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# The Impact of the Arab Spring on the Tunisian Economy

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## Abstract

This paper uses Synthetic Control Methodology to estimate the output loss in Tunisia as a result of the "Arab Spring." The results suggest that the loss was 5.5 percent, 5.1 percent, and 6.4 percent of GDP in 2011, 2012, and 2013 respectively. These findings are robust to a series of tests, including placebo tests, and are consistent with those from an Autoregressive Distributed Lag Model of Tunisia's economic growth. Moreover, this paper finds that investment was the main channel through which the economy was adversely impacted by the Arab Spring.


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For decades, many Arab countries have been dominated by dictators who restricted political liberties, controlled economic resources, and ignored social problems. As a result, a feeling of discontent and frustration built up over the years among citizens, especially the youth. The Arab Spring, named after the largely unanticipated public demonstrations aimed at replacing autocratic regimes by democratic systems across several Arab countries, has been considered by many as one of the political landmarks of the twenty-first century.[1] The Arab Spring was sparked on December 17, 2010 by the self-immolation of Mohamed Bouazizi, a Tunisian fruit vendor, after the police confiscated his vegetable cart and humiliated him. This event was the catalyst for large-scale protests that eventually toppled Zine El Abidine Ben-Ali's 24-year reign on January 2011. The winds of change that swept across Tunisia triggered a domino effect in several Arab countries, including Bahrain, Egypt, Libya, Syria, and Yemen.

Notwithstanding the worldwide interest in the Arab Spring, to the best of our knowledge there are almost no studies that have quantified its economic impact. In this paper, we use the Synthetic Control Methodology (SCM) as developed by Abadie and Gardeazabal (2003) to estimate the macroeconomic impact of the Arab Spring on the Tunisian economy from 2011 to 2013. The paper also contributes to the literature on the economic impact of conflicts and revolutions.

The Synthetic Control Method creates a synthetic control (counterfactual) as a weighted average of other control units (in this case countries) that were not affected by the treatment (in this case the Arab Spring), such that the outcome and characteristics of the treated unit and its synthetic counterpart are as similar as possible during the pre-shock period. Our "Synthetic Tunisia," which is our counterfactual for Tunisia in the absence of the Arab Spring, is constructed using data between 1990 and 2010. The effect of the Arab Spring is then estimated by comparing data for actual and Synthetic Tunisia in the period 2011–13.

The main results of this paper are as follows. The Arab Spring had a negative effect on Tunisia's aggregate economy: per capita GDP was lower than that of Synthetic Tunisia by an estimated US$ 600 (5.5 percent), US$ 574 (5.1 percent) and US$ 735 (6.4 percent) in 2011, 2012, and 2013, respectively. Thus, in the first year (2011) the loss was already substantial, and, by 2013, the shortfall had increased somewhat further. In addition, the main channel through which the Arab Spring adversely impacted the Tunisian economy was through investment.

To assess the robustness of our results, we perform various additional tests. In the SCM, it is typically the case that only a minority of the candidate control units end up with non-zero weights, so first we check if our results might be sensitive to the omission of the included countries. We find that excluding any of these control countries does not alter the path of the baseline Synthetic Tunisia after 2010. In addition, we perform what are known as time series falsification tests, to check that, if we applied the methodology at earlier dates than 2010 when Tunisia did not experience a shock, the SCM correctly identifies no shock effect after these dates (2000 and 2008). We find that our results are robust as Tunisia's per capita GDP did not drop relative to its synthetic counterpart after 2000 or after 2008. The construction of Synthetic Tunisia obviously depends on the criteria used to make it similar to actual Tunisia in the pre-shock period, so we also investigate the effect of amending these criteria. Finally, we compare our results with alternatives based on regression analysis. The outcome of all these tests is to confirm the robustness of our results. However, we fully acknowledge the limitations of our study as the SCM does not fully account for unobserved factors and possible idiosyncratic shocks that might have occurred around or after the Arab Spring.

A particular concern is the high level of oil prices in the years 2011 to 2013 relative to the previous decade. As we discuss in section 6, it is possible that this could have affected Synthetic

1. "Not since the collapse of the Berlin wall and the demise of the Soviet Union has change swept so suddenly across a geographical region" (e-International Relations 2011: 3).

Tunisia through asymmetric or non-linear effects on oil exporters and oil importers, even though Synthetic Tunisia, like actual Tunisia, was in approximate balance on its oil trade. Moreover, to the extent that the high oil prices of this period can be attributed to interruptions in supply associated with the Arab Spring, the control group may not have been immune to the shock as our methodology assumes. On the other hand, world oil production does not appear to have fallen significantly below trend after the Arab Spring. Increased output from Saudi Arabia compensated for reduced supply from Libya, so the role of the Arab Spring in the high oil prices is unclear. In our results, GDP per capita in Synthetic Tunisia follows a fairly smooth trend with no sign that 2011 marks a major economic shock caused by higher world oil prices.

The remainder of this paper is structured as follows. Section 2 presents the main political developments that happened in Tunisia in the aftermath of the Arab Spring. Section 3 briefly reviews the relevant literature on the economic cost of conflicts. Section 4 describes the empirical methodology and the data used while section 5 presents the results. This is followed by section 6, which includes some robustness checks. Section 7 determines the main channel through which the economy was impacted by the Arab Spring. Section 8 concludes.

## I. Major Political and Economic Developments in Tunisia after the Arab Spring

The Tunisian revolution[2] was sparked by the self-immolation of Mr. Mohammed Bouazizi, a street vendor, on December 17, 2010. Bouazizi's suicide was followed by a series of uprisings that spread quickly across Tunisia after 21 Tunisians were killed by government snipers in the province of Kasserine (Gelvin 2015). These uprisings, which demanded the departure of President Ben Ali, were successful in ousting him after the army stood down on January 13, 2011. Since then, Tunisia's political transition has experienced three distinct periods as documented by Kerrou (2013). The first phase stretched from January 14, 2011, when the reign of President Ben Ali came to an end after 24 years in power, to October 23, 2011, when a new National Constituent Assembly was elected. This period was characterized by the formation of a new government headed by Beji Caid Essabi and the election of a National Constituent Assembly.

The second phase, from 2012 until the end of 2013, was marred by a political crisis between the secular opposition represented by the National Salvation Front (NSF) and the Islamic-led government dominated by El-Nahda party. For example, in August 2012, thousands protested in Tunis, the capital of Tunisia, against the cabinet's decision to reduce women's rights. The tension intensified, however, in the aftermath of the assassination of Chokri Belaïd, an important figure of the Tunisian opposition, on February 6, 2013. This was followed by violent clashes between police and protesters when commemorating, on April 9, 2013, the martyr's day as well as the assassination of opposition figure Mohamed Brahmi. These events incited several strikes and calls for the government's resignation.

The third and final period was characterized by the ending of the political crisis and building the foundations of a sustainable democratic and inclusive political system. In October 2013, the El-Nahda party agreed to form a caretaker government of technocrats assigned with organizing new elections in 2014. As a result, a consensus was reached in December 2013 between the main civil society institutions and major political parties on a blueprint to accomplish a democratic transition process that included the nomination of a new non-politically affiliated government. The parliament approved a new constitution in January 2014 along with the formation a non-partisan technocratic government headed by Mehdi Jomaa. Then, in October 2014, parliamentary elections took place and Nidaa Tunis, the main secular party in Tunisia, secured the most seats followed by El-Nahda party. The transition to a democratic system was finalized in December 2014 when presidential

2. The Tunisian revolution is also referred to as the "Jasmine" revolution.

elections were held and Beji Caid Essebsi, the candidate of Nidaa Tunis, won the presidential elections against Mouncef Al-Marzouki.[3]

From an economic perspective, the drop in growth rates induced the central bank to adopt an expansionary monetary policy aimed at boosting economic growth by: (i) lowering its key interest rate by 100 basis points (bps) between May and September 2011; (ii) reducing the reserve requirement ratio of commercial banks from 12 to 2 percent; and (iii) giving US$ 2.6 billion to commercial banks in order to boost liquidity. From the fiscal side, the government implemented a 4.7 percent increase on civil servants' wages in 2011 while security forces were provided with additional benefits. As a result, the wage bill increased as a share of GDP from 10.7 percent in 2010 to 12.4 percent in 2013. Moreover, transfers and subsidies increased from 3.6 percent of GDP prior to the revolution to 7.6 percent in 2013.

In addition to the high youth unemployment rate (27 percent in 2010) and large regional disparities, the Tunisian economy was particularly plagued by high levels of corruption prior to 2011. According to Rijkers et al. (2014: 24), "Enterprises with direct ownership links to the Ben Ali family confiscated in the aftermath of the revolution accounted for 3% of all private sector output and appropriate approximately a fifth of all private sector profits. The disproportionate aggregate contribution of Ben Ali firms reflects their superior performance." Despite establishing a Good Governance and Anti-Corruption Commission in the new constitution that was ratified in 2014, corruption seems to have escalated following the uprisings. A recent poll by Transparency International (2016) reveal that 64 percent of Tunisians saw a rise in corruption compared to the previous year.

## II. Literature Review

Dating back to the 19th and 20th centuries, researchers have been interested in understanding the relation between economic dynamics and conflict. For example, von Clausewitz (1812) focused primarily on the relation between economic conditions and the capacity to prosecute a war while Lenin (1916) looked at the relation between fragile economic fundamentals and the probability of a conflict. While the political turmoil in Tunisia was not an armed conflict, estimating the economic impact of lower-level internal conflicts belongs to the same strand of literature as quantifying the impact of large-scale civil wars. According to Skaperdas et al. (2009), strikes, protests, and road blockades, which all fall under the category of low-level conflicts, are common examples of conflicts that could have disruptive impacts on the economy similar to those of armed conflict. Empirical research in this field is divided into two closely related categories: (i) the causes/correlates of conflicts[4]; and (ii) the economic consequences of conflicts. For the purpose of this paper, we will briefly review the literature on the latter.[5]

The literature regarding the economic cost of conflicts originated with the work of Organski and Kugler (1977), who examined the impact of World Wars I and II on European economies. Since

3. The relation between economic development and democratization is one of the most studied issues in the political science literature. Boix (2003), Boix and Stokes (2003), and Epstein et al. (2006) have all argued in favor of the modernization theory: higher income per capita causes political regimes to transition to democracies. On the other hand, Przeworski (2000) argued that "democratic transitions occur randomly, but once there, countries with higher levels of GDP per capita remain democratic" (Epstein et al. (2006, p. 551). In the case of the Arab Spring, we favor the latter explanation as Tunisia, which, in 2010 had a GDP per capita of US$ 10,768, and Yemen, which in the same year had a per capita GDP of US$ 3,663, were both under similar dictatorships.

4. Extensive reviews of the theoretical methodologies used in the literature to model the causes of conflicts can be found in chapter 3 of Blattman and Miguel (2010) and chapter 3 of Collier and Hoeffler (2007a).

5. For more details about the literature tackling the causes of civil wars, the reader is referred to Sambanis (2001), Collier and Hoeffler (2004), Fearon (2004), Sambanis and Hegre (2006), Buhaug and Gleditsch (2008), and Bleaney and Dimico (2011) among others. A recent survey of the causes and correlates of civil wars can be found in chapter 9 of the Oxford Handbook of the Economics of Peace and Conflict (2012).

then, an extensive literature has emerged trying to quantify the impact of conflicts on economic outcomes across different countries and periods. Different techniques have been adopted in the literature to calculate the economic costs of conflicts.[6]

The cost accounting method is based on summing all the direct and indirect costs of conflicts. Examples are Bilmes and Stiglitz (2006), who used it to estimate the economic cost of the Iraqi war for the United States, and Arunatilake et al. (2001), who applied it to the Sri Lanka civil war from 1984 to 1996. Regression methods have been applied in various ways. Venieris and Gupta (1986) and Alesina and Perotti (1996) investigated the effect of measures of social and political instability on savings and investment respectively. Cross-country panel data have been used by Collier (1999), Blomberg et al. (2004), and Hoeffler and Reynal-Querol (2003) to estimate the impact of conflict on GDP growth. Time series methods such as Vector Autoregression (VAR) models have been employed by Enders and Sandler (1991) to estimate the impact of transnational terrorist attacks on the number of tourist arrivals in Spain between 1970 and 1988. Finally, Besley and Mueller (2012) relied on a Markov switching model to quantify the impact of peace dividend in Northern Ireland proxied by changes in house prices.[7]

In recent years, a new methodology, called the Synthetic Control Method (SCM), has been used to estimate the impact of conflicts. In our context, the SCM involves the choice of a synthetic control, constructed as a weighted average of other countries selected to resemble as closely as possible the pre-shock features of Tunisia, to estimate what would have happened to the Tunisian economy in the absence of the Arab Spring. Abadie and Gardeazabal (2003) were the first to use this methodology in order to quantify the output forgone due to conflicts. Specifically, they analyzed the economic costs of the conflict of the Basque region of Spain from 1975 to 1997 by constructing a synthetic region composed of two other Spanish regions (Catalonia and Madrid) as a counterfactual. Based on this counterfactual, they concluded that per capita GDP in the Basque region fell by around ten percent compared to what would have been the case if the conflict did not occur. For recent applications of SCM to a variety of issues, see Abadie et al. (2010), Billmeier and Nannicini (2013), Campos et al. (2014), and Abadie et al. (2015).

Two recent studies have attempted to quantify the impact of the Arab Spring.[8] The World Bank (2013) used a VAR model to examine the impact of the Syrian conflict (captured by an exogenous dummy variable) on the Lebanese economy between 2012 and 2014. They found that investment and consumption dropped 1.2 and 2.6 percent, respectively, as a result of the Syrian conflict. Second, Ianchovichina and Ivanic (2014) examined the economic effects of the Syrian war and the rise of the Islamic State on Egypt, Iraq, Jordan, Lebanon, Syria, and Turkey. In particular, they employed a global, computable general-equilibrium model to quantify the output lost due to trade disintegration as a result of the Arab Spring. Their simulations suggested that all six countries were adversely impacted by these conflicts, with Syria and Iraq bearing the brunt of the losses.

## III. Methodology

In this section, we present the main building blocks of the SCM, which we will adopt to estimate the economic cost of the Arab Spring on Tunisia's economy. After that, we describe the data.

6. Extensive reviews of the different techniques are provided by De Groot et al. (2009), Gardeazabal (2010), and Skaperdas et al. (2009).

7. In addition to the econometric techniques, the Institute for Economics and Peace (IEP 2013) and Fearon and Hoeffler (2014) used other methods to estimate the economic cost of conflicts.

8. Regarding the causes of the Arab Spring, Campante and Chor (2012) found evidence that the expansion of education in the Arab world have contributed to the uprisings. In addition, Arampatzi et al. (2015) found that life dissatisfaction appears to have played a significant role in the outburst of the Arab revolutions.

*Theoretical Basis*

The SCM, as developed by Abadie and Gardeazabal (2003) and Abadie et al. (2010),[9] creates a synthetic control (counterfactual), as a weighted average of other control units (representing countries, states, or regions) that were not affected by the treatment (representing shocks, events, or interventions), such that the outcome (in this case per capita GDP) of the synthetic control and that of the treated unit are the same during the pre-treatment period. After constructing the appropriate synthetic control, the causal impact of the treatment is simply calculated as the difference between the outcome of the treated and that of the synthetic control in the post-treatment period.

In our case, we have panel data from Tunisia and $R$ other countries from 1990 to 2013 (24 years), where $R$ is a set of countries that were not affected by the Arab Spring (hereinafter referred to as controls). The per capita GDP of the real Tunisia ($GDP_{tun;t}$) and of a Synthetic Tunisia ($GDP_{syn;t}$ ), constructed as described below, are compared for the period after the Arab Spring, and the impact in each year is measured as the difference between them.

The GDP per capita of Synthetic Tunisia is constructed as follows. Let $X_r$ be an $(x \times 1)$ vector of observed covariates (or characteristics) correlated with real GDP per capita (outcome of interest) for every control country $r \in R$.[10] In addition, consider a vector of weights $W = (w_1, \dots, w_R)$ such that $w_{r \in R} \geq 0$ and $\sum_{r=1}^{R} w_r = 1$. Each particular combination of $W$ will yield a different synthetic control for Tunisian GDP per capita during the pre-Arab Spring (pre-AS) period. Abadie et al. (2010) proved that when we choose $w^*_{r \in R}$ such that

$$\sum_{r=1}^{R} w_r^* \, GDP_{r;t} = GDP_{tun;t} \quad for\ t = 1990, \dots, 2010 \tag{1}$$

and

$$\sum_{r=1}^{R} w_r^* \, X_{r;t} = X_{tun;t} \quad for\ t = 1990, \dots, 2010 \tag{2}$$

the synthetic control estimator, $Impact_t, for\ t = 2011, \dots, 2013$ is unbiased. Therefore, the vector of optimal weights $W^* = (w_1^*, \dots, w_R^*)'$ assigned to each control country, $r \in R$, is estimated by minimizing the difference between the vectors of pre-AS (before 2011) covariates and real GDP per capita of Tunisia on the one hand and the respective vectors corresponding to the Synthetic Tunisia on the other hand.[11] In simple terms, the optimal Synthetic Tunisia should not only have the same GDP per capita as Tunisia during the pre-AS period but it should also have the same values of the covariates (in this case, measures of the structure of the economy and social indicators).

After finding the optimal weights that satisfy equations (1) and (2) the real GDP per capita for the Synthetic Tunisia is estimated using

$$\widehat{GDP}_{Synth;t} = \sum_{r=1}^{R} w_r^* \, GDP_{r;t} \quad for\ t = 1990, \dots, 2013. \tag{3}$$

9. For a detailed methodology of the synthetic control model and the corresponding mathematical derivations see Abadie et al. (2010).

10. The vector of covariates will be defined later in the Data section.

11. To perform this minimization, we used the "synth" package developed by Abadie et al. (2010) for STATA. A brief description on how to use the synth command can be found in the supplemental appendix available alongside the published version of this paper.

The impact of the Arab Spring on Tunisia's per capita GDP can then be calculated as follows:

$$Impact_t = GDP_{tun;t} - \widehat{GDP}_{Synth;t} \; for \; t = 2011, \ldots, 2013. \quad (4)$$

In other words, the economic impact of the Tunisian revolution is equal to the difference, over the period 2011-2013, between the actual Tunisian GDP per capita and the estimated counterfactual GDP per capita had the Arab Spring not happened.

Before proceeding to describe the data, we should note that SCM depends on the following four assumptions. First, the exogenous shock affecting the treated unit should have no impact on the outcome of the control units during the post-treatment period, otherwise we will have a biased estimate. Second, and in order to control for possible unobserved factors affecting the outcome variable, Abadie et al. (2010) argue that increasing the number of pre-intervention periods reduces the likelihood of a bias stemming from unobserved variables. Third, the shock itself must, by definition, be exogenous and largely unexpected ex-ante, otherwise there might be some anticipation effects resulting in reverse causation (Billmeier and Nannicini- 2013). Fourth, and foremost, the synthetic control should have, approximately, the same structural characteristics (predictors of the outcome variable) as the treated unit during the pre-treatment period. If potential control units are not structurally similar to the treated unit we are interested in, then any difference between the outcome of the two series (treated and its synthetic counterpart) may only be due to structural breaks rather than from the exogenous shock itself (George and Benet [2005[ and Geddes [2003]).

Compared with traditional empirical methods used in the literature to estimate the economic impact of conflicts/revolutions, the SCM has several advantages. First, the SCM can be used in situations where time series regressions (VAR or VECM models) fail due to data limitations such as a relatively small number of time series observations. For example, in our case, we only have quarterly data for Tunisian GDP from Q1-2000 to Q4-2014, which only gives us 60 observations. The SCM method overcomes this problem. Second, and in contrast to constructing counterfactuals based on linear trends or using forecasts, counterfactuals constructed using the SCM capture global economic shocks that may occur in the post-treatment period. Third, Abadie et al. (2010) showed that the SCM is a generalization of the Difference-in-Difference (DiD) method used in micro-econometrics to evaluate the impact of a treatment on an aggregate outcome. However, unlike DiD, which only accounts for time-invariant effects, the SCM captures the effects of time-changing unobservable variables.

### *Data*

To construct Synthetic Tunisia, we use country-level panel data for Tunisia and all the other 182 countries available in the 2015 version of the World Development Indicators (WDI) published by the World Bank from 1990 to 2010.[12] Given that the Gross Domestic Product (GDP) per capita is recognized internationally to be the best reliable measure of the state of the economy, it will be used as the outcome variable. In particular, we use the GDP per capita adjusted to PPP at 2011 constant prices, which we refer to in the rest of the paper as GDP per capita also downloaded from the WDI database.

12. Ideally, we would have restricted our set of potential control units to countries in the MENA region that share similar characteristics with Tunisia (such as language, culture and weather). However, this is not feasible as most MENA countries have been impacted by the Arab Spring, and, therefore, we would not be able to construct a synthetic Tunisia. Consequently, our set of controls consisted of the global sample of economies, "as this helps to regain comparable GDP levels in the comparison countries" (Billmeier and Nannicini 2013: 992).

As explained earlier, suitable control countries should not have been exposed to a major exogenous shock from 2011 onwards, otherwise these may impact the per capita GDP path of the Synthetic Tunisia, leading to a biased estimate. For that reason, we exclude from our sample: (i) countries that were impacted, directly or indirectly, by the Arab Spring; (ii) countries that were hit by an unexpected exogenous shock (such as natural disasters, conflicts, or adverse economic spillovers from neighboring countries) after 2010; and (iii) countries that had to be bailed out to avoid a complete collapse of their economies such as Cyprus and Greece. For a list of the 32 omitted countries and a brief explanation on why we excluded them, we refer the reader to table A.1.[13] In addition, 36 countries were excluded from our sample of controls as a result of missing data in some of the covariates we use in the analysis (more details about the choice of covariates are presented in the paragraph below). Consequently, our final set of controls consists of 114 countries listed in table S.2 of the supplemental appendix.[14]

As previously discussed, and in addition to having approximately the same GDP per capita, the constructed Synthetic Tunisia should also have similar economic fundamentals to Tunisia prior to the Arab Spring (equation 2). In this case, we require Tunisia and its synthetic counterpart to have approximately the same structure in terms of the composition of expenditure[15] (consumption, investment [denoted as GCF], imports and exports) and value added[16] (value added of the agriculture, industry, and services sectors), all as a share of GDP, in the pre-treatment period. We also require Tunisia and its synthetic counterpart to have a similar level of life expectancy at birth and secondary school enrollment rate, which are both components of the widely used Human Development Index.[17] Data for all the covariates were downloaded from the World Bank WDI database. For each covariate, except for the human development indicators (life expectancy at birth and secondary school enrollment)[18] we use two values: the 1990-2000 average and the 2001-2010 average. The rationale behind this division is to ensure that the constructed Synthetic Tunisia does not only have the same average economic fundamentals as Tunisia during the whole pre-AS period but also a similar dynamic structure over time. If, on the other hand, we use the 1990-2010 averages we could end up choosing countries that had a different economic evolution compared to Tunisia, hence leading to biased estimates. Finally, and in order to maximize the goodness of fit of the Synthetic Tunisia with the actual Tunisia during the pre-AS period, we add to our set of covariates the average GDP per capita during the following periods: 1990–1994, 1995–1999, 2000–2004 and 2005–2010.[19] Table S.1 in the supplemental appendix provides a definition and the source of each

13. All tables are available in the appendix.

14. The supplemental appendix can be found in the published version of this paper.

15. According to the expenditure approach: $GDP = Consumption + Investment + Exports - Import$. Note that consumption accounts for both private and government components.

16. According to the value added (output) approach: $GDP = Value\ added\ (Agriculture + Industry + Services)$.

17. We also experimented with additional variables that capture institutional factors (ICRG and the Polity2 Indices) to test the robustness of our results, but their addition did not alter our result substantively, as illustrated in figure S.1.

18. The within variation of the life expectancy variable during the pre-revolution period (1990-2010) is only two years, meaning that this variable did not witness a significant variation across time. Hence, taking the average would be sufficient. Regarding the secondary school enrollment variable, we attempted to divide our sample into two subsamples (1990-2000 and 2001-2010). However, we noticed that, for many countries, data for this variable was missing during the first subsample, and, as a result, many countries would have been dropped from the analysis leading to a significant loss of data. For that reason, we considered the average over the whole pre-revolution period (1990-2010). This rationale also applies to all the other covariates.

19. The use of period averages as covariates is a common technique followed by most researchers that employed the Synthetic Control Methodology (Abadie and Gardeazabal [2003]; Abadie et al. [2010]; Campos et. al [2014]; Abadie et al. [2015] and Gobillon and Magnac [2015]; among others). Moreover, in a recent paper, Klaus et al. (2016) showed theoretically and empirically that, when using the SCM, we cannot use all the lagged variables of the outcome

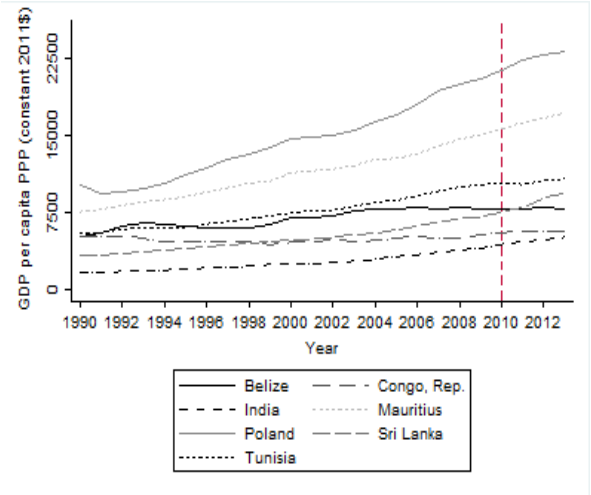
variable used, while table S.2 displays the variables' average corresponding to each country in the set of 114 donor controls.

## IV. Estimating the Economic Impact of the Arab Spring

### *Empirical Results*

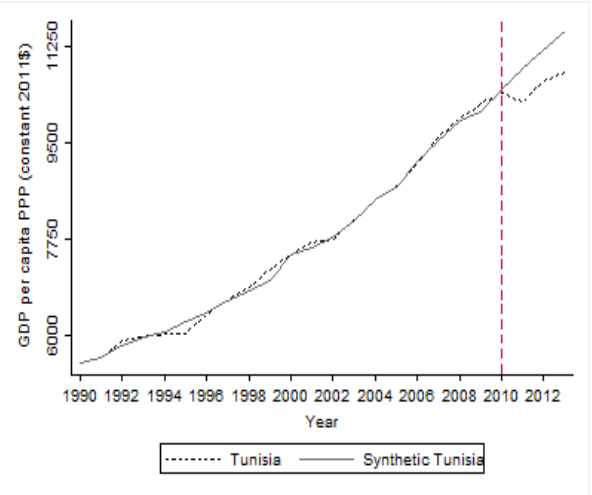
Table A.2 shows that Synthetic Tunisia is best reconstructed as a weighted average of 14 countries with Poland, Republic of Congo, Sri Lanka, India, Mauritius, and Belize having the highest weights. Figure 1 illustrates the GDP per capita of Tunisia and these six other countries over time.[20] Table A.3 displays the average pre-2011 values of the variables of interest for Tunisia, Synthetic Tunisia, and the simple average of the 114 countries in the set of control countries. Synthetic Tunisia approximates the pre-2011 values of the GDP per capita covariates for Tunisia much more closely than the average of the 114 countries. Indeed, Synthetic Tunisia is very similar to actual Tunisia in terms of pre-2011 per capita GDP, the respective shares of investment (GCF), consumption, imports, exports, agriculture, service in total GDP, and life expectancy at birth as well as the secondary school enrollment rate. In general, table A.3 suggests that Synthetic Tunisia, constructed using the SCM, has almost the same economic and social structure as the actual Tunisia during the pre-2011 period.

Figure 1. GDP per capita: Tunisia and countries with highest six weights in Synthetic Tunisia.




Source: World Development Indicators.

Figure 2. GDP per capita: Tunisia vs Synthetic Tunisia.




Source: Authors' Calculations.

Figure 2 depicts the paths of per capita GDP of actual and Synthetic Tunisia, which are very similar up to 2010 but diverge markedly thereafter. In particular, each Tunisian citizen is estimated to have lost, on average, US$ 600 (5.5 percent of GDP per capita), US$ 574 (5.1 percent of GDP per capita)

variable (in our case per capita GDP) as this will render the other covariates irrelevant, leading to severe biases in the estimated impact of the treatment.

20. From figure 1 we observe that Sri Lanka's per capita GDP was increasing rapidly after 2009. This improvement in economic activity was mainly driven by the reconstruction efforts and increased consumption following the 26 year war that ended in 2009. While this fast growth, which averaged 6.4 percent between 2009 and 2013, may bias upward our results as it was not purely driven by structural economic activity, our results are not affected by excluding Sri Lanka from our sample (see the robustness analysis in section V below).

and US$ 735 (6.4 percent of GDP per capita) by 2011, 2012, and 2013, respectively.[21] In section 0, we apply standard placebo tests to these results and in section 6 we perform a variety of other robustness tests and discuss some of the limitations of the SCM.

It is important to bear in mind, however, that these estimates also reflect some mitigating measures taken by the local authorities and the international community in order to boost economic activity in the aftermath of the Arab Spring. For instance, the Central Bank of Tunisia (CBT) adopted an expansionary monetary policy by: (i) lowering its key interest rate by 100 basis points (bps) between May and September 2011; (ii) reducing the reserve requirement ratio of commercial banks from 12 to two percent; and (iii) gave, in 2011, TD 3.6 billion (US$ 2.6 billion) to commercial banks in order to boost liquidity. At the same time, the government pursued an expansionary fiscal policy in the aftermath of the revolution (more details in section 0). In addition, the international community stepped up its assistance to Tunisia, including a US$ 500 million loan approved by The World Bank board in June 2011 and a US$ 1.74 billion Stand-by-Agreement signed with the IMF two years later.

*Testing the Validity of the Results*

Unfortunately, we cannot refer to standard p-values to make statistical inferences about our estimates given that we are not using a regression estimation technique, and our sample size is relatively small. Instead, we use "Placebo or Falsification Tests," which are also known in the statistical literature by the name of "Randomization Inference Tests" (Bertrand et al. [2004]). In a general context, the rationale behind these tests is simple: when SCM is applied to units (countries) that were not subject to the treatment (Arab Spring), we should not observe a significant divergence between the post-2010 outcomes for Tunisia and its synthetic counterpart. In essence, we want to examine whether repeating the synthetic control analysis for countries that, in 2011, were not subject to the Arab Spring would show the same negative shock to output as Tunisia. If this is the case, then the observed drop in Tunisia's per capita GDP cannot be attributed to the Arab Spring.

Figure 3 presents the results of the Placebo tests applied to the 114 countries in 2011. While the thick, black dotted line represents the previously estimated difference for Tunisia, the other different-colored lines are the difference between the GDP per capita corresponding to each of the 114 control countries and their respective synthetic counterparts constructed between 1990 and 2010. We can see from Figure 3 that the post-2010 lines for countries other than Tunisia are quite widely spread, suggesting at first glance that the negative impact generated by the Tunisian revolution was not unusually large. However, for many countries, the fit of the synthetic to the actual before 2010 is much worse than in the case of Tunisia. Consequently, we look at a normalized ratio, where we divide, for each placebo that exhibited a negative difference after 2010, the root mean square post-2010 difference by the root mean square pre-2010 difference for the same country.[22] The higher is this normalized ratio the larger is the negative impact of a shock after 2010 relative to the pre-2010 average. Table A.4 shows that Tunisia had an estimated normalized ratio

21. We do not think our results suffer from an endogeneity problem as: (i) the uprisings were unanticipated ex-ante (Gelvin, 2015); and (ii) the economic performance in Tunisia was relatively good prior to the revolutions. Indeed, "Tunisia enjoyed a 4.4 percent average annual growth in GDP over 2000-2010, placing the country among the leading performers in the MENA region. This level of growth was accompanied by rapid poverty reduction from 32 percent in 2000 to 16 percent in 2010 using the national poverty line. Similarly, the percentage of the population below the international US$2 per day (PPP) poverty line dropped from 12.8 percent in 2000 to 4.3 percent in 2010." (World Bank, 2014, p. 24). However, we should note that despite the overall improved economy, growth was not totally inclusive as Rijkers et al. (2014) found that firms connected to Ben Ali and his family outperformed their competitors (higher employment, output, and profits) mainly due to preferential regulatory treatments.

22 The difference for country $i$ during $s = 1, \dots, T$ is the Root Mean Squared Error (RMSE) calculated as $\sqrt{\frac{1}{T}\sum_{s=t}^{T}(y_s^i - y_s^{synth})^2}$.

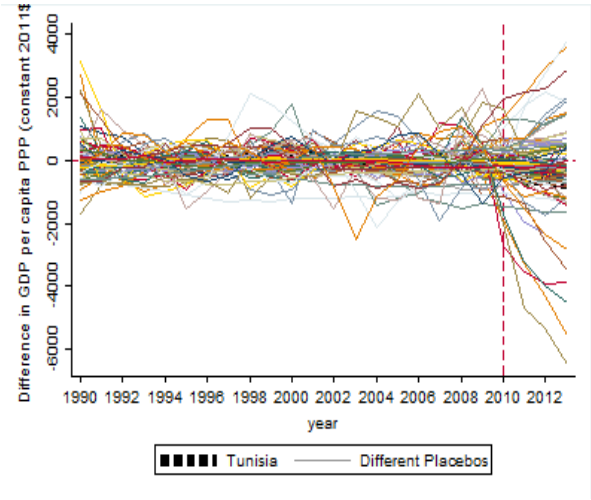
of 8.46 which is the second highest among all the 115 countries and is only surpassed by Antigua and Barbuda which recorded a ratio of 8.52. According to the IMF (2012), Antigua and Barbuda's economy contracted by 5.5 percent in 2011 as a result of the 2007-08 financial crisis. Hence, our original results are unlikely to have been driven by factors other than the Jasmine revolution.

In addition, we use another simple, yet novel, method to test the significance of our results. In particular, we calculate

$$y_t = \frac{Actual\ GDP\ per\ Capita_t}{Synthetic\ GDP\ per\ Capita_t} \quad for\ t = 1990, \ldots, 2013 \tag{5}$$

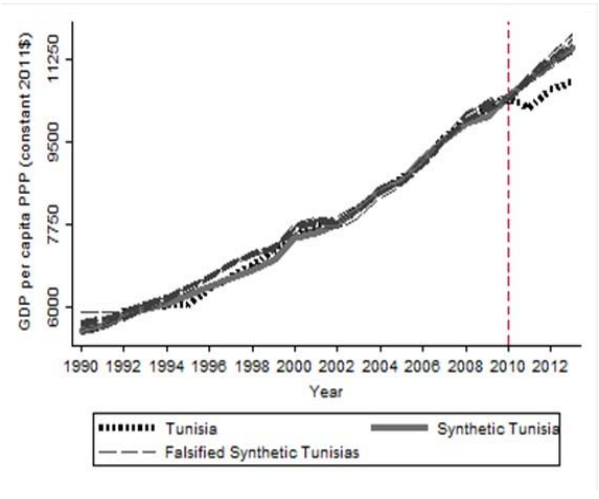
for Tunisia and each of the 114 control countries and then regress this variable on a constant and a dummy variable called $AS_t$ that takes the value 1 for 2011, 2012, and 2013 and 0 otherwise. In each of the 115 individual regressions, we are interested in the magnitude and sign of the t-statistic corresponding to the $AS_t$ dummy. The statistical significance of this dummy variable is a test of whether a country was subject to a significant shock to its GDP relative to its synthetic counterpart in the period 2011-2013. In particular, largely negative t-statistics suggest that events that occurred between 2011 and 2013 had significantly negative impacts on the respective economies. The results reported in table A.5 show that, with the exception of Spain, the Tunisian version of regression (5) yielded the largest negative t-statistic on the $AS_t$ dummy (-8.7), confirming the salience of our results.

Figure 3. Placebo Tests.




Source: Source: Authors' Calculations.

Figure 4. GDP per capita: Tunisia vs Synthetic Tunisia.




Source: Authors' Calculations.

## V. Robustness Checks

To assess the effectiveness of our results and to make sure that the GDP per capita of the constructed Synthetic Tunisia is not driven by only one country, we perform a robustness check according to the following procedure. First, we restrict our sample to all the control countries that were assigned a non-zero weight in the baseline Synthetic Tunisia.[23] Second, we construct several Synthetic Tunisias by omitting these countries one at a time while keeping the others in our set of

23. The control countries with non-zero weights are presented in table A.2.

controls. As noted by Abadie et al. (2015), the intuition is to check if the results are sensitive to the omission of any particular country. Figure 4 illustrates this sensitivity analysis and shows that excluding any of these control countries does not alter the path of the baseline Synthetic Tunisia after 2010, meaning that our results are fairly robust as they are not driven by one particular country.

Another falsification (or fake) test that can be used to determine the reliability of our results is "time series placebos." In this test, we replicate the synthetic control analysis for years earlier than 2011 in which the Tunisian economy did not actually experience any structural break (or shock) and ask the following question: do we observe a significant drop in the actual Tunisian per capita GDP compared to its synthetic counterpart after this fictitious treatment? If the answer to this question is yes, this means that our estimated results found earlier (illustrated in Figure 2 may have been driven by factors other than the Arab Spring itself. In contrast, a "no" answer supports our conclusion that the Arab Spring caused the observed economic slowdown during the period 2011–2013. Specifically, we replicate the same SCM procedure followed above by constructing Synthetic Tunisia using, instead of 1990 to 2010, the period 1990 to 2000 as a pre-shock period. In fact, we chose 2000 to be the end point given that Tunisia was not subject to any structural shock in the early 2000s. As illustrated in figure S.2 in the supplemental appendix, we find that Tunisia's per capita GDP did not drop relative to its synthetic counterpart in the aftermath of 2000.

However, given the high dependence of Tunisia's economy on economic activity in the Euro area,[24] one might argue that the sluggish economic activity in Tunisia after 2011 was driven by weaker demand from the Euro-area. In order to test for that, we replicate the SCM analysis for 2008, the year when the Euro area witnessed a sharp deceleration in its economic activity as a result of the 2007–08 financial crisis. We notice from figure S.3 in the supplemental appendix that Tunisian GDP per capita was almost unchanged relative to its synthetic counterpart (Synthetic Tunisia 2008) in the aftermath of the financial crisis that brought havoc to economies in the Euro area. This confirms our main finding that the observed drop in per capita GDP after 2011 was primarily caused by the Arab Spring rather than the deceleration in the Euro economy.

In addition, we conduct two additional tests. First, we remove the Republic of Congo, Poland, and Sri-Lanka from our pool of potential controls as these countries experienced major shocks in the run-up to the Arab Spring, possibly affecting the structure of the Synthetic Tunisia. In particular, Poland accessed the EU in 2004 while the Republic of Congo and Sri-Lanka were both ravaged by armed conflicts during the last two decades. Second, using five-year averages for GDP per capita may mask different underlying trends between the control countries and Tunisia. To address this we shorten our time span for the real GDP per capita covariate and consider three-year period averages instead of five. Figure S.4 in the supplemental appendix plots the GDP per capita for: (i) actual Tunisia (dotted blue line); (ii) baseline Synthetic Tunisia (straight red line); (iii) Synthetic Tunisia after omitting the three countries (straight black line); and (iv) Synthetic Tunisia after taking a three-year period (dashed green line).[25] The results illustrate that, in the first test, the GDP per capita of the Synthetic Tunisia follows closely its baseline counterpart even though its level is slightly lower since 2009 (i.e., prior to the Arab Spring) likely reflecting the fact that Tunisia was not severely hit by the 2007–08 financial crisis in contrast to the other control countries. Meanwhile, the black line representing the Synthetic Tunisia of the second test, has approximately

24. For example, the correlation between the growth rate of Tunisian exports and economic growth in the Euro area was 0.64 between 1998 and 2012.

25. The covariate averages of the Synthetic Tunisias developed using test 1 and 2 are reported along with the weights assigned to each control country composing the respective counterfactual in table S.3 and table S.4 of the supplemental appendix, respectively. Note that, with the first test, Angola and Malaysia have replaced the Republic of Congo, Poland, and Sri Lanka as control countries. However, India, Mauritius, and Belize, which formed the core of the baseline Synthetic Tunisia, were assigned even higher weights, meaning that the composition of the baseline synthetic was not particularly changed.

the same level before and after 2011, implying that our baseline results were not affected by different trends.

Another robustness check is to use a different methodology in order to quantify the impact of the Arab Spring (AS) on Tunisian GDP per capita. In particular, we estimate the following Autoregressive Distributed Lag (ADL [1]).

$$\Delta \log(\text{Tunisia}_t) = c + \beta_1 . \Delta \log(\text{World}_t) + \beta_2 . \Delta \log(\text{Tunisia}_{t-1}) + \beta_3 . \Delta \log(\text{World}_{t-1}) + \boldsymbol{\gamma}'[\boldsymbol{AS}] + \mu_t \quad (6)$$

where $\Delta\log(\text{Tunisia}_t)$ is the log difference of Tunisia's GDP per capita and $[\boldsymbol{AS}]$ is a $(3\times1)$ vector of individual time dummies for 2011, 2012, and 2013 that take the value 1 for the corresponding year and 0 otherwise. To capture the impact of changes in the global economy on the Tunisian economy, we added to our model $\Delta\log(\text{World}_t)$, which denotes the log difference of the World's GDP per capita. Since the difference of Tunisia's GDP per capita is a generated variable, we bootstrap our standard errors with 1000 replications.[26] The per capita GDP data for both Tunisia and the World, which run from 1990 to 2013,[27] were downloaded from the WDI database. In equation (6) the coefficients of interest are those in vector $\boldsymbol{\gamma}$ which capture the impact of the Arab Spring on Tunisia's per capita GDP growth in each year following the uprisings. The estimation results presented in table A.6, show that, of the year dummies, those of 2011 and 2013 are negative and statistically significant at the five percent level. In terms of magnitude, growth of GDP per capita (in PPP terms) dropped by 5.8 and 1.8 percentage points in 2011 and 2013, respectively. This compares to a 5.2 and 1.4 percentage point drop in 2011 and 2013 when using the Synthetic Control Method.[28] Overall, the SCM and regression results corroborate each other, because they suggest that the major impact of the Arab Spring on the Tunisian economy happened in 2011, but this impact is carried forward in 2012 and even amplified in 2013 as the Tunisian economy did not catch up with its synthetic counterpart (as evident by the SCM results).

Finally, there is the issue of the high level of oil prices after 2010 relative to previously. Oil price fluctuations have opposite effects on net exporters and net importers of oil. Although Tunisia's net oil exports are small, the same might not be true of Synthetic Tunisia, because we have not used this as a criterion for choosing the weights. Indeed, Synthetic Tunisia is a weighted average of some countries that have considerable oil imports and two (Republic of Congo and Trinidad and Tobago) that are major oil exporters as can be seen from the data presented in table S.6 of the supplemental appendix, but, in fact, the weighted average is not too different from that of actual Tunisia.[29] For example, net fuel exports for Tunisia in 2010 were -1.1 percent of GDP compared to 1.6 percent for its synthetic counterpart.[30] Therefore, there was a 2.7 percentage point (pp) difference even before

26. We should note that only 278 replications were successful. This is likely due to the fact that we had three one-year dummies. In particular, it is highly likely that, at any random draw, at least two of the three individual dummies will only be composed of 0 observation, hence leading to perfect multicollinearity. For additional testing we also employed the jackknife resampling technique. As reported in table S.5 in the supplemental appendix, the results magnitudes and statistical significance of the estimated coefficients remained unchanged.

27. GDP per capita (in PPP terms) for Tunisia and the World is only available since 1990.

28. The 5.2 percentage point estimate for 2011 is calculated as the difference between the GDP per capita growth rate of actual Tunisia in 2011 (-1.7 percent) and that of its synthetic counterpart calculated (3.5 percent) estimated using the SCM method. For 2013, the GDP per capita growth rate of actual Tunisia was 1.4 percent compared to 2.9 for its synthetic counterpart.

29. As can be seen from table S.6, net fuel exports data are not available for each country and year. For instance, it is missing for 14 out of 21 years for the Republic of Congo. In a general context, the SCM algorithm overcomes this data problem by taking the average of any non-missing values during the pre-intervention period. In our specific example, the corresponding average for net fuel exports between the period 1990-2000 will be the average values between 1993 and 1995, which equals 46.46 percent. While this is not perfect, it allows us to avoid losing valuable data and maximize our sample size (Billmeier and Nannicini, 2013).

30. The 1.6 percent representing net fuel exports (as a ratio of GDP) of Synthetic Tunisia in 2010 was calculated as follows. We multiplied the net fuel exports data for each of the 14 countries reported in table S.6 of the supplemental

the uprisings occurred. Repeating this same exercise for the years following the Arab Spring, we observe that this difference initially increased to 4.7 pp in 2011 and then dropped back to 3.8 and 3.3 pp.

It is a useful robustness test to add net fuel exports as a share of GDP to our initial set of covariates.[31] Because of the importance of the mining sector in the Tunisian economy (which accounted for 9.2 percent of total exported goods in 2010), we also add ores and metal exports (as a ratio of GDP) as a covariate.[32] Table A.7 reports the covariate averages of actual Tunisia and its synthetic counterpart after adding these two variables along with the corresponding weights assigned to each control country.[33] We notice that the set of control countries composing the new Synthetic Tunisia has changed slightly relative to the baseline. One major reason for that is data limitation as eleven countries, including Uzbekistan, which had a 3.5 percent weight in the baseline synthetic, had to be omitted from the initial set of 114 controls because of the lack of data on net fuel exports. This change also reflects the fact that it was suboptimal to closely match the two additional covariates using the initial set of 14 countries.

However, none of the newly added countries (Guinea-Bissau, Grenada, Malaysia, and Zimbabwe) receive a weight greater than 1.5 percent. Furthermore, countries which were originally assigned a weight greater than ten percent in the baseline specification (India, Sri Lanka, Mauritius, and Belize) still account for a total of 60.8 percent of the newly constructed Synthetic Tunisia. These two observations suggest that the core structure of the baseline synthetic Tunisia was not significantly altered by the inclusion of additional variables. Consequently, we do not expect a major change to our baseline findings regarding the impact of the Arab Spring on the Tunisian economy. Indeed, Figure 5 below shows that, even after adding these two variables, the path of Synthetic Tunisia's GDP per capita (gray dashed line) is roughly the same compared to the baseline (black straight line), suggesting that our baseline results are robust to changing our set of covariates.

It is important to recognize the limitations of the SCM approach. Ideally, we need a longer pre-Arab Spring period than we actually have in order to reduce any possible omitted variable bias. Unfortunately, we could not do this because the earliest observation for our outcome variable (GDP per capita in PPP terms) is 1990. More fundamentally, the SCM depends on the right criteria being used to match the synthetic with the actual. Features of a country that are not easily quantifiable such as trade and labor market regulations, tax systems, and the relationship between business and the state, cannot easily be included. It also depends on the weighted average being an adequate measure of similarity, which it will not be if the effects of a variable (oil prices, say) are asymmetric between oil importers and oil exporters. Non-linearities may also be a problem since the fuel trade balance of major oil exporters is much further from zero than that of any oil importer. Finally, the SCM does not control for idiosyncratic shocks that may have impacted Tunisia or any control country differently after 2011. These limitations mean that it is important to test the robustness of SCM results thoroughly.

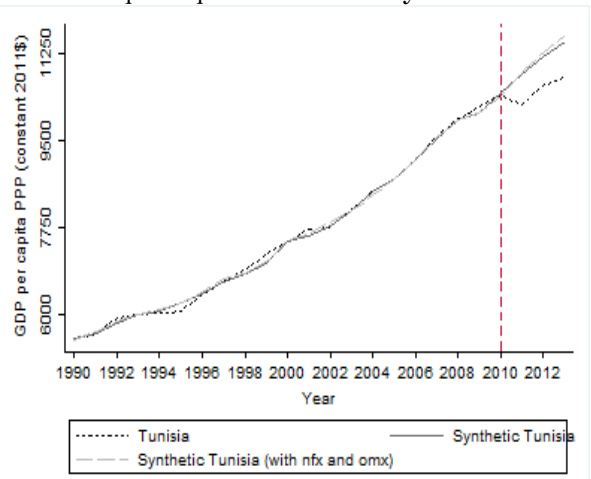
appendix (except for Uzbekistan and Trinidad and Tobago, which did not have completed net fuel exports data between 2010 and 2013) by their respective weights from table A.2 and then summed them up.

31. We are grateful to an anonymous referee for this suggestion.

32. The definition and source of the net fuel exports and exports of ores and metals can be found in table S.1 of the supplemental appendix.

33. We denote net fuel exports (as percent of GDP) and ores and metal exports (as a percent of GDP) by *nfx* and *omx*, respectively.

Figure 5. GDP per capita: Tunisia vs Synthetic Tunisia.




Source: Authors' calculations. Synthetic Tunisia (with nfx and omx) represents the baseline synthetic Tunisia after adding to the baseline the following variables (i) net fuel exports (% of GDP) and (ii) ores and metal exports (% of GDP).

## VI. The Main Channel of the Impact

Given the substantial negative impact of the Arab Spring on Tunisia, the question arises as to what was the main channel through which the impact occurred?

### *Stylized Facts in the Wake of the Revolution*

To better understand the channels through which the Arab Spring affected the Tunisian economy, we refer to the annual growth rate of the Gross Domestic Product (GDP) series from 2000 to 2013 published by the Tunisian National Institute of Statistics (TNIS). As illustrated in table A.8, investment was the main drag on economic activity after 2011 and its growth rate was largely impacted by the intensity of security and political developments between 2011 and 2013. More specifically, it dropped by 12.7 percent in 2011 when the Tunisian revolution erupted, grew by 6.1 percent in 2012 with the relatively improved security conditions, and then decelerated with only 0.2 percent growth in 2013 as the political crisis between the secular opposition and the Islamic brotherhood intensified. In addition to the observed drop in the level of investment, Burger et al. (2013) argued that the composition of foreign investment has changed as a result the increased political turmoil. In particular, they found evidence of lower investment inflows in the non-resource tradable sectors in contrast to investments in resource-rich sectors, which were found to be insensitive to political turmoil.

Furthermore, the revolution had an adverse effect on real exports through lower mining output and tourism inflows as illustrated in table A.9. The mining sector, which accounted for 9.2 percent of total exported goods in 2010 (pre-revolution), was hit severely in the aftermath of the revolution as protests by poor citizens demanding jobs and higher living standards paralyzed the phosphate industry in the city of Gafsa. Data published by the TNIS show that, in 2011, the value of mining exports plummeted by 39.7 percent due to a 56.6 percent drop in phosphate (DAP) exports. However, during 2011 the international price of DAP increased by 23.6 percent (from 500.6 US$/mt in 2010 to 618.8 US$/mt in 2011), meaning that the drop in DAP exports was driven by a reduction in the quantity supplied as a consequence of the uprisings. Indeed, "According to the

Compagnie des phosphates de Gafsa (CPG), phosphate production was only 2.5 million tons in 2011, compared to 8 million in 2010. The amount of phosphate produced fell to under 3 million" (African Development Bank 2012, 5). This has largely contributed[34] to the 4.3 percent contraction of total real exports in 2011. On the other hand, consumption growth did not witness a significant changing pattern after 2011.

*Empirical Results*

In order to determine which channel drove Tunisia's output to decline as a result of the Arab Spring, we employ the SCM methodology used above for each GDP component: Gross Capital Formation (CGF or Investment), Consumption, and Net Exports, all measured as a percentage of GDP.

We first start by constructing a counterfactual for CGF between 1996 and 2010.[35] Our set of covariates includes Foreign Direct Investment (FDI) and Broad Money as a ratio of GDP with the latter being a proxy for monetary policy that impacts investment. In addition, the long and protracted period of transition from an autocratic to a democratic regime created uncertainty about the future political and economic agendas (Pfeifer, 2015) and, as a result, investors' risk appetite may have been impacted. To account for this increase in uncertainty, which is argued to negatively impact investment,[36] we incorporate into our set of characteristics the Rule of Law Estimate[37] taken from the Worldwide Governance Indicators database (WGI) published by the World Bank.[38] Regarding consumption, our set of covariates is composed of: (i) remittances, which is found by Chami et al. (2008) to increase the consumption of domestic households; (ii) tax revenues which can be used as a proxy for domestic consumption; and (iii) government expenses for providing goods and services which controls for current government spending. Finally, and in order to create the synthetic counterpart of the Tunisian trade balance, we use the real effective exchange rate in addition to ores and metal exports and net fuel exports as covariates.

As illustrated in Figure 6a, consumption (as a ratio of GDP) for Tunisia surged above the value for its synthetic counterpart after 2011.[39] This increase was driven by a dramatic rise in government spending as a result of the fiscal expansion program adopted by the government in the aftermath of the uprisings that aimed at mitigating the impact of the revolution on its citizens and addressing their demands.[40] The wage bill increased as a share of GDP from 10.7 percent in 2010 to 12.4 percent in 2013. This increase was coupled with a significant rise in transfers and subsidies after the revolution.[41]

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34. $Contribution\ to\ total\ exports\ (t) = [growth\ rate\ (t) \times Share\ of\ total\ Exports\ (t-1)]/100$.

35. The starting period is 1996 and not 1990 because the rule of law estimate that we use as one of the characteristics to investment is only available since 1996.

36. Several scholars (Bernanke [1983], Barro [1991], Alessina and Perotti [1996], Pindyck and Solimano [1993], Bloom et al. [2007], and Julio and Yook [2012]; among many others) have argued that investment is negatively associated with uncertainty as it induces firms to postpone investment decisions in "anticipation of possible negative changes in the country's macroeconomic, taxation, or monetary policies, or in the regulatory environment in general" (Julio and Yook 2012: 49).

37. Table S.1 in the supplemental appendix provides a definition and the source of each variable used.

38. As a robustness test, we replaced the Rule of Law Index by the Government Stability component of the ICRG index as a measure of political instability. The results, presented in figure S.5 of the supplemental appendix, confirm the robustness of our finding.

39. For each variable in Figure 6 the dashed and straight lines represent Tunisia and Synthetic Tunisia, respectively.

40. According to a (2012) IMF report, the government recruited, on a net basis, 20 thousand new employees, which increased the total wage bill of the government by 14 percent in 2011. Furthermore, a 4.7 percent increase on civil servants' wages was implemented in 2011 while security forces were provided with additional benefits.

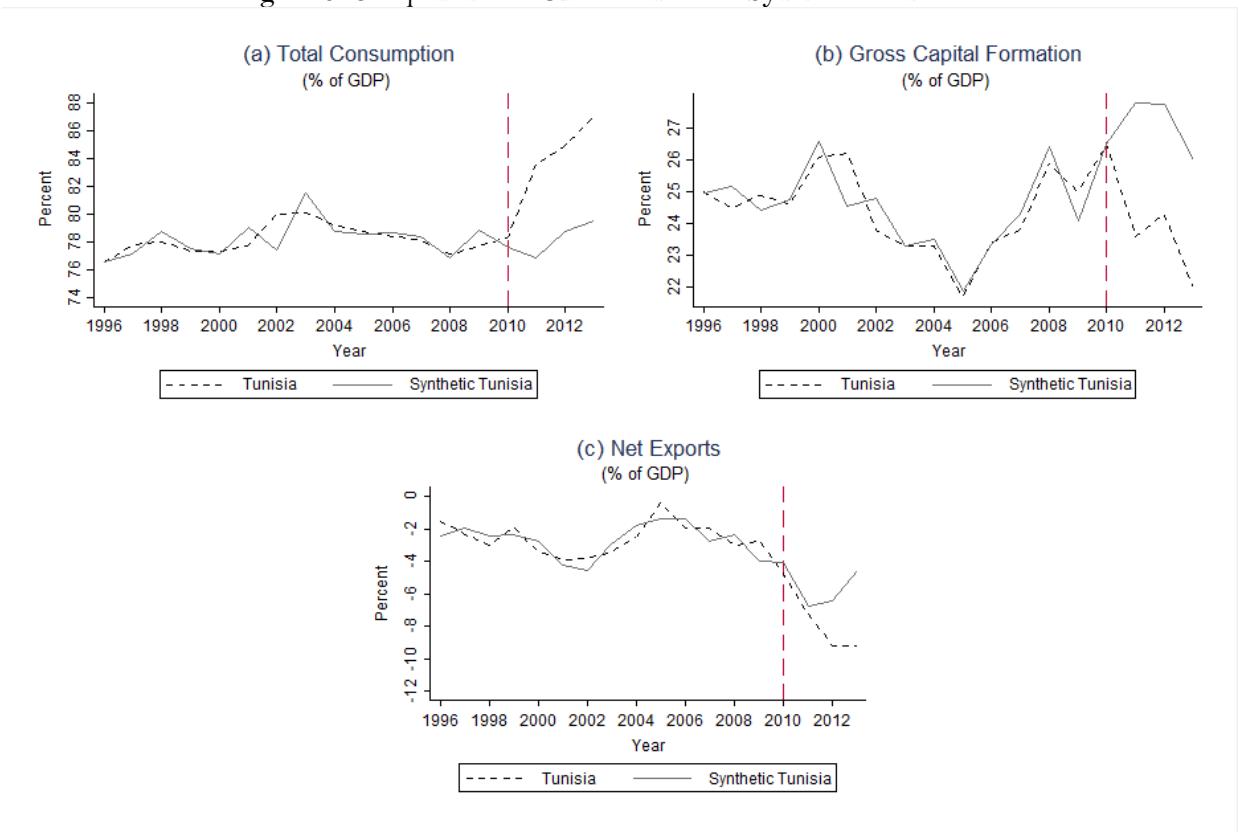
41. Many governments in the Middle East and North Africa region (Algeria, Bahrain, Egypt, Jordan, Kuwait, Morocco, Oman, and Tunisia) responded to the social demands in the onset of the Arab Spring by increasing fuel and food subsidies (World Bank, 2011, p. 14)(World Bank 2011: 14).

On the other hand, when looking at investment (GCF) in Figure 6b, we observe an opposite pattern with Tunisia's actual investment (as a percentage of GDP) plummeting compared to its constructed counterfactual since 2011, implying that investment in Tunisia was adversely impacted by the Arab Spring. In parallel, Figure 6c indicates that the actual trade balance deteriorated faster compared to its counterfactual without the Arab Spring. More specifically, Tunisia's investment (net exports) as a ratio of GDP was lower than that of its synthetic counterpart by an estimated 3.9 (2.6) percentage points on average between 2011 and 2013. As can be seen in table S.7 and table S.8 of the supplemental appendix, Tunisia had the second and first highest post-to-pre Arab Spring normalized ratio for investment and net exports, respectively, suggesting that the declines in these variables are unlikely to have been driven by issues other than the Arab Spring itself.

Overall, the results suggest that investment was the major channel through which the Arab Spring impacted the Tunisian economy, most likely due to the increased uncertainty associated with it. In particular, uncertainty may have induced firms to postpone investment decisions and reinforced investors' wait-and-see attitude. There was an unprecedented increase in the number of protests and riots in the country.[42] This led to fears of even greater conflict such as that which engulfed neighbouring Libya. Moreover, even if a worsening conflict could be avoided, there were policy uncertainties associated with the political deadlock between secularist and Islamic political leaders, some of whom wished to follow an Islamic economic model similar to the one attempted by the Muslim Brotherhood in Egypt. As a result, there was a succession of five governments between 2011 and 2013 and the drafting of a new constitution. Of course, we cannot conclusively establish that uncertainty was the most important factor that drove down investment. Another possibility is that the large drop in investment stemmed from a credit channel similar to the one that inhibited OECD countries after the 2008 global financial crisis. However, as noted at the end of section 0 above, the Tunisian Central Bank adopted an expansionary monetary policy aimed at boosting economic growth. Moreover, the Tunisian banking system is dominated by three large state-owned banks that were bailed out and encouraged to keep lending. Finally, Tunisian firms surveyed in the World Bank Enterprise Survey of 2013 cited political instability ahead of access to finance as the main constraint on their growth, a verdict supported by microeconometric analysis of data on firm sales growth from the survey (Matta 2016).

42. According to data collected from the ACLED database, the number of protests/riots that took place in Tunisia between 2011 and 2014 rose by more than eighteenfold compared to the period 1997-2010.

Figure 6. Components of GDP: Tunisia vs Synthetic Tunisia.




Source: Authors' calculations.

## VII. Conclusion

Notwithstanding the worldwide interest in the Arab Spring in general and the Tunisia revolution in particular, there are no studies that have quantified the impact of this largely unanticipated event on the Tunisian economy. This paper fills this research gap by quantifying the effect of the Arab Spring on the Tunisian macroeconomy from 2011 to 2013. To overcome the data limitation problems and to allow for time-changing unobservable variables, we use the Synthetic Control Method, constructing a Synthetic Tunisia (a weighted average of other countries selected to have a strong resemblance to Tunisia over the period 1990-2010) as an estimate of Tunisia in the absence of the Arab Spring.

Our results suggest that the Arab Spring had a negative effect on the aggregate economy with an estimated per capita reduction in output of US$ 600 (5.5 percent of GDP per capita) in 2011, US$ 574 (5.1 percent of GDP per capita) in 2012 and US$ 735 (6.4 percent of GDP per capita) in 2013. The estimates, which are robust to placebo tests and further sensitivity analysis, suggest that most of the impact occurred in the first year with limited further losses (but also no recovery) over the next two years. Our results are consistent with the literature on the growth dividends associated with regime changes, which finds a drop in growth rates during the early years of a political transition (see Freund and Jaud [2014]). We also find that investment was the main channel through which the economy was impacted.

Nevertheless, it is important also to recognize the limitations of the methodology, the most important of which is the assumption that the weighted average of any variable is a sufficient statistic to guarantee the similarity of Synthetic and actual Tunisia in any period. Because the countries that make up Synthetic Tunisia are a mixture of ones with higher and ones with lower

values of any variable than actual Tunisia, this may be an invalid assumption if the effects of these differences are non-linear or asymmetric as we have discussed above in relation to oil prices.

This paper draws a broad picture of the impact of the Arab Spring on Tunisia's economy. However, it does not quantify the possible political and social benefits Tunisians might have gained from moving from an autocratic to a democratic regime.[43] Moreover, the post-shock period is too short to assess the long-run impact of Arab Spring on the Tunisian economy. Whether, and at what pace, the Tunisian economy might catch up with its synthetic counterpart in the longrun will depend in part on the state's ability to protect the interests of investors and tourists. Recent hostilities by the Islamic State (IS) and the havoc it is bringing to many Arab countries, especially Libya, one of the main trading partners with Tunisia, might worsen the already weakened economy.

The analysis undertaken in this paper suggests several avenues for further empirical research. In particular, it would be valuable to examine the implications of the Arab Spring from a micro perspective. For example, research is needed to understand how micro agents (firms and households) were affected by the uprisings and whether the impact was heterogeneous across different groups. It would also be interesting to examine what impact the Arab Spring had on headcount poverty, inequality, and female and youth incomes. This line of research could help policymakers develop better tools to alleviate the impact of revolutions.

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# APPENDIX

TABLE A1. List of Omitted Countries

| Country | Exogenous Schock After 2010 |
|---|---|
| Algeria | Indirectly impacted by the Arab Spring since 2011 |
| Bahamas /1 | Impacted by several storms in 2012 and 2013 |
| Bahrain | Directly impacted by the Arab Spring since 2011 |
| Barbados | Impacted by tropical storm Chantal in 2013 |
| Central African Republic /2 | Impacted by a coup d'état in 2013 |
| China /3 | Hit by several earthquakes between 2011 and 2015 |
| Cuba | Relations between the US and Cuba have been restored after 54 years of anomisity |
| Cyprus | Agreed a 10 billion Euro bailout package to avoid bankruptcy in 2013 |
| Dominica /4 | Hit by hurricane Ophelia in 2011 |
| Egypt, Arab Republic | Directly impacted by the Arab Spring since 2011 |
| Gambia/5 | The agriculture sector was severely impacted as a result of the severe drought in 2011 |
| Greece | Agreed two bailout packages in 2012 and 2015 worth 130 and 86 billion Euros, respectively to avoid bankruptcy |
| Honduras | Honduras was affected by the tropical storm Ernesto in 2012 |
| Iraq | Subject to multiple security shocks |
| Islamic Republic of Iran | Impacted by the sanctions imposed since 2012 on the energy and financial sectors |
| Japan /6 | Hit by the Fukushima Daiichi nuclear disaster in 2011 |
| Jordan | Indirectly impacted by the Arab Spring since 2011 |
| Lebanon | Indirectly impacted by the Arab Spring since 2011 |
| Mali/7 | Impacted by a coup d'état in 2012 |
| Morocco | Indirectly impacted by the Arab Spring since 2011 |
| Nepal /8 | Hit by two severe earthquakes in 2015 |
| Philippines /9 | Hit by Typhoon Haiyan (Yolanda) in 2013 |
| Russian Federation /10 | Negatively impacted by economic sanctions in 2014 |
| St. Lucia /11 | Hit by a severe storm in December 2013 |
| St. Vincent and the Grenadines /12 | Hit by a severe storm in April 2011 |
| Sudan | In 2011 Sudan was divided into two states: Sudan and South Sudan |
| St. Kitts and Nevis /13 | Hit by intense floods |
| Swaziland /14 | Experienced a severe fiscal crisis |
| Thailand /15 | Hit by unprecedented floods in 2011 |
| Ukraine /16 | Impacted by the internal conflict that started in November 2013 and then evolved into an internal war in 2014 |
| Yemen Republic | Directly impacted by the Arab Spring since 2011 |
| Vanuatu /17 | Hit by Tropical Cyclone Pam in 2015 |

/1 http://www.huffingtonpost.com/2012/10/26/hurricane-sandy-2012-baha_n_2022420.html
/2 http://www.worldbank.org/en/country/centralafricanrepublic/overview
/3 http://www.theguardian.com/world/2014/aug/03/earthquake-kills-southern-china-yunnan china-yunnan
http://www.theguardian.com/world/2014/aug/03/earthquake-kills-southern-
http://www.news.com.au/world/magnitude61-earthquake-hits-chinas-yunnan-province-at-least-367-dead/story-fndir2ev-1227012167142
/4 https://www.imf.org/external/pubs/ft/scr/2012/cr1247.pdf
/5 http://www.africaneconomicoutlook.org/fileadmin/uploads/aeo/2014/PDF/CN_Long_EN/Gambie_EN.pdf
/6 http://www.bbc.co.uk/news/business-13045328
/7 https://www.imf.org/external/np/sec/pr/2012/pr12437.htm

/8 http://www.worldbank.org/en/news/press-release/2015/06/29/world-bank-approves-300-million-for-nepal-earthquake-recovery
/9 http://www.worldbank.org/en/news/press-release/2013/11/18/world-bank-group-supporting-philippines-typhoon-reconstruction-with-500-million-financial-package
/10 https://www.imf.org/external/pubs/ft/scr/2015/cr15211.pdf
/11 http://www-wds.worldbank.org/external/default/WDSContentServer/WDSP/IB/2014/02/03/000442464_20140203124432/Rendered/PDF/843290WP0SVG0R0Box0382136B00PUBLIC0.pdf
/12 http://www.imf.org/external/pubs/ft/scr/2011/cr11344.pdf
/13 http://www.ccmf-uwi.org/files/publications/newsletter/Vol7No04.pdf
/14 http://www.imf.org/external/pubs/ft/scr/2012/cr1237.pdf
/15 http://www.worldbank.org/en/news/feature/2011/12/13/world-bank-supports-thailands-post-floods-recovery-effort
/16 http://www.bbc.co.uk/news/world-middle-east-26248275; http://www.economist.com/news/europe/21591217-has-ukrainians-defiance-presidents-european-policy-split-country-new-revolution.
/17 http://www.worldbank.org/en/news/press-release/2015/03/30/world-bank-group-offers-support-to-aid-vanuatu-recovery

TABLE A2. Country Weights in the Synthetic Tunisia

| Country | Weight (%) |
|---|---|
| Vietnam | 0.3 |
| Moldova | 1.7 |
| Lesotho | 2.0 |
| Trinidad and Tobago | 2.0 |
| Korea, Rep. | 2.2 |
| Panama | 3.5 |
| Uzbekistan | 3.5 |
| Peru | 4.1 |
| Poland | 8.1 |
| Congo, Rep. | 8.7 |
| Sri Lanka | 10.3 |
| India | 16.4 |
| Mauritius | 17.5 |
| Belize | 19.7 |

Source: Authors' own calculations.

TABLE A3. Averages of Economic and Social Characteristics of GDP*

| | Tunisia | Synthetic Tunisia | Average of 114 Control Countries |
|---|---|---|---|
| GCF average 1990-2000 | 26.0 | 25.9 | 21.5 |
| GCF average 2001-2010 | 24.3 | 24.4 | 22.6 |
| Consumption average 1990-2000 | 78.1 | 78.2 | 83.4 |
| Consumption average 2001-2010 | 78.5 | 78.5 | 81.3 |
| Imports average 1990-2000 | 45.1 | 45.1 | 41.7 |
| Imports average 2001-2010 | 48.8 | 48.8 | 46.3 |
| Exports average 1990-2000 | 41.0 | 41.0 | 36.7 |
| Exports average 2001-2010 | 45.9 | 45.9 | 42.3 |
| Agriculture 1990-2000 | 14.9 | 16.3 | 18.9 |
| Agriculture 2001-2010 | 9.7 | 11.1 | 14.7 |
| Services 1990-2000 | 53.3 | 53.9 | 51.3 |
| Services 2001-2010 | 60.2 | 57.7 | 55.0 |
| Life Expectancy at birth (years) | 72.5 | 68.0 | 66.1 |
| Secondary School Enrollment (%) | 70.6 | 71.7 | 67.2 |
| GDP per capita average 1990-1994 (US$) | 5,810 | 5,801 | 12,068 |
| GDP per capita average 1995-1999 (US$) | 6,636 | 6,627 | 13,093 |
| GDP per capita average 2000-2004 (US$) | 7,895 | 7,877 | 14,585 |
| GDP per capita average 2005-2010 (US$) | 9,656 | 9,634 | 16,742 |

Source: Authors' own calculations. *All variables are in percentage of GDP (%) unless stated otherwise.

TABLE A4. Normalized Ratio of Post-2010 gap to Pre-2010 gap*

| Country | Normalized Ratio | Country | Normalized Ratio |
|---|---|---|---|
| Georgia | 0.14 | Grenada | 1.71 |
| Saudi Arabia | 0.14 | Fiji | 1.76 |
| Angola | 0.15 | Comoros | 1.81 |
| Dominican Republic | 0.17 | United Kingdom | 1.84 |
| Botswana | 0.22 | Togo | 1.85 |
| Ethiopia | 0.25 | Puerto Rico | 1.88 |
| Chile | 0.27 | Macedonia, FYR | 1.89 |
| Australia | 0.36 | Denmark | 1.93 |
| Moldova | 0.36 | Uganda | 1.95 |
| Korea, Rep. | 0.51 | Zambia | 1.95 |
| Sweden | 0.53 | Mauritania | 2.36 |
| Armenia | 0.56 | Guyana | 2.36 |
| Guinea-Bissau | 0.56 | Turkey | 2.37 |
| Poland | 0.57 | Tanzania | 2.66 |
| Tajikistan | 0.57 | Niger | 2.67 |
| United States | 0.67 | Burundi | 2.78 |
| Mozambique | 0.67 | Cameroon | 2.91 |
| Belize | 0.69 | Senegal | 3.07 |
| Tonga | 0.72 | Cote d'Ivoire | 3.10 |
| Costa Rica | 0.77 | Pakistan | 3.59 |
| Djibouti | 0.87 | Benin | 3.76 |
| New Zealand | 0.88 | Madagascar | 3.76 |
| Congo, Rep. | 1.02 | El Salvador | 3.76 |
| Chad | 1.08 | Paraguay | 3.77 |
| Nigeria | 1.10 | Bolivia | 3.87 |
| Lesotho | 1.14 | Suriname | 4.05 |
| Papua New Guinea | 1.18 | Guinea | 4.10 |
| Portugal | 1.18 | South Africa | 4.31 |
| Nicaragua | 1.21 | Namibia | 5.00 |
| Solomon Islands | 1.21 | Trinidad and Tobago | 5.78 |
| Kyrgyz Republic | 1.31 | Czech Republic | 5.82 |
| Congo, Dem. Rep. | 1.34 | Iceland | 5.96 |
| Venezuela, RB | 1.37 | Italy | 6.32 |
| Malawi | 1.45 | Romania | 6.72 |
| Finland | 1.49 | Bulgaria | 7.25 |
| Burkina Faso | 1.56 | Spain | 8.42 |
| Zimbabwe | 1.59 | Tunisia | 8.46 |
| Netherlands | 1.64 | Antigua and Barbuda | 8.52 |

Source: Authors' own calculations. Note: The normalized ratio for each country is calculated as the difference between the actual per capita GDP of each country and that of its synthetic counterpart after 2010 divided by the estimated difference before 2010. The higher this normalized ratio is the larger is the negative impact of a shock after 2010. *The normalized ratio is only calculated for control countries that exhibited a negative gap between actual and synthetic GDP per capita after 2010.

TABLE A5. t-statistic of the AS coefficient*

| Country | t-statistic | Country | t-statistic |
|---|---|---|---|
| Ethiopia | 6.00 | Venezuela, RB | -1.90 |
| Lesotho | 1.77 | Grenada | -1.95 |
| Mozambique | 1.31 | Zambia | -1.96 |
| Botswana | 0.91 | Zimbabwe | -2.00 |
| Chile | 0.90 | Macedonia, FYR | -2.11 |
| Tajikistan | 0.58 | Togo | -2.13 |
| Saudi Arabia | 0.40 | Fiji | -2.22 |
| Angola | 0.40 | Guyana | -2.28 |
| Dominican Republic | 0.27 | Comoros | -2.58 |
| Korea, Rep. | 0.17 | Turkey | -2.60 |
| Georgia | 0.17 | United Kingdom | -2.64 |
| Armenia | 0.09 | Burundi | -2.73 |
| Sweden | 0.07 | Puerto Rico | -2.76 |
| Australia | -0.01 | Mauritania | -2.90 |
| Poland | -0.10 | Denmark | -2.96 |
| Papua New Guinea | -0.16 | Niger | -3.24 |
| United States | -0.35 | Cameroon | -3.33 |
| Moldova | -0.40 | Tanzania | -3.44 |
| Guinea-Bissau | -0.61 | El Salvador | -3.63 |
| Tonga | -0.62 | Senegal | -3.71 |
| Costa Rica | -0.65 | Benin | -4.15 |
| Chad | -0.71 | Bolivia | -4.16 |
| Nigeria | -0.74 | Cote d'Ivoire | -4.20 |
| Belize | -0.78 | Suriname | -4.22 |
| Paraguay | -0.83 | Pakistan | -4.29 |
| Nicaragua | -0.83 | Madagascar | -4.67 |
| Finland | -0.92 | Guinea | -4.88 |
| Congo, Dem. Rep. | -0.94 | South Africa | -4.94 |
| Burkina Faso | -0.96 | Czech Republic | -5.11 |
| Portugal | -1.00 | Trinidad and Tobago | -5.27 |
| Djibouti | -1.03 | Romania | -5.53 |
| Netherlands | -1.04 | Namibia | -5.55 |
| Malawi | -1.07 | Iceland | -5.99 |
| New Zealand | -1.09 | Bulgaria | -6.20 |
| Kyrgyz Republic | -1.25 | Italy | -6.69 |
| Congo, Rep. | -1.27 | Antigua and Barbuda | -8.18 |
| Uganda | -1.32 | Tunisia | -8.70 |
| Solomon Islands | -1.44 | Spain | -8.77 |

Source: Authors' own calculations. Note: The lower is the t-statistic the more statistically significant is the impact of the events that happened between 2011 and 2013 on the respective economy. *We only report the t-statistics for countries that had a negative gap between the actual and synthetic per capita GDP after 2010.

TABLE A6. t-statistic of the AS coefficient*

| | (1) |
|---|---|
| D.log($World_t$) | 0.258 |
| | (0.266) |
| D.log($Tunisia_{t-1}$) | -0.084 |
| | (0.260) |
| D.log($World_{t-1}$) | 0.297 |
| | (0.288) |
| AS(2011) | -0.058*** |
| | (0.018) |
| AS(2012) | -0.003 |
| | (0.022) |
| AS(2013) | -0.018 |
| | (0.017) |
| Constant | 0.024** |
| | (0.010) |
| Observations | 22 |
| R-squared | 0.455 |

Bootstrapped standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. Note: AS is a dummy variable representing the Arab Spring that takes 1 from 2011 onward and 0 otherwise. AS(2011) is a dummy variable that takes 1 for 2011 and 0 otherwise. AS(2012) is a dummy variable that takes 1 for 2012 and 0 otherwise. AS(2013) is a dummy variable that takes 1 for 2013 and 0 otherwise.

TABLE A7. t-statistic of the AS coefficient*

| | Tunisia | Synthetic Tunisia |
|---|---|---|
| GCF average 1990-2000 | 26.0 | 26.0 |
| GCF average 2001-2010 | 24.3 | 24.4 |
| Consumption average 1990-2000 | 78.1 | 78.1 |
| Consumption average 2001-2010 | 78.5 | 78.5 |
| Imports average 1990-2000 | 45.1 | 45.1 |
| Imports average 2001-2010 | 48.8 | 48.8 |
| Exports average 1990-2000 | 41.0 | 41.0 |
| Exports average 2001-2010 | 45.9 | 45.9 |
| Agriculture 1990-2000 | 14.9 | 16.3 |
| Agriculture 2001-2010 | 9.7 | 11.5 |
| Services 1990-2000 | 53.3 | 53.0 |
| Services 2001-2010 | 60.2 | 55.0 |
| Life Expectancy at birth (years) | 72.5 | 67.2 |
| Secondary School Enrollment (%) | 70.6 | 69.8 |
| GDP per capita average 1990-1994 (US$) | 5,810 | 5,813 |
| GDP per capita average 1995-1999 (US$) | 6,636 | 6,651 |
| GDP per capita average 2000-2004 (US$) | 7,895 | 7,888 |
| GDP per capita average 2005-2010 (US$) | 9,656 | 9,652 |
| Net Fuel Exports 1990-2000 | -0.2 | 0.0 |
| Net Fuel Exports 2001-2010 | -1.2 | -0.6 |
| Ores and Metal Exports 1990-2000 | 0.4 | 1.7 |
| Ores and Metal Exports 2001-2010 | 0.5 | 2.5 |

Source: Authors' own calculations. *All variables are in percentage of GDP (%) unless stated otherwise. After adding net fuel exports and ores and metal exports, the control countries (with their corresponding weights) that compose Synthetic Tunisia are: Guinea-Bissau (0.1%), Grenada (0.3%), Malaysia (0.6%), Zimbabwe (1.4%), Seychelles (3%), Peru (3.6%), Belarus (6%), Korea, Rep. (6.6%), India (7.9%), Congo, Rep. (8.2%), Guinea (9.4%), Belize (12%), Mauritius (18.6%), Sri Lanka (22.3%).

TABLE A8. Decomposition of GDP Growth Rate from the Demand Side

| Growth (%) | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Real GDP | 4.3 | 4.8 | 1.7 | 5.5 | 6.0 | 4.0 | 5.7 | 6.3 | 4.5 | 3.1 | 3.0 | -1.9 | 3.9 | 2.4 |
| Imports of Goods and Services | 7.0 | 13.7 | -3.0 | 0.3 | 2.7 | 0.0 | 7.6 | 9.6 | 5.4 | -8.2 | 15.3 | -2.4 | 5.4 | -1.8 |
| Exports of Goods and Services | 5.8 | 11.7 | -3.5 | 0.0 | 5.5 | 4.5 | 4.3 | 11.8 | 2.8 | -7.0 | 10.6 | -4.3 | 4.3 | 1.9 |
| Total Consumption, of which | 5.5 | 5.3 | 4.1 | 5.2 | 5.0 | 4.4 | 5.0 | 5.5 | 4.7 | 4.0 | 4.1 | 4.5 | 4.6 | 3.2 |
| Public | 9.9 | 2.8 | 6.3 | 7.4 | 4.3 | 2.8 | 7.0 | 5.5 | 4.4 | 5.8 | 3.7 | 6.1 | 5.2 | 4.3 |
| Private | 4.3 | 6.0 | 3.5 | 4.6 | 5.2 | 4.8 | 4.5 | 5.5 | 4.8 | 3.6 | 4.3 | 4.1 | 4.4 | 3 |
| Total Investment | 4.3 | 8.4 | -1.7 | -1.8 | 1.0 | 2.7 | 9.5 | 6.3 | 5.3 | 3.5 | 4.3 | -12.7 | 6.1 | 0.2 |

Source: National Institute of Statistics.

TABLE A9. Share of Total Real Exports (%)

| | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 |
|---|---|---|---|---|---|---|---|---|---|
| Exports of Goods and Services | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 |
| Exports of Goods (FOB); of which: | 72.3 | 73.1 | 75.5 | 76.1 | 72.4 | 73.9 | 78.9 | 76.4 | 77.2 |
| Mining Exports | 5.1 | 4.9 | 5.6 | 10.7 | 6.2 | 6.8 | 4.1 | 4.7 | 4.6 |
| Other Exports | 67.3 | 68.3 | 69.9 | 65.4 | 66.2 | 67.1 | 74.8 | 71.6 | 72.6 |
| Exports of Services; of which: | 27.7 | 26.9 | 24.5 | 23.9 | 27.6 | 26.1 | 21.1 | 23.6 | 22.8 |
| Tourism | 13.8 | 13.3 | 12.0 | 10.9 | 12.9 | 11.1 | 7.6 | 9.1 | 9.0 |
| Other Services | 13.9 | 13.6 | 12.5 | 12.9 | 14.7 | 15.0 | 13.5 | 14.5 | 13.8 |

Source: National Institute of Statistics and authors' own calculations.

# Supplemental Appendix for

# "The Impact of the Arab Spring on the Tunisian Economy"

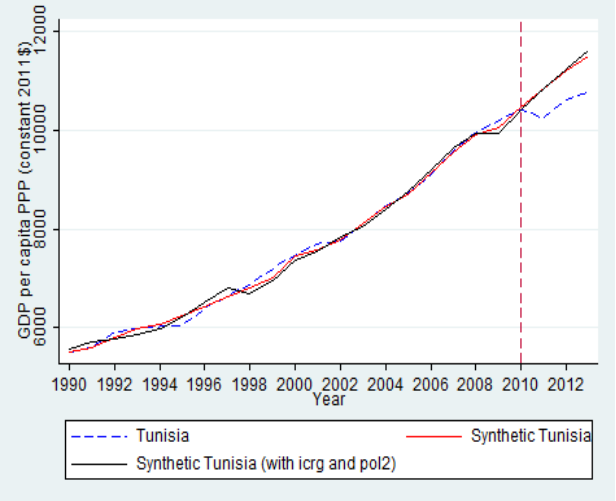
Samer Matta, Simon Appleton and Michael Bleaney

This Supplemental Appendix (SA) includes two sections. The first contains several tables and figures that are referred to in the main article, while the second includes a brief description on how to construct a synthetic control using the Synth command in Stata.

## S.1. Additional Figures and Tables

This section includes several tables and figures that are referred to in the main article. In Figure S.1 we add to our initial set of covariates the ICRG government stability index and the Polity2 index in order to control for possible institutional differences between Tunisia and its baseline synthetic counterpart. The plotted GDP per capita paths, suggest that our original results are largely robust to these inclusion.

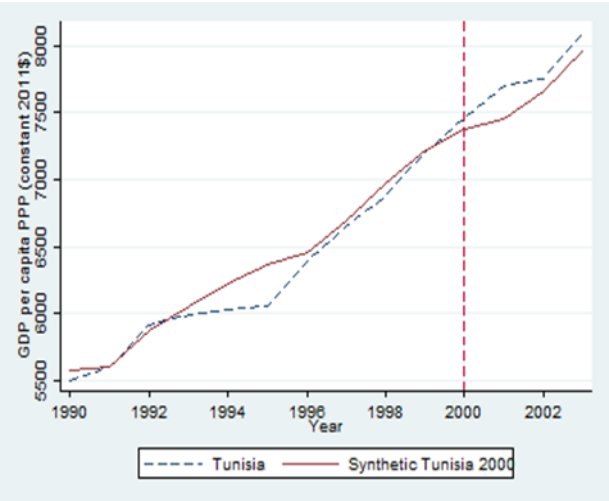
**Figure S.1: GDP per capita: Tunisia vs Synthetic Tunisia**




**Source: Authors' calculations.**

Synthetic Tunisia (with icrg and pol2) represents the baseline synthetic Tunisia after adding to ICRG government stability index and polity2 index as covariates.

**Figure S.2 : Time series placebo test in 2000**

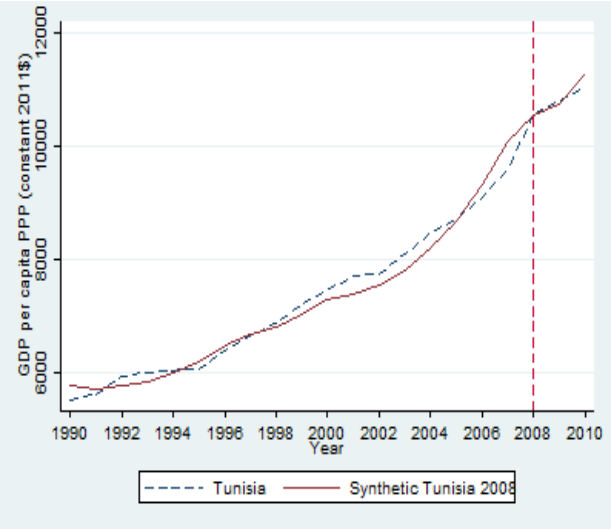



**Source: Authors' calculations.**

Figure S.2 and Figure S.3 illustrate the time series placebos by replicating the synthetic control analysis for years earlier than 2011 in which the Tunisian economy did not actually experience any structural break (or shock).

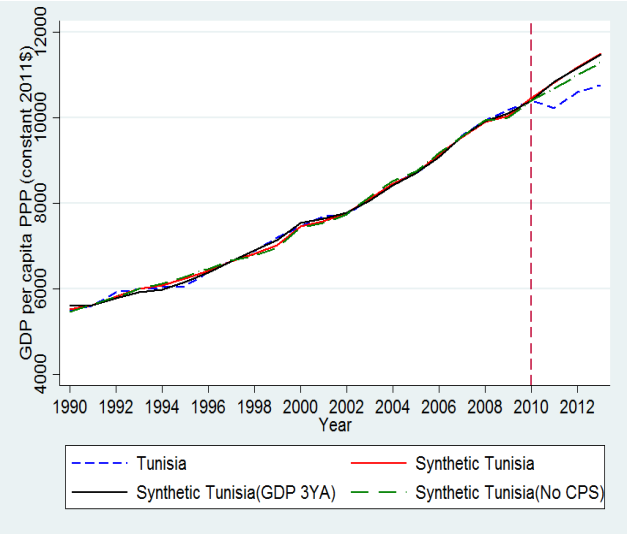
In Figure S.4 we illustrate the robustness tests of (i) removing the Republic of Congo, Poland and Sri Lanka from our sample of control countries and (ii) taking the three-year average real GDP per capita instead of five. The results are in line with our baseline results.

**Figure S.3: Time series placebo test in 2008**




**Source: Authors' calculations.**

**Figure S.4 : GDP per capita: Tunisia vs Synthetic Tunisia**

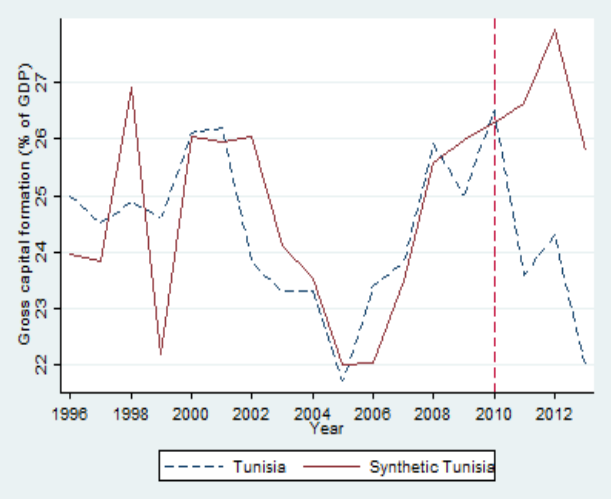



**Source: Authors' calculations.**

Synthetic Tunisia (No CPS) represents the baseline counterfactual after removing the Republic of Congo, Poland and Sri Lanka from our set of control countries, while Synthetic Tunisia (GDP 3YA) considers the same baseline specification with 3-year averages for the GDP per capita.

Figure S.5, illustrates the robustness test we perform in section 7.2 when we replace the Rule of Law Index by the Government Stability component of the ICRG index as a measure of political instability. The result confirms our finding that investment in Tunisia was largely impacted by the Arab Spring.

**Figure S.5: GCF (% of GDP): Tunisia vs Synthetic Tunisia.**




**Source: Authors' calculations.**

Table S.1 provides a definition and the source of each variable used in the paper. Table S.2 displays the variables' average of Tunisia and those corresponding to each country in the set of 114 donor controls.

Table S.3 reports the covariate averages of the synthetic Tunisia after omitting the Republic of Congo, Poland and Sri Lanka from our set of controls. Meanwhile, Table S.4 presents the covariate averages for the synthetic Tunisia when considering the three-year averages for GDP per capita.

Table S.5 includes the estimated results of the estimated ARDL(1) model when using the Jackknife standard errors. The results in terms of magnitude and statistical significance are identical to those in Table 6.

In Table S.6, we present the Net Fuel Exports (as a % of GDP) of Tunisia and the six most highly weighted countries that form synthetic Tunisia. This variable, used to proxy for a country's energy dependence, is calculated as the difference between fuel exports (as a % of GDP) and fuel imports (as a % of GDP).[1]

Table S.7 presents the normalized ratio, as defined in section 5.2 of the main article, between the actual GCF (% of GDP) of each country and that of its respective synthetic counterpart. The results suggest that the drop in investment (GCF as a ratio of GDP) after 2011 is unlikely to have been driven by factors other than the Arab Spring. In parallel, Table S.8 also suggests that the growing trade deficit was primarily driven by the Arab Spring itself which largely impacted exports, particularly through mining and tourism exports.

[1] Fuel exports (imports) and ores and metals exports as a ratio of GDP were all derived based on the fuel exports (imports) as a ratio of merchandise exports (imports) and the nominal values of GDP, both taken from the WDI as reported in Table S.1.

**Table S.1: Data Variables and Sources**

| Covariate | Unit | Definition | Source |
|---|---|---|---|
| Consumption | % of GDP | Final consumption expenditure the sum of household final consumption expenditure and general government final consumption expenditure | WDI |
| GCF | % of GDP | Gross capital formation consists of outlays on additions to the fixed assets of the economy plus net changes in the level of inventories. | WDI |
| Imports | % of GDP | Imports of goods and services represent the value of all goods and other market services received from the rest of the world. | WDI |
| Exports | % of GDP | Exports of goods and services represent the value of all goods and other market services provided to the rest of the world. | WDI |
| Agriculture | % of GDP | Value added of the agriculture sector which includes includes forestry, hunting, and fishing, as well as cultivation of crops and livestock production. | WDI |
| Services | % of GDP | Value added of the services sector which includes wholesale and retail trade , transport, and government, financial, professional, and personal services , health care, and real estate services. Also included are imputed bank service charges, import duties, and any statistical discrepancies noted by national compilers as well as discrepancies arising from rescaling. | WDI |
| Life expectancy at birth | Years | Life expectancy at birth indicates the number of years a newborn infant would live if prevailing patterns of mortality at the time of its birth were to stay the same throughout its life. | |
| Secondary School Enrollement | % | Gross enrollment ratio is the ratio of total enrollment, regardless of age, to the population of the age group that officially corresponds to the level of education shown. Secondary education completes the provision of basic education that began at the primary level, and aims at laying the foundations for lifelong learning and human development, by offering more subject- or skill-oriented instruction using more specialized teachers. | WDI |
| FDI | % of GDP | Foreign direct investment are the net inflows of investment to acquire a lasting management interest (10 percent or more of voting stock) in an enterprise operating in an economy other than that of the investor. It is the sum of equity capital, reinvestment of earnings, other long-term capital, and short-term capital as shown in the balance of payments. This series shows net inflows (new investment inflows less disinvestment) in the reporting economy from foreign investors, and is divided | WDI |
| Broad Money | % of GDP | Broad money (IFS line 35L..ZK) is the sum of currency outside banks; demand deposits other than those of the central government; the time, savings, and foreign currency deposits of resident sectors other than the central government; bank and traveler's checks; and other securities such as certificates of deposit and commercial paper. | WDI |

## Table S.1 (Continued): Data Variables and Sources

| Covariate | Unit | Definition | Source |
|---|---|---|---|
| Rule of Law Estimate | Score between -2.5 (worst) and 2.5 (best) | Rule of Law captures perceptions of the extent to which agents have confidence in and abide by the rules of society, and in particular the quality of contract enforcement, property rights, the police, and the courts, as well as the likelihood of crime and violence. | WGI |
| Fuel Exports | % of Merchandise Exports | Fuels comprise SITC section 3 (mineral fuels) | WDI |
| Fuel Imports | % of Merchandise Imports | Fuels comprise the commodities in SITC section 3 (mineral fuels) | WDI |
| Ores and Metals Exports | % of Merchandise Exports | Ores and metals comprise the commodities in SITC sections 27 (crude fertilizer, minerals nes); 28 (metalliferous ores, scrap); and 68 (non-ferrous metals) | WDI |
| Government Stability (ICRG) | Index | A measure of both of the government's ability to carry out its declared program(s), and its ability to stay in office. The risk rating assigned is the sum of three subcomponents: Government Unity, Legislative Strength, and Popular Support. | PRS |
| Personal remittances, received | % of GDP | Personal remittances comprise personal transfers and compensation of employees. Personal transfers consist of all current transfers in cash or in kind made or received by resident households to or from nonresident households. Personal transfers thus include all current transfers between resident and nonresident individuals. Compensation of employees refers to the income of border, seasonal, and other short-term workers who are employed in an economy where they are not resident and of residents employed by nonresident entities. Data are the sum of two items defined in the sixth edition of the IMF's Balance of Payments Manual: personal transfers and compensation of employees. | WDI |
| Tax Revenue | % of GDP | Tax revenue refers to compulsory transfers to the central government for public purposes. Certain compulsory transfers such as fines, penalties, and most social security contributions are excluded. Refunds and corrections of erroneously collected tax revenue are treated as negative revenue. | WDI |
| Expense | % of GDP | Expense is cash payments for operating activities of the government in providing goods and services. It includes compensation of employees (such as wages and salaries), interest and subsidies, grants, social benefits, and other expenses such as rent and dividends. | WDI |
| Real effective exchange rate index (2010 = 100) | Index | Real effective exchange rate is the nominal effective exchange rate (a measure of the value of a currency against a weighted average of several foreign currencies) divided by a price deflator or index of costs. | WDI |

## Table S.2: Average of Each Covariate by Country pre-2011

| Country | GCF (% of GDP) 1990-2000 | GCF (% of GDP) 2001-2010 | Consumption (% of GDP) 1990-2000 | Consumption (% of GDP) 2001-2010 | Imports (% of GDP) 1990-2000 | Imports (% of GDP) 2001-2010 | Exports (% of GDP) 1990-2000 | Exports (% of GDP) 2001-2010 | GDP (US$) 1990-1994 | GDP (US$) 1995-1999 | GDP (US$) 2000-2004 | GDP(US$) 2005-2010 | Agriculture (% of GDP) 1990-2000 | Agriculture (% of GDP) 2001-2010 | Services (% of GDP) 1990-2000 | Services (% of GDP) 2001-2010 | Life Expectancy at birth (year) | Secondary School Enrollement (%) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Albania | 17.1 | 27.8 | 110.9 | 95.9 | 41.0 | 48.8 | 13.0 | 25 | 3,387 | 4,304 | 5,979 | 8256.7 | 40.8 | 22.6 | 34.5 | 58.9 | 74.2 | 71.8 |
| Angola | 18.2 | 13.0 | 79.7 | 68.4 | 63.0 | 53.3 | 65.1 | 72 | 3,208 | 2,958 | 3,413 | 5806.2 | 12.4 | 8.7 | 29.9 | 27.7 | 45.4 | 17.9 |
| Antigua and Barbuda | 36.0 | 29.9 | 68.0 | 84.2 | 83.6 | 65.4 | 79.5 | 51 | 17,579 | 18,089 | 19,269 | 23355.1 | 3.8 | 1.9 | 77.5 | 79.5 | 73.3 | 104.4 |
| Armenia | 21.4 | 30.3 | 105.7 | 89.6 | 57.4 | 43.9 | 30.2 | 24 | 2,573 | 2,463 | 3,720 | 6409.7 | 33.6 | 22.1 | 29.7 | 37.1 | 71.1 | 92.2 |
| Australia | 25.2 | 26.9 | 75.7 | 74.6 | 18.8 | 21.2 | 17.9 | 20 | 28,587 | 32,190 | 36,449 | 40451.9 | 3.6 | 3.1 | 67.7 | 69.9 | 79.4 | 142.9 |
| Austria | 26.3 | 24.0 | 74.2 | 72.9 | 36.3 | 45.0 | 35.8 | 48 | 31,929 | 35,241 | 39,321 | 42552.2 | 2.5 | 1.6 | 65.2 | 68.2 | 78.1 | 101.2 |
| Azerbaijan | 21.2 | 31.5 | 87.2 | 55.4 | 47.9 | 41.3 | 39.5 | 54 | 6,359 | 3,597 | 5,397 | 12952.6 | 25.7 | 10.0 | 37.8 | 30.0 | 67.0 | 89.0 |
| Belarus | 28.4 | 31.1 | 75.8 | 75.0 | 60.9 | 66.9 | 56.8 | 61 | 7,155 | 6,063 | 8,355 | 13450.7 | 17.6 | 10.4 | 41.0 | 48.1 | 69.2 | 96.6 |
| Belgium | 22.7 | 23.1 | 74.5 | 73.4 | 58.7 | 69.8 | 61.5 | 73 | 31,378 | 34,314 | 38,126 | 40791.3 | 1.4 | 1.0 | 70.0 | 73.8 | 78.0 | 125.8 |
| Belize | 24.4 | 20.6 | 81.0 | 86.6 | 57.6 | 62.9 | 52.2 | 56 | 5,944 | 6,170 | 7,379 | 7906.0 | 17.6 | 14.6 | 61.5 | 65.5 | 71.2 | 73.8 |
| Benin | 17.2 | 20.2 | 89.9 | 88.6 | 32.2 | 28.3 | 25.2 | 20 | 1,368 | 1,446 | 1,573 | 1619.4 | 34.7 | 34.7 | 52.5 | 51.2 | 55.8 | 23.8 |
| Bhutan | 40.4 | 52.0 | 72.7 | 65.1 | 45.3 | 56.4 | 32.2 | 39 | 2,481 | 3,189 | 4,011 | 5473.3 | 31.7 | 22.2 | 37.0 | 37.0 | 60.1 | 44.7 |
| Bolivia | 17.0 | 15.0 | 90.3 | 82.1 | 27.9 | 31.0 | 20.6 | 34 | 3,848 | 4,293 | 4,457 | 5061.8 | 16.2 | 14.2 | 51.9 | 52.4 | 62.8 | 79.0 |
| Botswana | 29.4 | 31.7 | 62.4 | 62.5 | 43.9 | 42.0 | 52.1 | 48 | 8,379 | 9,531 | 10,712 | 12651.3 | 4.2 | 2.7 | 44.3 | 53.9 | 52.4 | 66.5 |
| Brunei Darussalam | 27.5 | 14.6 | 63.4 | 46.2 | 49.3 | 32.5 | 58.4 | 72 | 77,353 | 76,110 | 76,238 | 74445.0 | 1.1 | 0.9 | 41.6 | 31.6 | 76.0 | 88.0 |
| Bulgaria | 15.8 | 27.2 | 83.1 | 85.0 | 43.4 | 56.3 | 44.5 | 44 | 8,458 | 8,630 | 10,264 | 14160.2 | 14.9 | 8.2 | 52.7 | 63.1 | 71.9 | 92.4 |
| Burkina Faso | 22.3 | 21.8 | 91.4 | 92.2 | 24.6 | 25.2 | 11.0 | 11 | 849 | 969 | 1,110 | 1321.8 | 32.8 | 25.1 | 45.5 | 52.2 | 51.2 | 12.5 |
| Burundi | 8.6 | 17.5 | 105.4 | 106.7 | 22.8 | 31.3 | 8.8 | 7 | 1,015 | 761 | 705 | 697.5 | 50.9 | 43.2 | 30.8 | 39.8 | 48.7 | 11.6 |
| Cameroon | 14.9 | 18.5 | 81.4 | 83.1 | 17.4 | 22.3 | 21.1 | 21 | 2,425 | 2,283 | 2,478 | 2559.3 | 24.1 | 22.1 | 45.2 | 46.9 | 52.7 | 28.2 |
| Chad | 14.0 | 32.9 | 100.0 | 83.6 | 30.1 | 52.2 | 16.1 | 36 | 1,112 | 1,049 | 1,198 | 1781.3 | 37.2 | 46.3 | 49.3 | 37.1 | 47.2 | 13.5 |
| Chile | 25.0 | 22.0 | 74.3 | 72.0 | 28.4 | 31.6 | 29.1 | 38 | 10,652 | 14,068 | 15,542 | 18385.5 | 7.9 | 4.4 | 54.5 | 58.1 | 76.5 | 86.9 |
| Colombia | 19.5 | 20.5 | 82.1 | 82.2 | 18.4 | 19.1 | 16.8 | 16 | 7,780 | 8,437 | 8,528 | 10229.7 | 14.5 | 8.2 | 53.1 | 59.0 | 70.9 | 74.7 |
| Comoros | 17.4 | 13.2 | 104.9 | 109.8 | 39.5 | 38.7 | 17.2 | 16 | 1,506 | 1,381 | 1,435 | 1424.0 | 40.9 | 41.1 | 47.6 | 47.0 | 57.9 | 35.2 |
| Congo, Dem. Rep. | 7.7 | 11.9 | 91.3 | 92.7 | 21.0 | 31.0 | 22.0 | 27 | 977 | 647 | 506 | 565.4 | 45.5 | 25.3 | 33.4 | 41.8 | 47.2 | 32.3 |
| Congo, Rep. | 28.2 | 22.3 | 58.6 | 53.9 | 46.0 | 56.0 | 61.2 | 80 | 5,090 | 4,645 | 4,744 | 5193.9 | 10.0 | 4.9 | 42.1 | 25.1 | 53.9 | 46.1 |
| Costa Rica | 18.6 | 22.7 | 84.2 | 81.5 | 42.4 | 49.1 | 39.6 | 45 | 7,753 | 8,779 | 9,827 | 12019.6 | 12.5 | 8.3 | 57.0 | 63.0 | 77.6 | 65.7 |
| Cote d'Ivoire | 11.3 | 11.6 | 82.3 | 79.8 | 31.1 | 38.9 | 37.6 | 47 | 3,008 | 3,063 | 2,832 | 2712.0 | 27.1 | 24.1 | 50.1 | 53.2 | 48.7 | 24.3 |
| Czech Republic | 29.2 | 29.7 | 71.3 | 69.0 | 40.8 | 56.8 | 40.3 | 58 | 18,062 | 19,742 | 22,368 | 27703.5 | 4.0 | 2.4 | 57.3 | 60.4 | 74.7 | 91.9 |
| Denmark | 20.4 | 22.0 | 74.0 | 72.8 | 32.3 | 42.6 | 37.9 | 48 | 34,156 | 38,479 | 42,103 | 44246.4 | 3.0 | 1.6 | 71.0 | 72.7 | 76.7 | 119.8 |
| Djibouti | 10.9 | 20.0 | 106.4 | 92.6 | 59.8 | 54.0 | 42.5 | 41 | 2,718 | 2,170 | 2,124 | 2452.7 | 3.4 | 3.6 | 80.1 | 80.1 | 57.6 | 16.6 |
| Dominican Republic | 20.1 | 21.6 | 85.7 | 85.3 | 42.3 | 37.5 | 36.5 | 31 | 5,670 | 6,989 | 8,203 | 10188.1 | 10.4 | 7.0 | 55.4 | 62.9 | 70.6 | 63.9 |
| Ecuador | 21.3 | 23.3 | 79.0 | 78.6 | 23.3 | 28.8 | 22.9 | 27 | 7,594 | 7,740 | 7,757 | 9024.4 | 20.7 | 10.8 | 51.3 | 55.2 | 72.9 | 61.3 |
| El Salvador | 17.0 | 15.7 | 96.8 | 102.3 | 35.4 | 44.0 | 21.5 | 26 | 4,951 | 6,002 | 6,622 | 7395.5 | 14.3 | 10.8 | 56.2 | 59.7 | 69.5 | 55.4 |
| Ethiopia | 19.6 | 30.4 | 87.7 | 87.1 | 15.8 | 30.4 | 8.5 | 13 | 575 | 604 | 640 | 894.1 | 55.8 | 44.8 | 34.1 | 42.9 | 53.1 | 16.2 |
| Fiji | 18.0 | 21.1 | 83.5 | 90.8 | 60.7 | 66.3 | 59.1 | 55 | 5,744 | 6,233 | 6,743 | 7128.0 | 19.3 | 13.8 | 56.4 | 63.6 | 67.5 | 83.5 |
| Finland | 22.3 | 23.3 | 72.6 | 71.7 | 27.7 | 35.2 | 32.9 | 40 | 26,560 | 29,913 | 35,984 | 40139.0 | 4.4 | 2.7 | 62.5 | 63.9 | 77.6 | 116.8 |
| France | 21.2 | 22.3 | 77.5 | 78.0 | 21.9 | 26.7 | 23.2 | 26 | 29,837 | 32,038 | 35,352 | 36914.7 | 2.7 | 1.9 | 72.6 | 76.7 | 79.1 | 108.6 |
| Gabon | 25.6 | 24.3 | 55.0 | 47.5 | 36.0 | 28.2 | 55.4 | 56 | 19,213 | 19,762 | 17,204 | 16224.6 | 7.6 | 5.1 | 43.4 | 41.8 | 60.7 | 48.1 |
| Georgia | 19.3 | 27.9 | 102.0 | 91.5 | 50.5 | 50.3 | 29.2 | 31 | 4,465 | 2,825 | 3,765 | 5512.1 | 39.0 | 14.9 | 37.6 | 61.1 | 71.6 | 82.7 |
| Germany | 23.9 | 19.9 | 75.8 | 75.4 | 23.8 | 33.0 | 24.1 | 38 | 32,721 | 34,723 | 37,342 | 39792.2 | 1.1 | 0.9 | 66.1 | 69.6 | 77.7 | 99.4 |
| Ghana | 20.3 | 23.7 | 92.6 | 93.8 | 40.3 | 51.3 | 27.3 | 34 | 1,986 | 2,154 | 2,363 | 2813.5 | 42.3 | 35.5 | 32.8 | 40.5 | 58.0 | 45.0 |
| Grenada | 35.6 | 32.2 | 82.8 | 93.3 | 64.0 | 53.3 | 45.7 | 28 | 7,477 | 8,309 | 9,994 | 11646.7 | 9.8 | 5.3 | 69.9 | 74.5 | 70.4 | 103.9 |
| Guinea | 21.2 | 16.4 | 81.9 | 86.8 | 27.1 | 33.2 | 23.9 | 30 | 1,077 | 1,082 | 1,170 | 1192.8 | 20.3 | 24.0 | 49.3 | 38.4 | 52.1 | 19.8 |
| Guinea-Bissau | 24.0 | 5.6 | 99.3 | 105.1 | 37.3 | 29.9 | 14.0 | 19 | 1,531 | 1,519 | 1,258 | 1286.6 | 55.1 | 44.1 | 32.2 | 41.2 | 51.4 | 28.3 |
| Guyana | 33.5 | 24.2 | 81.0 | 94.2 | 115.4 | 108.3 | 101.0 | 92 | 3,763 | 4,937 | 5,221 | 5383.8 | 36.9 | 26.5 | 31.4 | 43.6 | 63.7 | 92.5 |
| Hong Kong SAR, China | 29.3 | 22.5 | 68.0 | 68.6 | 131.3 | 177.0 | 133.9 | 186 | 29,676 | 32,307 | 35,220 | 45083.8 | 0.1 | 0.1 | 87.5 | 91.2 | 80.5 | 80.5 |
| Iceland | 21.0 | 23.9 | 79.3 | 78.9 | 33.4 | 40.6 | 33.0 | 38 | 27,752 | 30,128 | 34,935 | 40434.3 | 9.2 | 6.7 | 62.8 | 68.1 | 80.0 | 106.8 |
| India | 23.9 | 32.6 | 77.0 | 70.3 | 10.9 | 21.4 | 10.0 | 19 | 1,832 | 2,246 | 2,714 | 3797.6 | 27.0 | 19.2 | 46.9 | 53.3 | 62.1 | 51.5 |
| Indonesia | 27.1 | 26.1 | 69.6 | 69.3 | 27.7 | 26.1 | 31.1 | 31 | 5,059 | 6,051 | 6,149 | 7631.7 | 17.7 | 14.4 | 40.2 | 39.7 | 67.1 | 57.7 |
| Ireland | 20.5 | 24.6 | 69.8 | 62.2 | 62.4 | 71.3 | 72.1 | 84 | 23,529 | 32,562 | 43,902 | 47103.1 | 4.4 | 1.6 | 62.0 | 65.8 | 77.2 | 109.7 |
| Italy | 20.1 | 21.1 | 77.6 | 79.1 | 19.7 | 25.2 | 21.9 | 25 | 31,269 | 33,735 | 36,615 | 36917.4 | 3.2 | 2.3 | 68.0 | 71.8 | 79.5 | 92.4 |
| Kazakhstan | 21.4 | 28.9 | 81.1 | 63.1 | 45.6 | 41.0 | 43.1 | 49 | 10,611 | 8,430 | 12,084 | 18012.0 | 14.0 | 7.0 | 51.0 | 52.8 | 66.3 | 97.0 |
| Kenya | 18.2 | 18.4 | 86.0 | 90.7 | 31.4 | 32.6 | 27.1 | 24 | 2,259 | 2,205 | 2,166 | 2399.9 | 30.9 | 27.0 | 51.4 | 53.4 | 55.8 | 47.2 |
| Korea, Rep. | 32.7 | 31.8 | 66.4 | 66.1 | 28.1 | 37.4 | 29.0 | 39 | 13,801 | 18,009 | 22,699 | 28024.2 | 5.9 | 3.1 | 56.2 | 59.8 | 75.9 | 97.6 |
| Kyrgyz Republic | 18.1 | 21.3 | 94.3 | 98.7 | 47.5 | 65.0 | 35.1 | 45 | 2,677 | 1,873 | 2,211 | 2634.2 | 40.3 | 30.9 | 31.9 | 45.2 | 67.8 | 88.4 |
| Lao PDR | 13.9 | 24.5 | 100.2 | 85.1 | 36.7 | 42.1 | 23.6 | 33 | 1,704 | 2,081 | 2,563 | 3451.3 | 55.5 | 37.7 | 25.6 | 37.9 | 61.2 | 33.9 |
| Lesotho | 61.8 | 27.7 | 144.3 | 143.8 | 131.7 | 125.2 | 25.6 | 54 | 1,379 | 1,537 | 1,703 | 1999.0 | 18.0 | 9.0 | 42.0 | 57.2 | 50.4 | 34.9 |

Source: World Development Indicators and authors' own calculations.

## Table S.2 (Continued): Average of Each Covariate by Country pre-2011

| Country | GCF (% of GDP) 1990-2000 | GCF (% of GDP) 2001-2010 | Consumption (% of GDP) 1990-2000 | Consumption (% of GDP) 2001-2010 | Imports (% of GDP) 1990-2000 | Imports (% of GDP) 2001-2010 | Exports (% of GDP) 1990-2000 | Exports (% of GDP) 2001-2010 | GDP (US$) 1990-1994 | GDP (US$) 1995-1999 | GDP (US$) 2000-2004 | GDP(US$) 2005-2010 | Agriculture (% of GDP) 1990-2000 | Agriculture (% of GDP) 2001-2010 | Services (% of GDP) 1990-2000 | Services (% of GDP) 2001-2010 | Life Expectancy at birth (year) | Secondary School Enrollement (%) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Luxembourg | 20.8 | 19.3 | 57.2 | 51.7 | 91.1 | 136.2 | 113.1 | 165.3 | 61,368 | 68,825 | 83,592 | 91,905 | 0.9 | 0.5 | 79.3 | 83.3 | 77.8 | 90.8 |
| Macao SAR, China | 25.2 | 21.3 | 48.6 | 42.3 | 64.1 | 62.8 | 90.3 | 99.2 | 40,437 | 41,859 | 46,671 | 79,040 | 0.0 | 0.0 | 83.8 | 86.1 | 77.6 | 88.9 |
| Macedonia, FYR | 19.0 | 22.0 | 90.4 | 96.3 | 46.0 | 53.0 | 36.6 | 34.6 | 5,596 | 7,992 | 5,668 | 10,578 | 12.9 | 12.0 | 53.4 | 64.1 | 73.1 | 79.8 |
| Madagascar | 12.6 | 24.4 | 95.5 | 92.2 | 29.2 | 43.0 | 21.1 | 26.3 | 1,509 | 1,402 | 1,381 | 1,438 | 28.6 | 28.1 | 39.0 | 36.2 | 57.8 | 24.9 |
| Malawi | 17.3 | 21.9 | 96.5 | 95.3 | 39.0 | 43.0 | 25.2 | 25.8 | 551 | 635 | 608 | 674 | 37.5 | 33.2 | 40.3 | 49.0 | 48.0 | 26.8 |
| Malaysia | 35.5 | 22.6 | 58.9 | 57.6 | 88.1 | 85.9 | 93.8 | 105.7 | 11,580 | 14,762 | 16,206 | 19,335 | 12.7 | 9.2 | 44.2 | 45.7 | 72.8 | 62.9 |
| Malta | 25.5 | 16.7 | 83.8 | 84.2 | 90.6 | 83.7 | 81.4 | 82.8 | 18,101 | 22,423 | 25,108 | 26,860 | 2.9 | 2.5 | 66.8 | 69.0 | 78.1 | 85.2 |
| Mauritania | 21.0 | 32.4 | 82.7 | 89.1 | 41.4 | 58.0 | 37.8 | 36.5 | 2,761 | 2,802 | 2,715 | 3,283 | 35.5 | 29.0 | 38.0 | 37.4 | 59.7 | 17.8 |
| Mauritius | 28.0 | 23.9 | 75.8 | 81.3 | 65.3 | 62.5 | 61.5 | 57.4 | 8,181 | 9,861 | 11,865 | 14,178 | 9.9 | 5.3 | 58.1 | 66.5 | 71.3 | 79.5 |
| Mexico | 20.9 | 22.4 | 79.7 | 79.1 | 21.5 | 28.0 | 20.9 | 26.5 | 13,062 | 13,604 | 14,619 | 15,434 | 5.1 | 3.5 | 62.9 | 61.7 | 74.1 | 68.5 |
| Moldova | 31.3 | 27.9 | 80.8 | 110.1 | 56.6 | 84.7 | 44.4 | 46.8 | 4,414 | 2,441 | 2,684 | 3,647 | 34.1 | 17.6 | 34.9 | 63.7 | 67.4 | 85.7 |
| Mongolia | 26.8 | 34.6 | 84.0 | 74.0 | 55.0 | 62.9 | 44.2 | 54.3 | 4,369 | 4,434 | 5,050 | 7,038 | 29.2 | 20.8 | 39.2 | 45.6 | 63.3 | 76.1 |
| Mozambique | 21.6 | 18.9 | 101.7 | 92.9 | 36.4 | 41.8 | 13.1 | 30.0 | 463 | 326 | 661 | 841 | 33.7 | 27.7 | 48.5 | 48.5 | 46.8 | 11.4 |
| Namibia | 19.4 | 22.6 | 86.2 | 84.2 | 49.3 | 52.9 | 43.7 | 46.2 | 5,931 | 5,960 | 6,425 | 7,940 | 10.0 | 10.0 | 63.7 | 58.1 | 58.4 | 56.9 |
| Netherlands | 22.8 | 21.3 | 71.5 | 71.1 | 53.0 | 58.8 | 58.7 | 66.4 | 33,377 | 37,586 | 41,980 | 45,582 | 3.4 | 2.0 | 69.8 | 74.4 | 78.4 | 124.2 |
| New Zealand | 21.5 | 23.2 | 76.4 | 75.7 | 27.9 | 29.5 | 30.1 | 30.7 | 23,571 | 26,212 | 29,571 | 32,113 | 7.1 | 6.3 | 65.7 | 68.7 | 78.3 | 111.7 |
| Nicaragua | 22.8 | 25.3 | 98.9 | 96.0 | 40.6 | 47.6 | 18.9 | 26.3 | 2,908 | 3,165 | 3,547 | 3,972 | 21.2 | 17.7 | 56.9 | 58.9 | 69.5 | 54.3 |
| Niger | 9.4 | 23.2 | 97.2 | 91.8 | 23.1 | 32.6 | 16.6 | 17.6 | 843 | 802 | 778 | 795 | 39.2 | 37.1 | 43.4 | 47.5 | 50.6 | 8.5 |
| Nigeria | 10.1 | 9.3 | 78.2 | 81.4 | 24.5 | 26.2 | 36.2 | 35.6 | 2,904 | 2,787 | 3,177 | 4,617 | 32.7 | 35.1 | 23.4 | 27.5 | 47.5 | 31.8 |
| Norway | 23.6 | 23.3 | 69.0 | 62.6 | 31.6 | 28.1 | 39.0 | 42.2 | 45,814 | 54,525 | 60,238 | 64,240 | 2.8 | 1.6 | 63.3 | 57.8 | 78.8 | 113.5 |
| Oman | 16.1 | 26.0 | 73.4 | 53.7 | 35.8 | 33.6 | 46.3 | 53.9 | 36,513 | 40,844 | 43,646 | 44,975 | 2.5 | 1.7 | 48.8 | 38.0 | 72.1 | 72.9 |
| Pakistan | 18.6 | 17.7 | 84.8 | 86.5 | 19.5 | 18.5 | 16.1 | 14.4 | 3,199 | 3,405 | 3,595 | 4,237 | 26.1 | 23.2 | 49.6 | 53.7 | 63.8 | 28.1 |
| Panama | 24.6 | 20.5 | 72.3 | 73.2 | 85.4 | 66.1 | 88.4 | 72.5 | 8,358 | 9,366 | 10,161 | 13,440 | 8.0 | 6.3 | 74.0 | 75.2 | 75.1 | 64.6 |
| Papua New Guinea | 21.5 | 21.0 | 71.9 | 67.9 | 47.0 | 53.8 | 53.6 | 67.0 | 1,940 | 2,082 | 1,788 | 1,960 | 32.7 | 38.6 | 31.1 | 23.2 | 58.9 | 12.7 |
| Paraguay | 20.1 | 16.1 | 73.7 | 73.7 | 47.2 | 44.1 | 53.3 | 54.3 | 6,142 | 6,377 | 5,970 | 6,620 | 17.7 | 19.3 | 46.7 | 46.5 | 70.1 | 54.1 |
| Peru | 19.0 | 20.1 | 84.3 | 76.8 | 17.3 | 21.0 | 14.0 | 24.2 | 5,367 | 6,359 | 6,736 | 8,741 | 9.3 | 7.8 | 59.3 | 55.8 | 70.1 | 79.7 |
| Poland | 20.5 | 21.0 | 80.5 | 81.6 | 24.6 | 37.8 | 23.6 | 35.2 | 9,851 | 12,504 | 15,219 | 19,324 | 4.2 | 3.2 | 60.4 | 64.7 | 73.5 | 96.6 |
| Portugal | 25.9 | 23.7 | 82.1 | 84.6 | 34.4 | 36.7 | 26.5 | 28.4 | 21,021 | 23,624 | 26,382 | 27,270 | 4.4 | 2.7 | 67.0 | 72.6 | 76.5 | 97.6 |
| Puerto Rico | 17.3 | 13.8 | 75.0 | 68.0 | 62.1 | 61.5 | 69.8 | 79.8 | 26,294 | 30,243 | 35,624 | 36,106 | 1.4 | 0.6 | 13.3 | 10.3 | 76.3 | 84.1 |
| Romania | 24.3 | 25.3 | 81.9 | 83.8 | 31.5 | 42.1 | 25.3 | 33.0 | 9,992 | 10,284 | 11,495 | 16,249 | 19.3 | 10.0 | 39.4 | 52.9 | 70.9 | 83.4 |
| Rwanda | 14.0 | 17.9 | 105.9 | 96.4 | 26.0 | 25.4 | 6.1 | 11.2 | 813 | 747 | 892 | 1,179 | 39.9 | 36.2 | 41.6 | 51.0 | 45.0 | 17.0 |
| Saudi Arabia | 20.0 | 23.7 | 71.6 | 54.0 | 29.1 | 29.1 | 37.5 | 51.4 | 36,743 | 35,400 | 35,153 | 41,831 | 5.7 | 3.5 | 45.2 | 38.2 | 72.4 | 94.8 |
| Senegal | 13.2 | 23.5 | 94.1 | 92.3 | 33.9 | 42.2 | 26.5 | 26.4 | 1,806 | 1,810 | 1,964 | 2,141 | 19.7 | 16.3 | 56.8 | 59.6 | 59.0 | 19.5 |
| Seychelles | 29.8 | 26.4 | 105.8 | 81.9 | 57.2 | 98.7 | 21.6 | 88.1 | 15,011 | 16,936 | 17,482 | 19,675 | 3.8 | 2.8 | 74.1 | 66.8 | 72.3 | 93.6 |
| Sierra Leone | 6.3 | 12.6 | 98.9 | 102.0 | 27.7 | 28.7 | 22.4 | 14.1 | 1,244 | 1,037 | 1,073 | 1,259 | 48.8 | 53.0 | 19.1 | 37.1 | 39.3 | 19.4 |
| Solomon Islands | 9.5 | 10.2 | 110.3 | 104.5 | 59.5 | 52.3 | 34.4 | 33.9 | 1,976 | 2,184 | 1,566 | 1,727 | 41.5 | 33.8 | 45.2 | 56.3 | 62.5 | 25.5 |
| South Africa | 17.2 | 19.0 | 80.1 | 80.3 | 20.7 | 28.6 | 23.4 | 29.3 | 9,847 | 9,529 | 10,245 | 11,839 | 4.1 | 3.1 | 61.2 | 66.2 | 56.8 | 86.6 |
| Spain | 23.8 | 28.0 | 78.0 | 75.5 | 23.4 | 28.9 | 21.6 | 25.4 | 24,631 | 27,335 | 31,808 | 33,876 | 4.4 | 3.1 | 65.0 | 67.5 | 79.2 | 113.7 |
| Sri Lanka | 25.2 | 25.4 | 83.9 | 83.2 | 43.2 | 38.9 | 34.2 | 30.2 | 3,603 | 4,376 | 5,182 | 6,702 | 23.3 | 13.4 | 50.2 | 57.5 | 71.5 | 77.5 |
| Suriname | 14.6 | 24.2 | 93.1 | 98.7 | 34.9 | 46.6 | 27.1 | 23.7 | 10,191 | 9,768 | 10,573 | 13,445 | 12.7 | 8.1 | 62.9 | 50.4 | 68.4 | 67.8 |
| Sweden | 22.1 | 22.6 | 73.4 | 70.9 | 30.9 | 38.8 | 35.4 | 45.3 | 30,016 | 32,757 | 38,193 | 42,533 | 2.6 | 1.6 | 67.2 | 69.0 | 79.6 | 120.5 |
| Switzerland | 26.7 | 24.2 | 69.4 | 67.4 | 39.8 | 47.3 | 43.7 | 55.7 | 43,343 | 45,942 | 49,292 | 53,453 | 1.6 | 0.9 | 69.3 | 72.3 | 79.8 | 96.5 |
| Tajikistan | 24.5 | 16.7 | 81.2 | 111.6 | 58.9 | 65.6 | 53.2 | 37.2 | 2,519 | 1,110 | 1,407 | 1,932 | 30.9 | 23.6 | 32.5 | 43.5 | 64.2 | 83.3 |
| Tanzania | 21.4 | 24.1 | 96.5 | 83.3 | 33.5 | 25.5 | 15.7 | 18.1 | 1,417 | 1,408 | 1,612 | 1,993 | 43.5 | 32.4 | 39.8 | 45.8 | 52.0 | 8.6 |
| Togo | 16.2 | 16.3 | 93.7 | 100.2 | 40.5 | 54.5 | 30.6 | 38.1 | 1,206 | 1,317 | 1,241 | 1,214 | 37.2 | 36.4 | 42.1 | 46.0 | 54.5 | 31.7 |
| Tonga | 21.1 | 23.4 | 111.3 | 114.2 | 53.3 | 53.3 | 20.9 | 15.7 | 3,847 | 4,316 | 4,832 | 4,848 | 29.2 | 20.3 | 52.9 | 59.8 | 70.8 | 104.7 |
| Trinidad and Tobago | 20.6 | 20.6 | 71.5 | 56.8 | 40.7 | 38.7 | 48.6 | 60.5 | 13,469 | 15,268 | 20,512 | 28,981 | 2.3 | 0.8 | 52.1 | 42.4 | 68.7 | 81.7 |
| Turkey | 23.2 | 18.9 | 79.7 | 83.4 | 21.5 | 25.7 | 18.5 | 23.5 | 10,918 | 12,399 | 13,008 | 16,041 | 15.2 | 10.0 | 52.3 | 62.1 | 69.7 | 73.5 |
| Uganda | 16.4 | 22.3 | 95.3 | 89.3 | 21.6 | 27.1 | 9.9 | 15.5 | 807 | 996 | 1,135 | 1,423 | 46.2 | 25.6 | 38.1 | 50.4 | 49.8 | 17.0 |
| United Kingdom | 19.4 | 18.1 | 81.1 | 84.5 | 25.5 | 28.8 | 25.0 | 26.3 | 26,576 | 29,813 | 34,188 | 37,025 | 1.3 | 0.7 | 69.5 | 76.3 | 77.9 | 99.4 |
| United States | 21.6 | 21.4 | 79.8 | 83.0 | 11.6 | 14.9 | 10.2 | 10.6 | 37,532 | 41,925 | 46,838 | 49,948 | 1.3 | 1.1 | 75.3 | 77.4 | 76.7 | 93.7 |
| Uruguay | 15.3 | 17.9 | 85.1 | 82.0 | 19.3 | 27.0 | 18.9 | 27.0 | 10,722 | 12,653 | 12,043 | 14,847 | 8.0 | 10.0 | 62.8 | 63.9 | 74.6 | 92.2 |
| Uzbekistan | 26.4 | 22.0 | 77.9 | 74.0 | 31.4 | 32.2 | 27.1 | 36.2 | 2,653 | 2,291 | 2,636 | 3,599 | 32.9 | 27.0 | 37.6 | 45.7 | 66.9 | 96.6 |
| Venezuela, RB | 20.9 | 24.1 | 72.7 | 65.2 | 22.7 | 20.0 | 29.2 | 30.8 | 15,361 | 15,092 | 13,561 | 16,659 | 5.1 | 4.6 | 45.0 | 43.4 | 72.6 | 68.1 |
| Vietnam | 23.9 | 34.2 | 83.2 | 74.1 | 45.8 | 69.9 | 38.7 | 61.6 | 1,679 | 2,306 | 2,942 | 3,985 | 29.6 | 19.9 | 41.1 | 42.8 | 73.3 | 45.8 |
| Zambia | 13.8 | 29.9 | 91.6 | 64.0 | 36.5 | 32.9 | 30.5 | 30.3 | 2,199 | 2,062 | 2,227 | 2,849 | 19.4 | 14.9 | 41.3 | 54.3 | 44.8 | 20.8 |
| Zimbabwe | 18.9 | 8.2 | 83.0 | 106.3 | 35.6 | 49.0 | 33.7 | 34.4 | 2,432 | 2,594 | 2,203 | 1,435 | 17.1 | 17.7 | 52.4 | 51.3 | 48.9 | 41.9 |
| Tunisia | 26.0 | 24.3 | 78.1 | 78.5 | 45.1 | 48.8 | 41.0 | 45.9 | 5,810 | 6,636 | 7,895 | 9,656 | 14.9 | 9.7 | 53.3 | 60.2 | 72.5 | 70.6 |
| Average without Tunisia | 21.5 | 22.6 | 83.4 | 81.3 | 41.7 | 46.3 | 36.7 | 42.3 | 12068.3 | 13093.5 | 14585.3 | 16741.5 | 18.9 | 14.7 | 51.3 | 55.0 | 66.1 | 67.2 |

Source: World Development Indicators and authors' own calculations.

**Table S.3: Averages of Economic and Social Characteristics of GDP after Removing the Republic of Congo, Poland and Sri Lanka***

| | Tunisia | Synthetic Tunisia |
|---|---|---|
| GCF average 1990-2000 | 26.0 | 25.7 |
| GCF average 2001-2010 | 24.3 | 24.4 |
| Consumption average 1990-2000 | 78.1 | 78.2 |
| Consumption average 2001-2010 | 78.5 | 78.4 |
| Imports average 1990-2000 | 45.1 | 45.1 |
| Imports average 2001-2010 | 48.8 | 48.7 |
| Exports average 1990-2000 | 41.0 | 41.0 |
| Exports average 2001-2010 | 45.9 | 45.7 |
| Agriculture 1990-2000 | 14.9 | 17.2 |
| Agriculture 2001-2010 | 9.7 | 12.3 |
| Services 1990-2000 | 53.3 | 53.3 |
| Services 2001-2010 | 60.2 | 58.5 |
| Life Expectancy at birth (years) | 72.5 | 68.2 |
| Secondary School Enrollement (%) | 70.6 | 71.3 |
| GDP per capita average 1990-1994 (US$) | 5,810 | 5,801 |
| GDP per capita average 1995-1999 (US$) | 6,636 | 6,630 |
| GDP per capita average 2000-2004 (US$) | 7,895 | 7,875 |
| GDP per capita average 2005-2010 (US$) | 9,656 | 9,634 |

Source: Authors' own calculations.

* All variables are in percentage of GDP (%) unless stated otherwise.

Synthetic Tunisia: Angola (0.007); Belize (0.22); India (0.222); Lesotho (0.013); Malaysia (0.046); Mauritius (0.26); Moldova (0.027); Peru (0.105); Trinidad and Tobago (0.041); Uzbekistan (0.057).

**Table S.4: Averages of Economic and Social Characteristics of GDP after Taking 3-year GDP per capita averages***

| | Tunisia | Synthetic Tunisia |
|---|---|---|
| GCF average 1990-2000 | 26.0 | 25.7 |
| GCF average 2001-2010 | 24.3 | 24.6 |
| Consumption average 1990-2000 | 78.1 | 78.2 |
| Consumption average 2001-2010 | 78.5 | 78.4 |
| Imports average 1990-2000 | 45.1 | 45.0 |
| Imports average 2001-2010 | 48.8 | 48.7 |
| Exports average 1990-2000 | 41.0 | 41.0 |
| Exports average 2001-2010 | 45.9 | 45.5 |
| Agriculture 1990-2000 | 14.9 | 16.7 |
| Agriculture 2001-2010 | 9.7 | 11.9 |
| Services 1990-2000 | 53.3 | 54.0 |
| Services 2001-2010 | 60.2 | 58.8 |
| Life Expectancy at birth (years) | 72.5 | 67.7 |
| Secondary School Enrollement (%) | 70.6 | 72.5 |
| GDP per capita average 1990-1992 (US$) | 5,675 | 5,667 |
| GDP per capita average 1993-1995 (US$) | 6,026 | 6,021 |
| GDP per capita average 1996-1998 (US$) | 6,641 | 6,635 |
| GDP per capita average 1999-2001 (US$) | 7,455 | 7,441 |
| GDP per capita average 2002-2004 (US$) | 8,105 | 8,094 |
| GDP per capita average 2005-2007 (US$) | 9,134 | 9,119 |
| GDP per capita average 2008-2010 (US$) | 10,179 | 10,169 |

Source: Authors' own calculations.

* All variables are in percentage of GDP (%) unless stated otherwise.

Synthetic Tunisia: Angola (0.002); Belize (0.22); Congo, Rep. (0.065); Djibouti (0.013); Dominican Republic (0.012); Grenada (0.024); India (0.2); Ireland (0.01); Lesotho (0.018); Mauritius (0.179); Moldova (0.019); Panama (0.072); Poland (0.131); Uzbekistan (0.107); Vietnam (0.015).

**Table S.5: ADRL(1) with Jackknife Standard Errors**

| | (1) |
|---|---|
| D.log($World_t$) | 0.258 |
| | (0.195) |
| D.log($Tunisia_{t-1}$) | -0.084 |
| | (0.327) |
| D.log($World_{t-1}$) | 0.297 |
| | (0.275) |
| AS(2011) | -0.058*** |
| | (0.009) |
| AS(2012) | -0.003 |
| | (0.020) |
| AS(2013) | -0.018*** |
| | (0.003) |
| Constant | 0.024 |
| | (0.015) |
| Observations | 24 |
| R-squared | 0.455 |

Jackknife standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.
Note: AS is a dummy variable representing the Arab Spring that takes 1 from 2011 onward and 0 otherwise. AS(2011) is a dummy variable that takes 1 for 2011 and 0 otherwise. AS(2012) is a dummy variable that takes 1 for 2012 and 0 otherwise. AS(2013) is a dummy variable that takes 1 for 2013 and 0 otherwise.

**Table S.6: Net Fuel Exports (as a % of GDP)***

| | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Belize** | n.a. | n.a. | -6.3 | -5.6 | -5 | -4.8 | -4.5 | -5.7 | -4.8 | -12 | -11 | n.a. | n.a. | -6.7 | -7.4 | -12 | -3.1 | 0.6 | 3.9 | 0.1 | 4.1 | 7.7 | 1.9 | -0.7 |
| **Congo, Rep.** | n.a. | n.a. | n.a. | 52 | 45 | 42 | n.a. | n.a. | n.a. | n.a. | n.a. | n.a. | n.a. | n.a. | n.a. | n.a. | n.a. | 57 | 58 | 44 | 51 | 63 | 58 | 48 |
| **India** | -1.8 | -2.1 | -2.2 | -2 | -1.8 | -2.1 | -2.7 | -2.3 | -2 | -3.1 | -3.9 | -3 | -3.1 | -3.2 | -3.9 | -4.9 | -5.1 | -4.8 | -7.5 | -4.8 | -5 | -6.7 | -8.4 | -7.3 |
| **Korea, Rep.** | -3.7 | -3.4 | -3.7 | -3.4 | -3 | -3 | -3.5 | -4.1 | -3.8 | -3.6 | -5.2 | -4.9 | -4.3 | -4.7 | -5.2 | -5.7 | -6.4 | -6.3 | -10 | -7.5 | -8.2 | -10 | -10 | -9.6 |
| **Lesotho** | n.a. | n.a. | n.a. | n.a. | n.a. | n.a. | n.a. | n.a. | n.a. | n.a. | n.a. | -6.2 | -9.2 | -7.4 | -7.4 | n.a. | n.a. | n.a. | -11 | -12 | -11 | -14 | -13 | n.a. |
| **Mauritius** | -4.2 | -5 | -3.6 | -3.7 | -3.4 | -3.4 | -4.1 | -4 | -3.2 | -3.7 | -5.4 | -4.9 | -4.7 | -4.6 | -5.7 | -8.3 | -9 | -9.2 | -10 | -6.7 | -8.7 | -9.9 | -9.8 | -9.9 |
| **Moldova** | n.a. | n.a. | n.a. | n.a. | -20 | -22 | n.a. | n.a. | -19 | -19 | -20 | -16 | -14 | -14 | -14 | -16 | -19 | -18 | -18 | -13 | -14 | -10 | -9.7 | -9.4 |
| **Panama** | -4.8 | -4.3 | -4.6 | -3.7 | -3.8 | -4.1 | -4.4 | -3.9 | -2.7 | -2.9 | -4.9 | -4.6 | -3.7 | -2.8 | n.a. | -11 | -3.8 | -4 | -1.9 | -0.5 | -0.8 | -0.7 | -2.2 | -2.4 |
| **Peru** | -0 | -0.4 | -0.5 | -0.4 | -0.4 | -0.7 | -0.7 | -0.8 | -0.6 | -0.7 | -1.3 | -0.9 | -0.8 | -1 | -1.5 | -0.7 | -0.8 | -1 | -1.7 | -0.3 | 0.1 | 0.3 | 0.5 | 0.1 |
| **Poland** | -1.7 | -2.7 | -1.8 | -1.3 | -0.8 | -0.6 | -1.1 | -1.3 | -0.9 | -1.2 | -2.2 | -1.6 | -1.6 | -1.9 | -1.7 | -2.3 | -2.4 | -2.7 | -3.1 | -2.3 | -2.7 | -3.4 | -3.6 | -2.8 |
| **Sri Lanka** | -4.1 | -3.6 | -3.2 | -3 | -2.5 | n.a. | n.a. | n.a. | n.a. | -2.2 | -4.1 | -3.6 | -5 | -4 | -5.6 | -4.9 | -6.1 | -8.2 | -8 | -4.6 | -4 | -6.4 | -6 | -5.7 |
| **Trinidad and Tobago** | 23 | 21 | 19 | 16 | 18 | 22 | 16 | 15 | 10 | 14 | 21 | 14 | 15 | 19 | 21 | 31 | 47 | 29 | 35 | 26 | 24 | n.a. | n.a. | n.a. |
| **Tunisia** | 0.9 | 0.8 | 0.8 | -0.4 | -0.4 | -0.6 | -0.4 | -0.6 | -0.3 | -0.7 | -0.9 | -1.4 | -1.1 | -1.4 | -1.3 | -1.4 | -2.1 | 0 | -1.8 | -0.5 | -1.1 | -2.1 | -3.1 | -3.7 |
| **Uzbekistan** | n.a. | n.a. | n.a. | n.a. | n.a. | n.a. | n.a. | n.a. | n.a. | n.a. | n.a. | n.a. | n.a. | n.a. | n.a. | n.a. | n.a. | n.a. | n.a. | n.a. | n.a. | n.a. | n.a. | n.a. |
| **Vietnam** | n.a. | n.a. | n.a. | n.a. | n.a. | n.a. | n.a. | 1.7 | 2 | 4.4 | 5.1 | 4.1 | 3.6 | 3.3 | 4.4 | 5 | 4.1 | 1.5 | -0.1 | 1 | -0.2 | -1.3 | -0.1 | -0.3 |

Source: World Development Indicators and authors' own calculations. The blue shaded area represents the post-Arab Spring period.
Net Fuel Exports (as a % of GDP) are calculated as the difference between Fuel Exports (as a % of GDP) and Fuel Imports (as a % of GDP). * n.a. means not available

**Table S.7: GCF (% of GDP): Normalized Ratio of Post-2010 gap to Pre-2010 gap***

| Country | Normalized Ratio | Country | Normalized Ratio |
|---|---|---|---|
| Colombia | 0.04 | Antigua and Barbuda | 1.12 |
| Chile | 0.08 | Serbia | 0.93 |
| Mexico | 0.14 | Gabon | 1.06 |
| Albania | 0.15 | Costa Rica | 1.08 |
| Angola | 0.15 | South Africa | 1.21 |
| El Salvador | 0.17 | Togo | 1.22 |
| Congo, Dem. Rep. | 0.21 | Croatia | 1.28 |
| Brunei Darussalam | 0.22 | Australia | 1.37 |
| Kyrgyz Republic | 0.29 | Sierra Leone | 1.39 |
| Hong Kong SAR, China | 0.30 | Denmark | 1.50 |
| Romania | 0.31 | Saudi Arabia | 1.54 |
| Kuwait | 0.32 | United Kingdom | 1.58 |
| Czech Republic | 0.34 | Burundi | 1.66 |
| New Zealand | 0.34 | Guatemala | 1.66 |
| Bosnia and Herzegovina | 0.39 | Grenada | 1.79 |
| India | 0.40 | Guinea-Bissau | 1.81 |
| Latvia | 0.41 | Dominican Republic | 1.90 |
| Macao SAR, China | 0.50 | Comoros | 2.04 |
| Korea, Rep. | 0.54 | Hungary | 2.16 |
| Cambodia | 0.55 | Paraguay | 2.19 |
| Ethiopia | 0.56 | Benin | 2.21 |
| Zimbabwe | 0.57 | Belarus | 2.31 |
| Kazakhstan | 0.59 | Switzerland | 2.41 |
| Tajikistan | 0.63 | Nigeria | 2.71 |
| Mauritius | 0.69 | Pakistan | 2.80 |
| Belize | 0.70 | Madagascar | 2.81 |
| Cameroon | 0.71 | Guyana | 2.86 |
| Namibia | 0.74 | Vietnam | 3.57 |
| Lesotho | 0.77 | Cote d'Ivoire | 4.81 |
| Ghana | 0.81 | Haiti | 5.56 |
| Poland | 0.86 | Armenia | 5.72 |
| Turkey | 0.88 | Tunisia | 5.92 |
| Iceland | 1.13 | Malawi | 7.43 |
| Slovak Republic | 1.15 | | |

Source: Authors' own calculations. Note: The normalized ratio for each country is calculated as th difference between the actual GCF (% of GDP) of each country and that of its syntehtic counterpart after 2010 divided by the estimated difference before 2010. The higher this normalized ratio is, the larger is the negative impact of a shock after 2010. * The normalized ratio is only calculated for control countries that exhibited a negative gap between actual and synthetic GCF (% of GDP) after 2010.

**Table S.8: Net Exports (% of GDP): Normalized Ratio of Post-2010 gap to Pre-2010 gap***

| Country | Normalized Ratio | Country | Normalized Ratio |
|---|---|---|---|
| Latvia | 0.08 | Brazil | 0.97 |
| Burundi | 0.13 | Switzerland | 1.14 |
| Gabon | 0.19 | United States | 1.16 |
| Antigua and Barbuda | 0.27 | Paraguay | 1.44 |
| Nigeria | 0.28 | Germany | 1.50 |
| Dominican Republic | 0.29 | Togo | 1.52 |
| Pakistan | 0.33 | Bolivia | 1.55 |
| Czech Republic | 0.34 | Netherlands | 1.57 |
| Italy | 0.40 | Israel | 1.63 |
| Macedonia, FYR | 0.40 | Denmark | 1.68 |
| Costa Rica | 0.47 | Cameroon | 1.73 |
| Sweden | 0.47 | Nicaragua | 1.74 |
| Grenada | 0.48 | Austria | 1.83 |
| Colombia | 0.50 | Uruguay | 1.86 |
| South Africa | 0.51 | Uganda | 1.95 |
| Canada | 0.56 | Norway | 1.98 |
| Singapore | 0.57 | Chile | 2.40 |
| Australia | 0.58 | Belgium | 2.62 |
| Samoa | 0.61 | Venezuela, RB | 2.66 |
| Malaysia | 0.68 | New Zealand | 2.66 |
| Belize | 0.70 | Mexico | 2.75 |
| Moldova | 0.72 | France | 3.12 |
| Poland | 0.75 | Fiji | 3.34 |
| Armenia | 0.77 | Finland | 4.29 |
| Trinidad and Tobago | 0.83 | Tunisia | 4.35 |
| Cote d'Ivoire | 0.91 | | |

Source: Authors' own calculations. Note: The normalized ratio for each country is calculated as th difference between the actual net exports (% of GDP) of each country and that of its syntehtic counterpart after 2010 divided by the estimated difference before 2010. The higher this normalized ratio is, the larger is the negative impact of a shock after 2010. * The normalized ratio is only calculated for control countries that exhibited a negative gap between actual and synthetic the net exports (% of GDP) after 2010.

## S.2. Constructing a Synthetic Control in Stata

In this section, we briefly describe how to construct synthetic Tunisia using the "Synth" algorithm developed by Abadie et al. (2011) for Stata. Before applying this routine it is essential to set our data in a long panel format and define the unit (in our case country) and time (in our case year) variables using the *tsset* command. Then, we should specify the following variables:

1. The outcome variable which in our case is GDP per capita adjusted to PPP at 2011 constant prices.
2. The set of predictors of GDP per capita which are presented in section 4.2 of the paper.
3. The treated unit, which in our case is Tunisia.
4. The pre-treatment period, which in our case is the pre-Arab Spring period that stretches from 1990 to 2010.

By default, the optimal weights assigned to each control country and each individual predictor are calibrated using a constrained quadratic programming routine that minimizes the Mean Square Prediction Error (in other words the difference) between the actual Tunisia and the synthetic Tunisia over the period 1990-2010 period.[2]

[2] More details about the mechanics of the Synth command in Stata can be found using an online video prepared by Jens Hainmueller and that can be accessed through the following website: http://web.stanford.edu/~jhain/Video/SynthDemo.mp4.