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Food security and political reforms

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1. Introduction

In the last decade there has been a renewed interest in food and nutrition security. The food price spikes of 2007-08 and 2010-11 have revived the fight against hunger and malnutrition and has given food security a more prominent place on the international policy agenda. Despite the growing consensus of reducing hunger and child malnutrition, there is less consensus on the way forward.

Food security is a complex and multidimensional problem consisting of many causes at different levels of aggregation (individual, household, national and international). In the past decade a large literature on food security and its drivers and determinants has been developed over time. In the empirical literature, four main determinants of food security can be identified (see e.g. Headey, 2012): economic status, health status and environment, education and demographic factors. Among the various determinants, the impact of political reforms on food security has received less attention. In this paper, we therefore test whether a transition into a democracy systematically affects food security at country level.

The median voter model predicts that democracies redistribute from the rich to the poor. As a result, a political reform towards a democracy will have a positive effect on food security only if the median voter in a democracy attaches more importance to food security issues compared to the ruling elite in an autocracy. There are, however, confounding factors that can make the relationship more complex. Autocracies, for example, might care as well about poverty and food security issues as it reduces the incentives of the population to revolt against the autocratic regime. In this case, a transition into a democracy might not significantly improve food security.

There are only a few papers that test the impact of political reforms on food security. Among these, Smith and Haddad (2000) mention democracy as a possible determinant of nutritional outcomes and report a positive correlation between democracies and food security. In the health literature, few papers investigate the relation between politics and health (see e.g. Kudamatsu, 2012, Besley and Kudamatsu, 2006, Franco et al., 2004). Besley and Kudamatsu (2006) explore the relationship between life expectancy and political reforms and conclude that there exists a robust and positive association. Kudamatsu (2012) restricts his analysis to sub-Saharan African countries and finds a negative relationship between democratization and infant mortality rate.

The purpose of this paper is to explore the relationship between political reforms and food security outcomes in a comparative case study framework by using a new estimation technique in addition to the traditional difference-in-difference method. The Synthetic Control Method, developed by Abadie and Gardeazabal (2003) and extended in Abadie et al. (2010), is a technique that allows to construct a better fit between control and treated units in the pre-treatment period compared to more traditional estimation techniques.

The SCM has three main advantages compared to the difference-in-difference approach, which is traditionally used to analyze the relationship between democratic transitions and health and nutritional outcomes. First, the SCM constructs the counterfactual as a weighted average of the control units and provides, thereby, a better fit than the difference-in-difference methodology. Second, the SCM accounts for the presence of time invariant unobserved heterogeneity (Abadie et al., 2010). Finally, the SCM estimator has the proposition that the results are both external and internal valid, as it succeeds to find a balance

between large cross-country studies, which often lack internal validity, and case studies, that often cannot be generalized (Billmeier and Nannicini, 2009).

Our main results can be summarized as follows: using the difference-in-difference approach our estimation results show a positive and robust effect of a political regime transition into a democracy on food security. However, when we apply the synthetic control method we do not find a systematic effect of democratic transitions on food security. Of the 32 country case studies, we find a significant and positive relation between food security and political reforms for 4 countries, while for the remaining 28 countries no impact was found.

2. Data

Food security and health indicators

Food security is a very wide concept and it is hard to define it with a single indicator. Among the various proxies for food security, we select child mortality as our food security indicator. Child mortality is collected from the UN Inter-agency Group for Child Mortality Estimation¹ (2013) and measures the probability of dying before the age of five for a new born child.

There are several advantages related to the selection of child mortality, but the main reason is data availability. In order to analyse our research question we need yearly data. Child mortality is available on a yearly basis from 1960 until now for almost all the countries in the world, while other commonly used food security indicators such as stunting, wasting, underweight and undernutrition have a more limited time span or country coverage.

Food security is caused by different factors at different levels of aggregation ranging from household inequality, poverty, a lack of proper sanitation, restricted or no access to clean water to conflict and natural disasters. In a similar way, child mortality can be caused by an interaction of factors that overlap with the determinants of food insecurity as child mortality is a reflection of the interaction between inadequate dietary intake and an unhealthy environment. Although child mortality is also affected by other factors that are not strictly related to food security, it encompasses the most important determinants of food security. Caulfield et al. (2004) estimated that 53-55 percent of the child deaths worldwide are related to undernutrition and more specific of a weakened immune system caused by hunger and malnutrition (FAO, IFAD and WFP, 2005).

Political reform indicator

A key issue in studying how a regime transition toward democracy affects food security, is the definition of the exact year of each democratization episode. Indeed, there is not always concordance on the year in which democratization takes place. For the construction of the political reform indicator, we follow the same strategy as recent studies that have investigated similar questions at aggregated level (see e.g. Persson and Tabellini, 2008, Persson 2005, Giavazzi and Tabellini, 2005, Olper et al. 2014). Following Persson and Tabellini (2008), the political reform indicator is constructed based on the Polity2 index from Polity IV data (Marschall and Jagers, 2007). The Polity2 index assigns a value ranging from -10 to +10 to each country for each year, with higher values associated with better democracies. We

¹ Organisations involved in the estimation: United Nations Children's fund, World Health Organisation, the World Bank, United Nations Department of Economic and Social Affairs (Population Division) and United Nations Economic Commission for Latin America and the Caribbean (Population Division)

classify a country as “democratic” if the polity2 index is strictly positive, and “autocratic” otherwise.² A reform into democracy occurs in a year when a country’s political regime indicator switches from 0 to 1. In order to avoid the use of very short reform episodes, we also introduce the criterion that the dependent variable is observed for at least 4 or 10 years before and after each regime transition.

Other explanatory variables

In the empirical specifications we include, apart from the variables discussed above, additional controls that are likely to affect the prevalence of child mortality in a country. Different frameworks (see e.g. UNICEF, 1990, Pieters et al., 2013) identify a broad list of social and economic factors that affect food security, but also existing empirical studies have shed light on the different drivers of food security. The vector of control variables has been selected on the basis of previous evidence of the cross-country determinants of food security and health (see e.g. Headey, 2012, Besley and Kudamatsu, 2006).

The level of development defined as the real GDP per capita (Penn World Tables by Heston et al., 2013) can be viewed as one of the main determinants of food security at the national level. Indeed, a higher level of national income facilitates the purchase of food at international markets and allows governments to spend more on health and sanitation facilities, education programs, and etcetera. The relation between child mortality and national income is non-linear and will be therefore expressed in logs and squares.

The incidence of armed conflict is assumed to be positively correlated with the under-five mortality rate. The conflict dummy – which is based on the Armed Conflict Database by Gleditsch et al. (2002) – is equal to 1 if the country was involved in a conflict with at least 1,000 deaths (Kudamatsu, 2012). Violence and social conflicts typically have negative direct and indirect effects on food security.

Food security depends also on the availability of food as it is a necessary condition to guarantee food security. At the country level, food availability is related to food production, the net-imports of food and food aid. It is measured as the total amount of kilocalories per capita available per day and retrieved from the FAO food balance sheets (2013).

The percentage of rural population collected from the FAOSTAT database (2013) is included as an additional control in the regression. Nowadays, most of the poor and food insecure people are living in remote areas where the availability and access to food is rather limited. Therefore, we expect a negative relation between the percentage of rural population and the food security indicator.

The percentage of female children who have completed the last year of the primary school, or a higher level of education, is an indicator for the improvements in education levels in a country. Education is an important tool to reduce poverty and to fight food insecurity, as it creates better future income opportunities for children by targeting illiteracy and the lack of numeracy. The data is collected from the World Bank (2013).

² The threshold is set at zero, since many large changes in the polity2 are clustered around zero and thereby the identification of the causal effect can exploit the time variation in the data. In the case that the threshold value would be set higher, polity2 would classify also very gradual changes in the underlying indicators of polity2 that are unlikely to be significantly correlated with changes in political regimes.

3. Empirical strategy

Difference-in-difference

In the first step of our empirical analysis we test the relation between the under-five mortality rate and the transition to democracy running the following regression:

$$y_{i,t} = \alpha_i + \rho_t + \beta D_{i,t} + \gamma X_{i,t} + \varepsilon_{i,t} \quad (1)$$

The difference-in-difference estimation method controls for both the country fixed effects α and time fixed effects ρ . In the regression we compare the average mortality rate y of the treated countries before and after the political reform with the averages of the control countries, namely those that remain an autocracy or a democracy. D is the democratization index in the regression equation which is equal to 1 for a democracy and 0 otherwise. For the treated countries the democratization indicator switches from 0 to 1. β is the average change of child mortality before and after transition for the treated countries compared to the average change in the control countries, over the same period. X contains a set of control variables as discussed in the previous section.

The estimates must comply with the following conditions (see Abadie, 2005; Persson and Tabellini, 2008; and Olper et al., 2014). First, in the absence of treatment the average under-five mortality rate must be the same for the treated and control countries conditional on the set of control variables. The condition would fail if a democratic transition would coincide with conflict, which might have long lasting effects on the mortality rate in former autocracies. To avoid this issue, one must increase the similarity between the treated and control countries by adding relevant control variables, such as conflict. The second issue is that the difference-in-difference estimation method does not account for heterogeneity of the political regime switches on child mortality. In the literature, it is suggested to interact the democratization index with other variables that characterize political regimes. Our dataset will not always be able to apply this method since the amount of possible interactions will be too large with respect to the amount of political regime changes. In addition, we include in each regression regional-trend effects to cope with spatial dependence. Finally, to control for autocorrelation, we will always cluster our regressions at country level.

Synthetic control method

After studying the relationship between child mortality and political regime transitions with the difference-in-difference estimator, we test the robustness of our results using an innovative approach, the synthetic control method (SCM), implemented for comparative case studies by Abadie and Gardeazabal (2003) and then further developed in Abadie et al. (2010). This method is in particular appropriate to study the evolution of aggregate outcomes for a *treated* unit affected by an event or intervention of interest. SCM compares the evolution of child mortality both for the treated unit (i.e. countries where democratization take place) and for a control group, the synthetic control, not affected by the intervention. The synthetic control group is built as a weighted combination of potential control units, with the aim to generate a synthetic control that proxies the main characteristics of the treated unit (Abadie et al., 2010). In this section we summarize the main features of the SCM, following Billmeier

and Nannicini (2013), who implemented such method to study the relation between trade liberalization and growth.

Formally, assume that we observe a panel of $I_C + 1$ countries over a period T , where only country i is affected by the treatment (in our case democratization) at time $T_0 < T$. The other countries I_C represent potential controls as they are not subjected to the democratization process and maintain the autocracy status for all the considered period. The treatment effect involving country i at time T_0 can be defined as follow:

$$\tau_{it} = Y_{it}(1) - Y_{it}(0) = Y_{it} - Y_{it}(0) \quad (2)$$

where $Y_{it}(1)$ and $Y_{it}(0)$ represent the potential outcome of the treated and untreated unit, respectively. In this paper, the outcome refers to the under-five mortality rate associated to the democratization episode. The SCM aims at estimating the treatment outcome vector $(\tau_{i,T_0+1}, \dots, \tau_{i,T})$ for $t > T_0$. Abadie et al. (2010) propose with the SCM an innovative approach to estimate the treatment effect for the potential outcomes of child mortality of all countries using the following general model:

$$Y_{jt}(0) = \delta_t + X_j\theta_t + \lambda_t\mu_j + \varepsilon_{jt} \quad (3)$$

where δ_t represents an unknown and common factor to all the $j = 1, \dots, I_C + 1$ countries. X_j is a vector of observed relevant covariates that are not affected by the political reform and can be either time variant or invariant, while θ_t represents a vector time-specific parameters. Finally, μ_j is a vector of country-specific unobserved factors, with λ_t that accounts for unknown common factors and ε_{jt} that represents transitory shocks with zero mean. Note that all the variables included in X_j are referred to the pre-treatment period. The assumption that they are not affected by a political reform means that any possible “anticipation” effect has to be ruled out, namely, that these variables may change due to the anticipation of the future democratization reform.

The use of the synthetic control method is an improvement upon the difference-in-difference method for the following reasons. First, the counterfactual of the SCM fits, by construction, better the pre-treatment period between treated country and the counterfactual, as the counterfactual is a weighted average of the available control units. Second, the synthetic control method accounts for the presence of time variant unobservables, while the difference-in-difference approach only controls for time invariant unobserved heterogeneity (Abadie et al., 2010). A macro-economic shock that is correlated with both the democratization process and child mortality can affect each individual differently and thereby influencing the statistical inference of the difference-in-difference model. Third, the synthetic control estimator has the proposition that the results are both external and internal valid. Large cross-country studies are often not internal valid because of a lack of a good common support, while case studies have the proposition of being internal valid, but they can often not be generalized. The synthetic control method succeeds to find a balance between a good common support due the innovative construction of the counterfactual - and the generalization of the results as it can be tested on large set of countries (Billmeier and Nannicini, 2009).

4. Estimation results

Difference-in-difference estimates

Table 1 reports the results of the specification of equation (1) and corresponds to the difference-in-difference estimation. In every regression, we control for country fixed effects, year fixed effects, regional-trend effects and all the covariates discussed above. Moreover, the standard errors are clustered within countries. The different regressions test for different assumptions about the treatment and the control group to assess the robustness of our results.

Table 1. Effect of political reforms on child mortality

Dependent variable Variables	Under-five Mortality Rate				
	(1)	(2)	(3)	(4)	(5)
Democratization index	-16.40*** (4.670)	-17.68*** (4.527)	4.947 (8.311)	-25.11*** (4.695)	4.386 (17.23)
Log GDP per capita	-175.0*** (39.03)	-165.1*** (41.00)	-128.6** (48.43)	-221.3*** (49.59)	-146.0*** (53.19)
Log GDP per capita squared	12.37*** (2.430)	11.86*** (2.549)	7.604** (2.943)	14.38*** (2.973)	8.901** (3.305)
Conflict dummy	2.830 (2.995)	-1.302 (3.255)	0.660 (2.886)	4.734 (3.598)	0.792 (3.999)
Percentage of females with primary education	0.123 (0.283)	-0.0184 (0.288)	-0.419 (0.371)	-0.0721 (0.262)	-0.358 (0.403)
Log Food supply per capita	-72.05*** (18.48)	-83.83*** (19.33)	-49.19** (20.76)	-50.82*** (17.94)	-47.63* (23.94)
Percentage of rural population	93.02* (48.97)	43.52 (47.03)	77.31 (65.68)	38.82 (48.30)	59.95 (66.36)
Constant	6420.6*** (634.4)	6832.7*** (693.2)	4475.9*** (795.9)	6313.8*** (684.4)	5069.9*** (866.9)
Time fixed effects	Yes	Yes	Yes	Yes	Yes
Country fixed effects	Yes	Yes	Yes	Yes	Yes
Region trend effects	Yes	Yes	Yes	Yes	Yes
Observations	3651	3232	2032	2810	1705
Number of countries	85	79	57	67	43

Notes:

Standard errors clustered at country levels are reported in parentheses

* p<0.10, ** p<0.05, *** p<0.01

In column (1), we test whether a transition to an autocracy or to a democracy has an impact on food security. The results indicate that there is a negative and significant relation between a transition to democracy and child mortality. More in specific, the estimated effect suggests that a transition to democracy (autocracy) reduces (increases), on average, child mortality with 16 per 1,000 new borns.

As the reform effect might be asymmetric across democracies and autocracies, we split the sample into two sub-samples. The first subsample includes only political reforms towards democracies, while the second group is restricted to the countries switching to autocracies. The results using the two different subsamples can be found in regressions (2)

and (3). Column 2 indicates that there is a negative and significant association between a political regime transition to democracy and child mortality: a reduction of 17 child deaths is resulting from a reform to a democracy. There is, however, no impact found of a political reform to an autocracy on child mortality (see column 3). These findings suggest that the reform effect is asymmetric. In other words, a transition to a democracy does not have the same impact as a switch to an autocracy.

Regressions (4) and (5) test whether the impact is stronger when considering only **permanent** regime transitions³. Since our previous results showed that the reform effect is asymmetric, we split up the sample into a group with permanent transitions to democracy (column 4) and into a group only testing for permanent transitions to autocracies (column 5). The coefficient of democracy is significant for countries that undergo a transition from autocracy to democracy. The magnitude of a transition into a democracy is higher compared to regression (2), implying that the consolidation of a permanent democracy has a larger impact on child mortality. The result in column (4) shows that child mortality will be reduced by 25 per 1,000 children if a country switches permanently to a democracy. Column 5 shows that there is no impact of a permanent reform to autocracy on food security, implying that the reform effect is asymmetric for permanent transitions as well.

Synthetic Control Method

In this section, we analyse the impact of 32 permanent democratization episodes⁴ on child mortality. The control group includes those countries that remain an autocracy over the considered period⁵. Among the 32 permanent democratization episodes investigated we find a reduction in child mortality for 8 countries, for 20 countries we do not find any effect, while for 7 countries the synthetic control did not fit the pre-treatment characteristics of the treated country.

In this section, we present the results graphically (Figures 1 and 2), which makes it possible to compare the evolution of child mortality of the treated country with the one of the synthetic control group. Because of space constraints we show the results only for those case studies for which a positive effect of a permanent democratic transition seems to be more evident and robust.

The figures show graphically the evolution of the outcome variable, under-five mortality rate, for the treated unit (solid line) and the synthetic unit (dashed line), for ten years of the pre-treatment period and ten years of the post-treatment period. Below each case study, we present the relative placebo test, that has the role of assessing the significance of the result. A key limitation of the SCM is that, due to the small number of observations involved in these comparative case studies, the standard inferential techniques used to assess the significance of

³ A transition is defined as permanent when the transition lasts for at least 10 years.

⁴ The countries used to run the 32 synthetic control experiments are (in parentheses the year of the democratization transition): Dominican Republic (1978); Honduras (1980); Bolivia (1982); El Salvador (1982); Brazil (1985); Uruguay (1985); Guatemala (1986); Philippines (1986); Korea (1987); Pakistan (1988); Chile (1989); Panama (1989); Paraguay (1989); Mongolia (1990); Nicaragua (1990); Nepal (1990); Benin (1991); Bangladesh (1991); Cape Verde (1991); Madagascar (1991); Zambia (1991); Guyana (1992); Mali (1992); Central African Republic (1993); Mexico (1994); Mozambique (1994); Malawi (1994); Ghana (1996); Djibouti (1999); Indonesia (1999); Nicaragua (1999); Senegal (2000)

⁵ Our donor pool is composed by the following countries: United Arab Emirates; Bahrain; Cote d'Ivoire; Cameroon; Cuba; Egypt; Jordan; Kuwait; Laos; Libya; Morocco; Mauritania; Qatar; Rwanda; Swaziland; Syria; Togo; Tunisia; Tanzania; Vietnam; Yemen.

the results, cannot be used in implementing such method. To overcome this problem, Abadie et al. (2010) suggest the use of placebo tests, where the magnitude of the estimated effect is compared with those obtained by randomly assigning the treatment to any (untreated) country of the donor pool. The results can be considered robust if the effect of the treated country is larger than the majority of the placebo tests.

In Figure 1 we present the results for 2 Central American countries (Guatemala and Mexico) and 2 African countries (Cape Verde), while in Figure 2 we show the results for 4 Asian countries (Philippines, Mongolia, Nepal and Bangladesh). From Figure 1 and 2, it emerges that for all the considered countries the transition from autocracy to democracy is associated with a reduction of child mortality. As in correspondence with the year of the treatment, the solid lines (which represent the outcome of the treated units) depart from the dashed line. The effect seems to be more strong in the cases of Cape Verde, Senegal and Philippines.

To control for the robustness of our result, we perform a placebo test (figure below each case study). An effect can be considered significant if the red line, which represents the treated unit, shows an effect that is larger than the majority of the other lines. Looking at the placebo tests, we can argue that only in the cases of Guatemala, Mexico, Senegal and Philippines, the placebo test confirms the positive effect of the democratic transition on the reduction of the child mortality. In the other 4 cases, the trajectory of the treated unit (red line) seems to be similar to the trajectory of the untreated units (black lines).

Figure 1: Synthetic Control Estimation results and related placebo test for 2 Latin American and 2 African countries

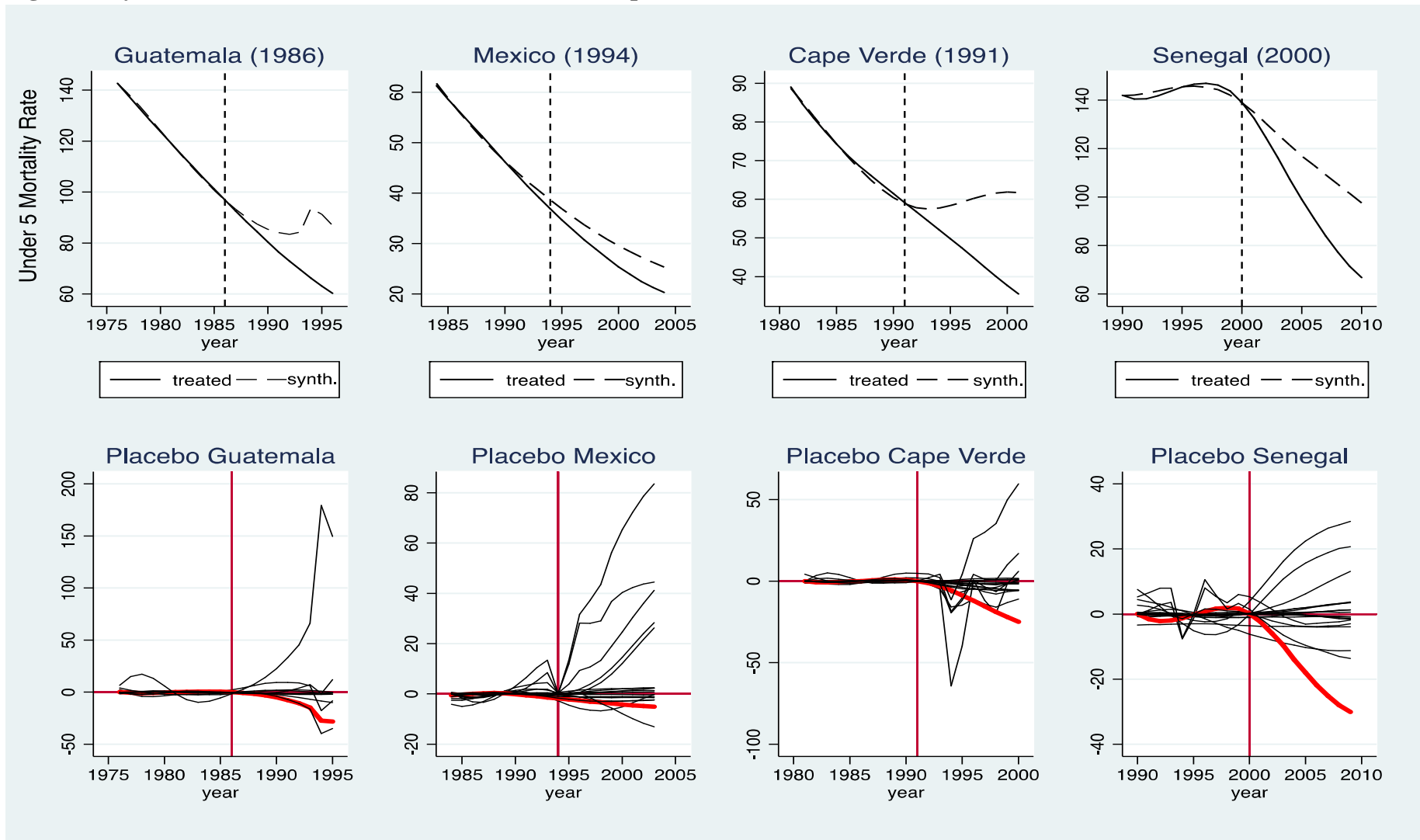
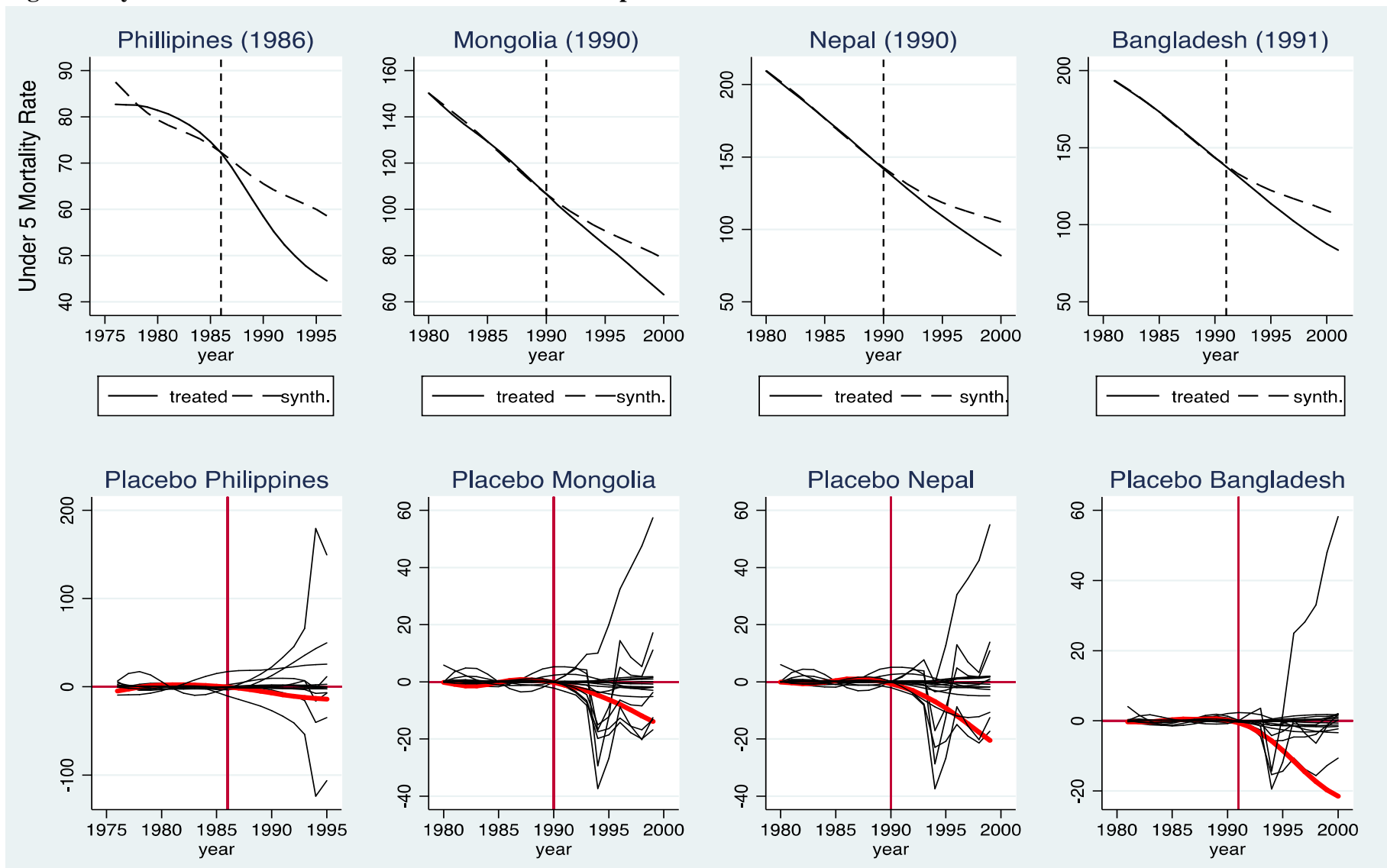


Figure 2: Synthetic Control Estimation results and related placebo test for 4 Asian countries



5. Conclusion

In this paper we have studied the impact of political reforms on food security using evidence from child mortality rates. In addition to the traditional difference-in-difference estimation we applied a new econometric approach for case studies analysis, the synthetic control method.

The main results of the difference-in-difference estimation show that a only political reforms into a democracy have a positive impact on food security with the magnitude of the effect increasing as democracies remain installed for at least ten years.

The results of the synthetic control method provide a less convincing picture of the role of political reforms play in the reduction of child mortality. In the 32 country case studies investigated, we found a significant and positive effect of democratization for Guatemala, Mexico, Senegal and Philippines, while for the other 28 countries we did not find any effect.

The wedge between the results of the two methods can be attributed to the use of the weighted counterfactual in the synthetic control method. By weighing the control countries in the donor pool, the synthetic control method allows to take into account the time-varying impact of country heterogeneity.

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