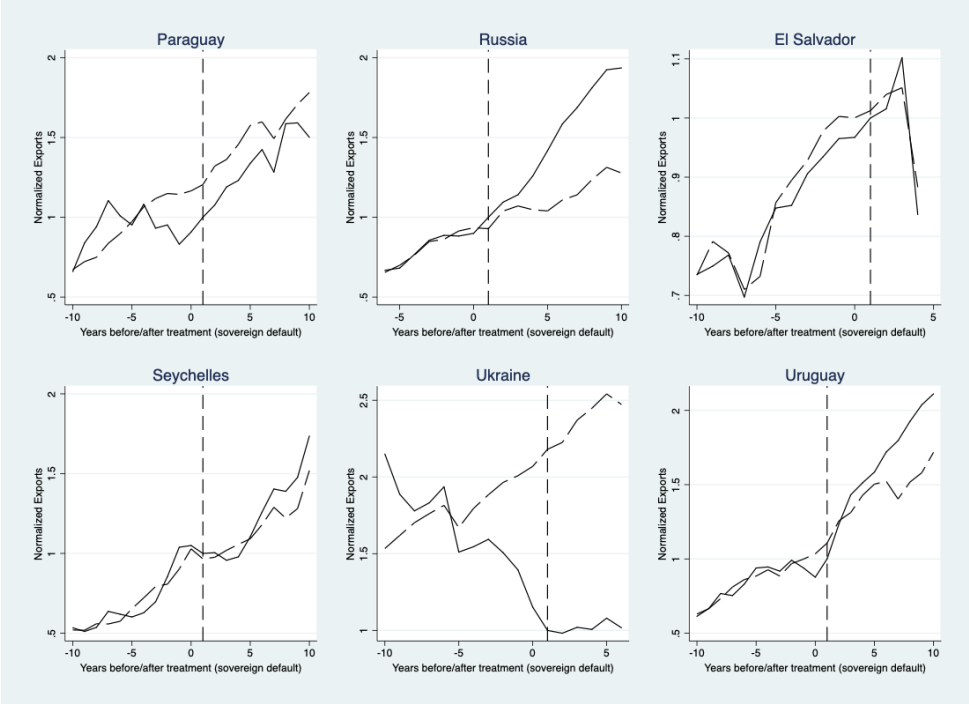

Figure 24: Effects of defaults on exports.

10.6 Imports

Figures 25, 26, and 27 display the synthetic controls assessing the impact of sovereign defaults on import levels for each defaulting country. In several cases, such as Argentina, the Dominican Republic, El Salvador, Greece, Indonesia, Jamaica, Pakistan, Russia, Seychelles, Ukraine, and Uruguay, defaulting appears to have a negative effect, leading to a reduction in imports compared to the synthetic counterpart.In general, the negative effects appear to be long-lasting, as the synthetic control trend for most defaulting countries consistently remains above the actual import levels, with the latter never fully catching up. Conversely, in countries like Cyprus, Mozambique, and Mali, sovereign defaults seem to have no significant impact on imports. Lastly, Belize exhibits a particularly poor pre-treatment adjustment, making it impossible to determine the effect of defaulting on its import levels.

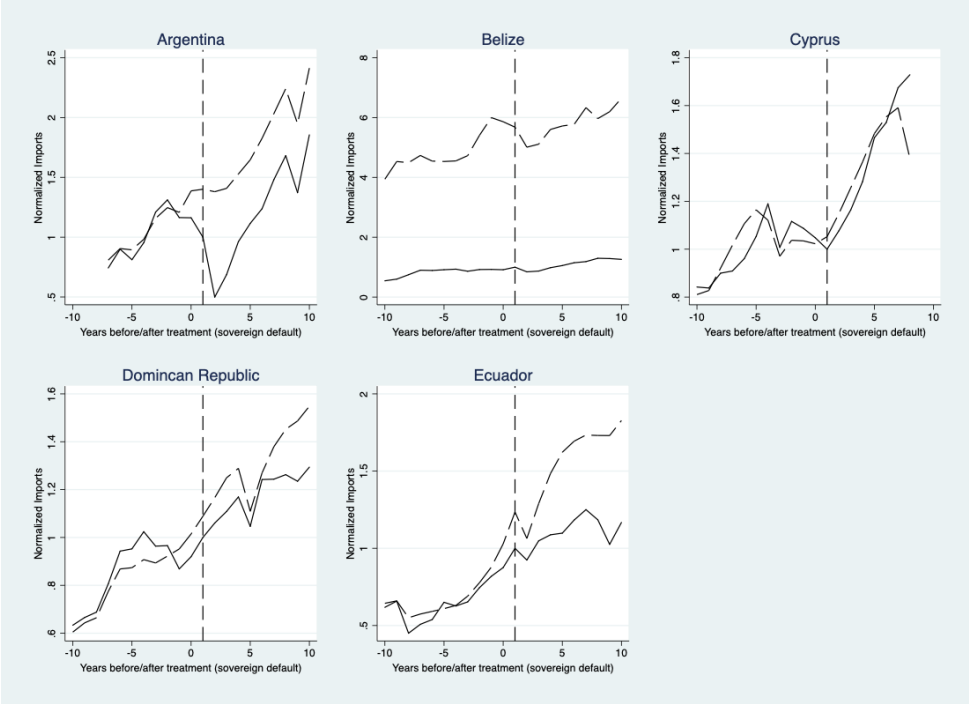

Figure 25: Effects of defaults on imports.

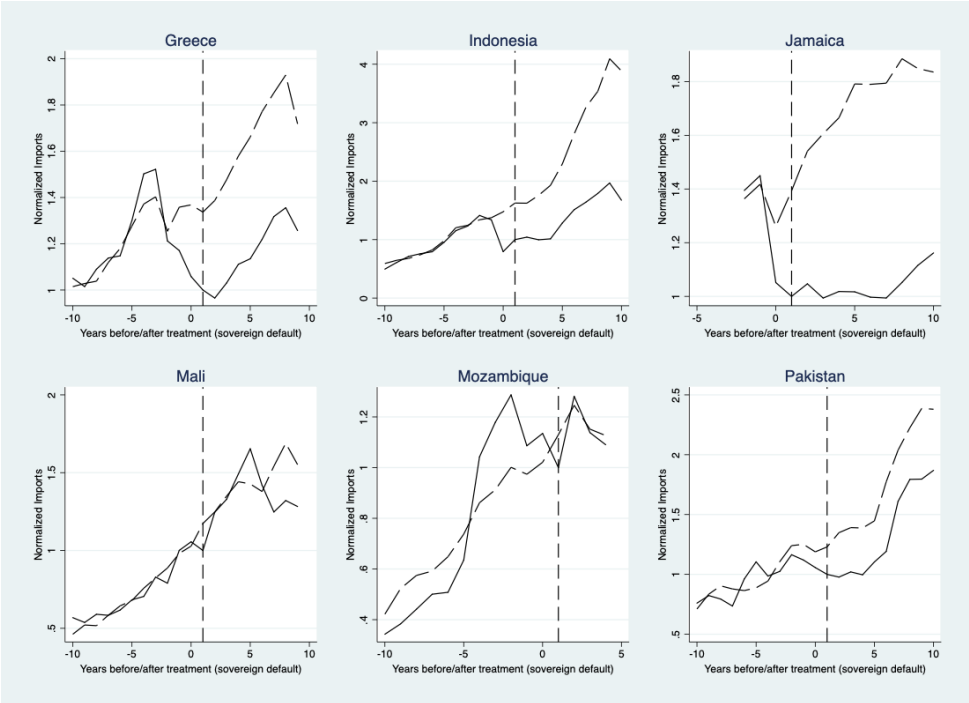

Figure 26: Effects of defaults on imports.

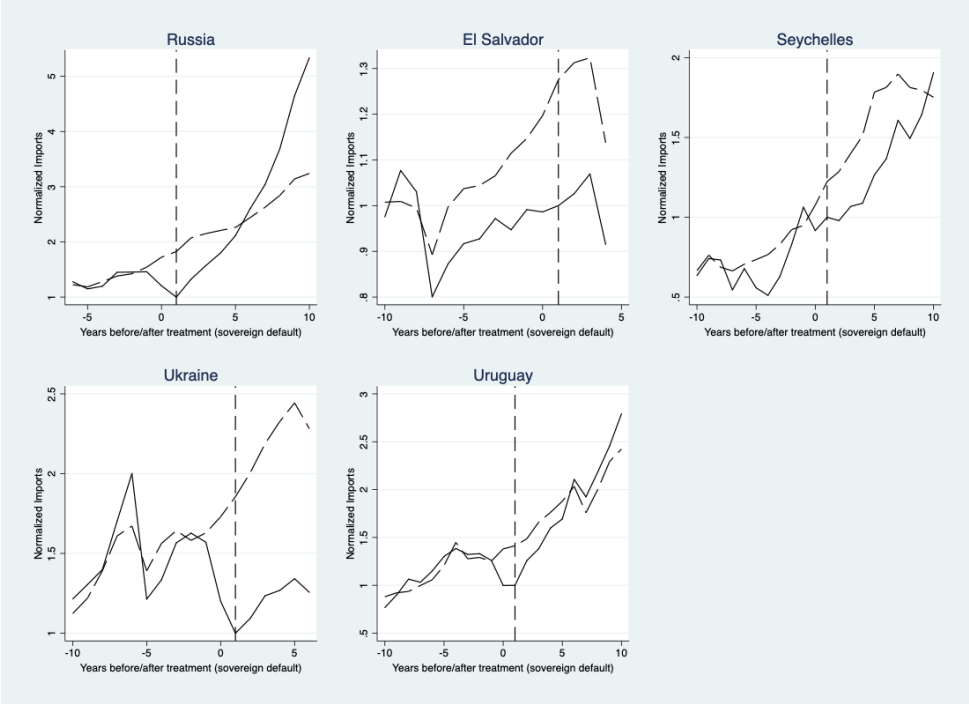

Figure 27: Effects of defaults on imports.

10.7 Unemployment Rate

Figures 28 and 29 show the individual synthetic controls for the effect of defaulting on unemployment rate. The pre-treatment adjustment of trends depends on the defaulting country. Some cases such as Cyprus, Greece, Uruguay and Dominican Republic present a good pre-treatment adjustment, while the rest of the cases show a poorer quality of the pre-treatment trends fit. Despite that not all the cases show a good pre-treatment adjustment, it can be seen that, in general, the effect of sovereign defaults on unemployment seems to be positive. That is, defaulting is associated with an increase on the unemployment rate. There are other countries such as El Salvador and Russia where defaulting seems to have no impact on the level of unemployment.

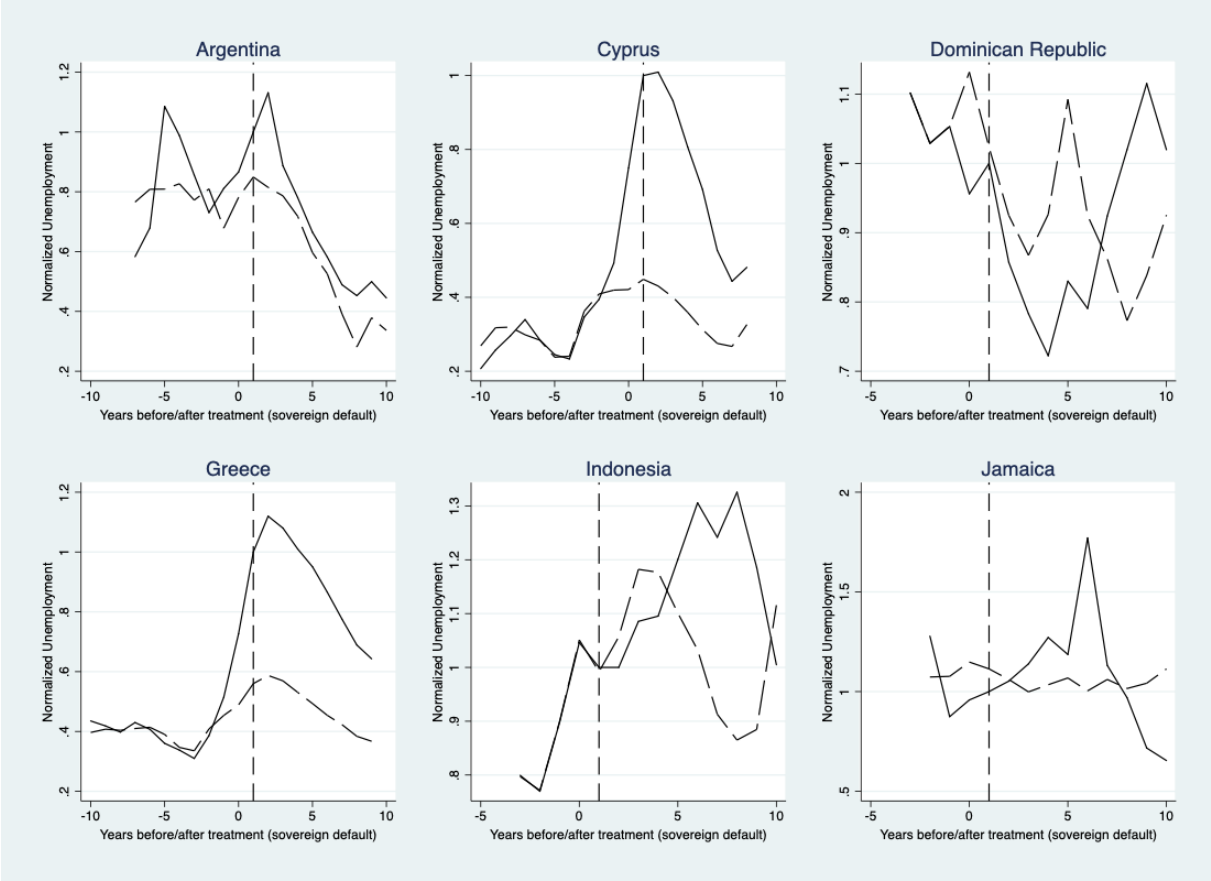

Figure 28: Individual effects of defaults on unemplpoyment rate.

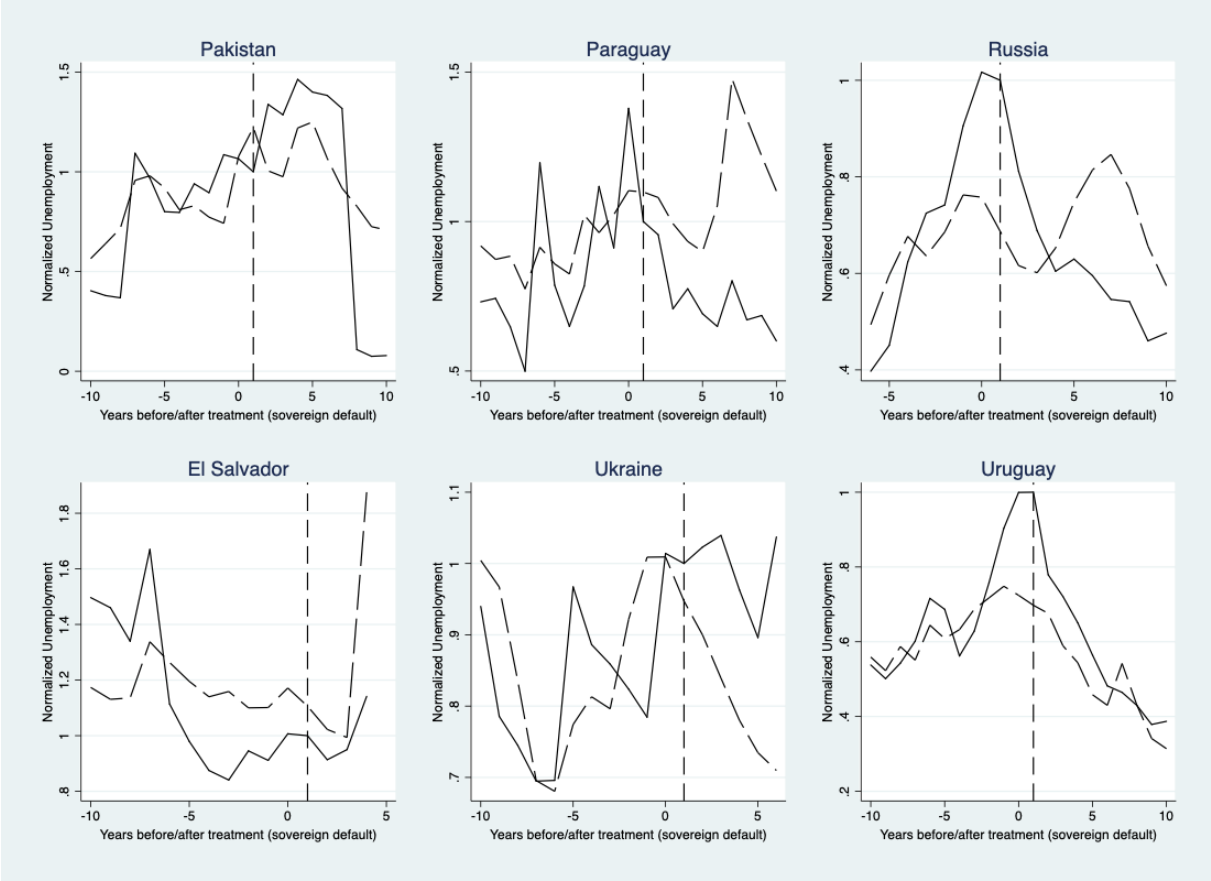

Figure 29: Individual effects of defaults on unemplpoyment rate.

10.8 Inflation

Figures 30 and 31 illustrate the impact of sovereign defaults on inflation rates for each defaulting country. Generally, most synthetic controls show an acceptable pre-treatment alignment, which allows us to assess the effect of default announcements on inflation. However, in many cases, due to fluctuations in the data, the direction of the effect remains unclear. A common pattern across defaulting countries is that inflation tends to rise during or immediately following the default period, suggesting that sovereign defaults are often associated with higher inflation, potentially triggered by the default itself. There are exceptions, such as Belize and El Salvador, where inflation remained below the synthetic counterpart during the default period.

Overall, these effects do not appear to persist in the long run. If there is an effect, it tends to be short-lived, with inflation rates eventually converging with their synthetic controls over time.

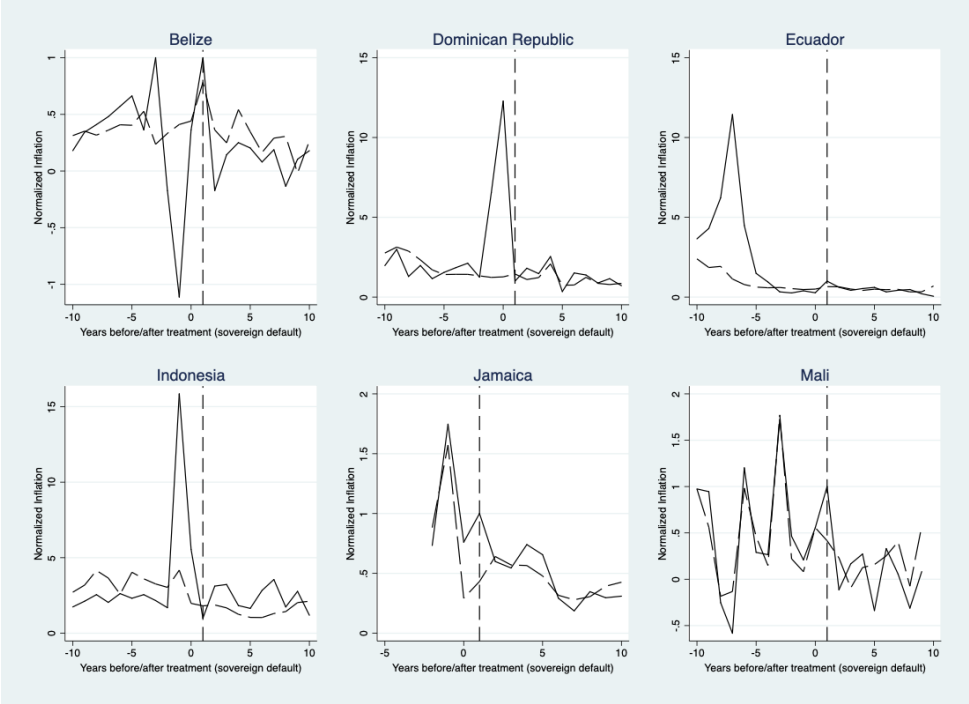

Figure 30: Effects of defaults on inflation.

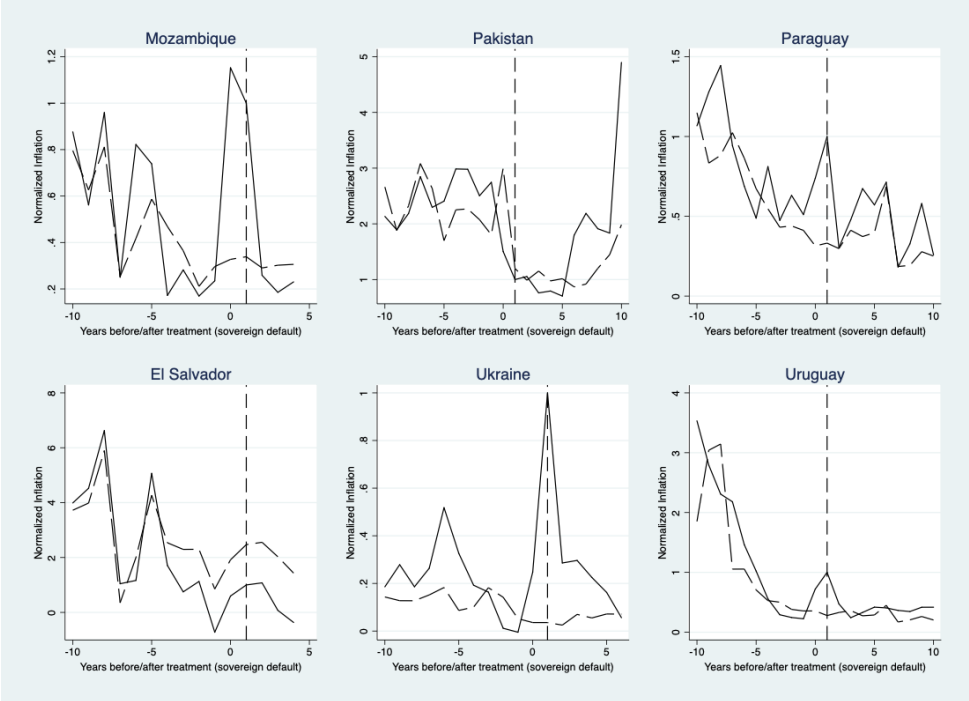

Figure 31: Effects of defaults on inflation.