The Economics of State Fragmentation - Assessing the Economic Impact of Secession

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THE ECONOMICS OF STATE FRAGMENTATION: ASSESSING THE ECONOMIC IMPACT OF SECESSION

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Abstract

This paper provides empirical evidence that declaring independence significantly lowers per capita GDP based on a large panel of countries covering the period 1950-2013. To do so, we rely on a semi-parametric identification strategy that controls for the confounding effects of past GDP dynamics, anticipation effects, unobserved heterogeneity, model uncertainty and effect heterogeneity. Our baseline results indicate that declaring independence reduces per capita GDP by around 20% in the long run. We subsequently propose a novel quadruple-difference procedure to demonstrate the stability of these results. A second methodological novelty consists of the development of a two-step estimator to shed some light on the primary channels driving our results. We find robust evidence that the adverse effects of independence increase in the extent of surface area loss, pointing to the presence of economies of scale, but that they are mitigated when newly independent states liberalize their trade regime or use their new-found political autonomy to democratize.

Keywords: Independence dividend; panel data; dynamic model; synthetic control method; difference-in-difference; triple-difference; quadruple-difference; two-step approach

JEL Classification: C14, C32, H77, O47

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1 Introduction

Historically, state formation tended to be a tale of the aggregation of resources, power and territory.[1] Over the course of the last century, however, the world has witnessed a persistent trend towards state fragmentation, raising the importance of understanding its economic consequences. This is especially so since independence movements increasingly embed their case in the economic realm (Rodríguez-Pose & Gill, 2005). In the wake of the Scottish independence referendum, for example, the Financial Times (2014) reports that

> Alex Salmond, Scotlands first minister who is leading the campaign for independence, said [...] that each household would receive an annual "independence bonus" of £2,000 - or each individual £1,000 - within the next 15 years if the country votes to leave the UK. The UK government, in contrast, claimed that if Scots rejected independence each person would receive a "UK dividend of £4,000 ... for the next 20 years".

In spite of its current poignancy, there is still surprisingly little empirical research on the economic impact of secession and our knowledge on how independence processes have affected economic trajectories of newly independent countries (NICs) remains highly imperfect. In this light, this paper presents estimates of monetary per capita independence gains/losses for a large panel of countries for the period covering 1950-2013.

There are at least three motivations for this exercise. First of all, the theoretical literature on the relation between state fragmentation, state size and economic growth delivers contradictory results. Hence, it remains theoretically ambiguous whether and to what extent a declaration of independence can be expected to meaningfully affect the economic outlook of a NIC. Second, the empirical literature on this subject is disappointingly small (Rodríguez-Pose & Stermšek, 2015). This implies that it is also unclear what can be learned from past instances of state fragmentation. Finally, the *expected* economic impact of secession does shape people's views on the merits of independence today and thus also shapes electoral behavior.[2] Getting a clearer view on the actual economic consequences of secession should serve to yield a more efficient democratic decision-making process.

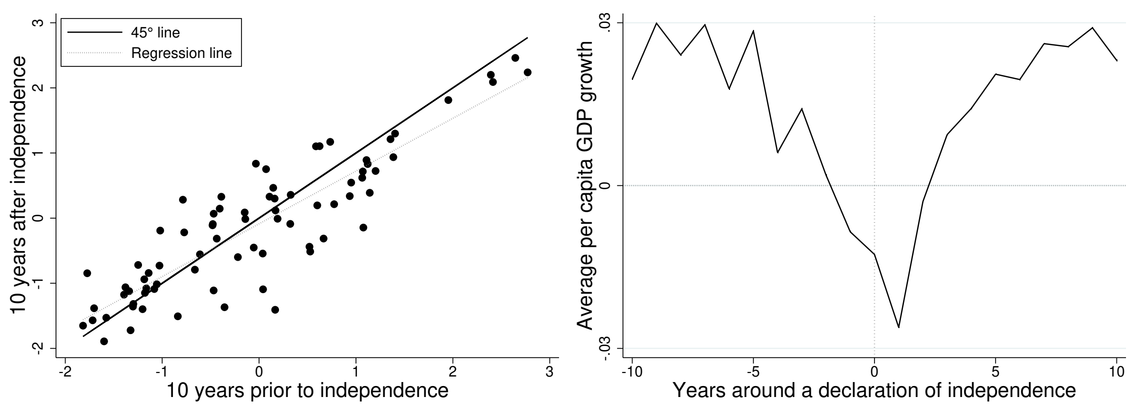
In order to provide a preliminary view on the existence as well as the magnitude of the independence dividend, Figure 1a presents difference-in-difference estimates of the impact of declaring independence on the relative economic performance of NICs, where the 'relative economic performance' of a country is here defined as the percentage discrepancy between its own and worldwide per capita GDP. More specifically, the figure plots the relative economic performance of NICs ten years *after* their declaration of independence against their relative economic performance ten years *prior* to independence. The vertical

[1] See, for instance, Tilly (1990) and Lake and O'Mahony (2004).

[2] Curtice (2013), for instance, reports opinion research results indicating that 52% of Scots would support independence if it were clear beforehand that this would make them £500 a year *better off*, but that support for independence drops to 15% if this decision is anticipated to come at a yearly *cost* of £500.

distance of each point on the graph to the ray of equality reflects a difference-in-difference estimate for the net gain of independence pertaining to a specific NIC. As can be seen, the figure provides tentative evidence that the decision to declare independence did affect the relative economic performance of most NICs, and sometimes substantially so. Also apparent is the heterogeneity of this effect across countries, where some NICs outperformed the rest of the world in terms of per capita GDP growth during this period whereas others seemingly incurred an independence cost. Nevertheless, the aggregate difference-in-difference estimate of -.08 suggests that the net gain of independence tended to be negative and lowered per capita income by 8%, 10 years after independence.

Figure 1: **Trends in per capita GDP around a declaration of independence**



(a) Relative economic performance

(b) Growth

Note: Figure 1a plots the relative economic performance of each NIC in the 10^{th} post-independence year against its relative economic performance in the 10^{th} pre-independence year. Figure 1b plots average per capita GDP growth in the group of NICs, in a period stretching from 10 years before up until 10 years after their declaration of independence. The number of years before (-) or after (+) secession is indicated on the horizontal axis.

The crude correlation in Figure 1a, however, could also be driven by other omitted factors. Indeed, several challenges complicate the estimation of the causal impact of declaring independence on economic outcomes emanating from omitted variable bias, simultaneity, anticipation effects, effect heterogeneity and model uncertainty. First, as shown in figure 1a, NICs and established countries differ quite extensively in terms of their underlying socio-economic structure. More specifically, the figure suggests that the group of NICs is predominantly composed of economically less developed regions.[3] Therefore, a simple comparison of the economic performance of NICs *vis-á-vis* established states may not only reflect the effect of declaring independence, but also the effect of pre-independence differences in terms of economic growth determinants. Second, as illustrated in figure 1b, NICs, in the run-up to their declaration of independence, are typically confronted with a sharp decline in per capita GDP growth rates. As per capita GDP trajectories tend to be highly persistent, this raises an obvious endogeneity concern. In other words, it is important to

[3]Table 1 provides a more detailed account.

distinguish the causal impact of declaring independence on future growth potential, ruling out any feedback-effects past growth dynamics might have on the contemporary incentive to secede. Third, this pre-secession growth-dip is also consistent with the presence of anticipation effects, indicating that state fragmentation may already have an economic impact in the years prior to the actual decision to secede. Failure to account for these *ex ante* effects will generally result in an underestimation of the full economic impact of secession. Fourth, the economic impact of declaring independence might differ both across countries and across time, such that an aggregate independence dividend estimate may be sensitive to the chosen time horizon and country sample. Finally, the lack of convergence on the functional form capturing the economic impact of declaring independence in the theoretical literature raises concerns with respect to the sensitivity of the estimated parameters to specific functional form assumptions.

To mitigate these concerns, this paper develops a semi-parametric estimation strategy rooted in the synthetic control method pioneered by Abadie and Gardeazabal (2003). This methodology allows to simulate, for each NIC, the counterfactual post-independence per capita GDP trajectory that would be observed, in the hypothetical case that it would have decided *not* to declare independence. By comparing these simulated trajectories with their observed counterparts, we are able to track both country-specific and aggregate independence dividends over time. Our central results show robust and statistically significant evidence that the decision to secede lowered per capita GDP trajectories in NICs, and persistently so. The baseline estimates of the aggregate long-run welfare cost of independence, in terms of per capita GDP foregone, range from 20.5% to 46.4%. Yet, there is considerable cross-country heterogeneity in the economic impact of secession.[4]

To address a well-known drawback of this methodology, namely the difficulty of assessing the statistical significance of the estimates, we extend the placebo test approach put forward by Abadie, Diamond, and Hainmueller (2007, 2010, 2014) to propose a novel quadruple-difference inferential procedure. Most reassuringly, we find comparatively little effect on per capita GDP when applying the simulation procedure on countries *unaffected* by state fragmentation, while the negative per capita GDP discrepancy between NICs and their counterfactuals in the post-independence period also clearly exceeds the discrepancy between both typically observed in the pre-independence period. In addition, our main conclusions remain qualitatively unchanged when we parametrically control for potential contamination effects stemming from the economic effects of independence in other recently formed states. Although this underscores that they are unlikely to be driven by simulation inaccuracy, matching inaccuracy or spillover effects, we show that not correcting for these three potential sources of bias tends to artificially inflate both the estimated net cost of independence as well as its persistence.

[4]To demonstrate that these findings appear to hold irrespective of the estimation procedure employed, Reynaerts and Vanschoonbeek (2016) formulate a parametric approach to estimate the independence payoff, obtaining similar results.

One additional methodological contribution concerns the development of a two-step procedure to shed some light on the channels primarily driving the sign and the magnitude of these independence payoffs. To do so, we regress the estimated independence payoffs on a number of underlying characteristics and evaluate various potential channels: trade openness, country size, macroeconomic uncertainty, the intensity of conflict and the level of democracy. In addition to its importance in terms of policy implications, this set-up provides a meaningful way to empirically evaluate the various claims laid out in the existing literature. Doing so, we find tentative evidence that the cost of independence increases in the degree of surface area loss, pointing to the presence of economies of scale. These negative effects dissipate, however, when trade barriers fall or democratic institutions improve. We fail to find clear-cut results with respect to the effect of state size, macroeconomic uncertainty and the intensity of military conflict.

Our argument is closely related to existing economic thinking on the consequences of state fragmentation, which can at least be traced back to the conference on the *Economic Consequences of the Size of Nations* held by the International Economic Association in 1957, the proceedings of which were published in a compendium in 1960 (Robinson, 1960). A persistent narrow focus on this related issue of country size, however, seemingly prevented the ensuing literature to develop a more comprehensive approach to study the economic impact of state-breakup. In addition, the relation between state size and economic growth remains theoretically ambiguous. Thus, although country size is considered growth-neutral in early neo-classical, closed-market growth models such as Solow (1956), more recent work in growth theory includes either some form of agglomeration effect (Krugman, 1991) or a scale effect (Romer, 1986; Barro & Sala-i Martin, 2004; Aghion & Howitt, 2009), benefiting growth potential in larger states.[5] Larger countries are also thought to benefit from scale economies in the public sector, due to their ability to spread the costs of public policy over a larger population (Alesina & Wacziarg, 1998; Alesina & Spolaore, 2003). Nevertheless, Alesina, Spolaore, and Wacziarg (2000) and Ramondo and Rodríguez-Clare (2010) contend that smaller countries can compensate the costs imposed by the limited size of their domestic market by increased trade openness. Furthermore, it has been frequently asserted that the free-rider problem is less disruptive of collective action in smaller states, facilitating a more flexible and effective economic policy (Kuznets, 1960; Streeten, 1993; Armstrong & Read, 1995; Yarbrough & Yarbrough, 1998). Finally, smaller countries may benefit from a more homogenous population, easing the accumulation of social capital and generalized trust (Armstrong & Read, 1998).

Another related line of research emphasizes the negative effects implied by the policy uncertainty and the fear of potential conflict arising from the decision to secede. Onour (2013) develops a macroeconomic model to analyze the adverse effects on asset market stability and government debt sustainability of a small open economy splitting up in two

[5] Jones (1999, p. 143), for instance, argues that in reviewing three classes of endogenous growth models *"the size of the economy affects either the long-run growth rate or the long-run level of per capita income."*.

independent parts. Other studies maintain that a high propensity of policy change may reduce both investment and the speed of economic development by triggering domestic and foreign investors to delay economic activity or exit the domestic economy by investing abroad (Gupta & Venieris, 1986; Alesina, Ozler, Roubini, & Swagel, 1996) and inducing purchasers of government bonds to require higher risk premiums, increasing the cost of providing government (Somers & Vaillancourt, 2014).[6]

The political science literature, on the other hand, has emphasized that secession generally involves some degree of (military) conflict (Fearon, 1998; Spolaore, 2008), resulting in human capital losses, reductions in investment and trade diversion, all of which are generally associated with lower levels of growth. Additionally, these costs may be persistent as Fearon and Laitin (2003b) find that NICs face drastically increased odds of civil war onset, possibly due to the loss of coercive backing from the mother country. Following Murdoch and Sandler (2004), the impact of secession is thus expected to be codetermined by the existence, intensity, duration and timing of conflict.

In examining the influence of colonial heritage on post-independence economic performance, a different strand of the literature stresses the relevance of the initial conditions left behind by the mother country (Acemoglu, Simon, & Robinson, 2001; Acemoglu & Robinson, 2009). Due to institutional persistence, moreover, colonial origin is argued to be at the root of contemporary growth differentials in Latin America and Africa (Bertocchi & Canova, 2002). In addition, the more recent transition economy literature points out that the identity of neighboring countries may matter too in shaping incentives to implement political and economic reform (Roland, 2002; Fidrmuc, 2003).[7]

One hitherto overlooked issue is the temporal coincidence of surges of secession and surges of democracy (Spencer, 1998; Alesina & Spolaore, 1997; Alesina et al., 2000). Dahl, Gates, Hegre, and Strand (2013), for instance, provide empirical evidence that the wavelike shape of the global democratization process is (at least partially) explained by the wavelike shape of state entry, finding that NICs are initially considerably more democratic compared to the rest of the world but are also more susceptible to subsequent reversal. Although it is unclear whether secession operates as a democratization tool or whether democracies are more liable to demands for autonomy, this suggests that the effect of declaring independence is at least partially contingent on ensuing democratization processes in NICs.[8] The link between democracy and economic development, however, is itself subject to an inconclusive academic literature.[9]

This study is also directly related to a relatively small empirical literature that has attempted to uncover the link between state fragmentation and economic performance.

[6] Walker (1998) mentions that when the intensity to secede is large, a declaration of independence may actually *reduce* policy uncertainty since this decision clarifies that the current government will collapse.

[7] A more comprehensive discussion of the economic impact of the demise of colonial rule in Africa and Latin America is offered by Bates, Coatsworth, and Williamson (2007) and Prados De La Escosura (2009).

[8] Conversely, these findings also suggest that the link between democracy and economic development may be confounded by the economic impact of state fragmentation, an issue overlooked in the existing literature.

[9] Gerring, Bond, Barndt, and Moreno (2005) provide a summary of this literature.

Sujan and Sujanova (1994) use a macroeconomic simulation model to estimate the short-term economic impact of the Czechoslovakian dissolution into the Czech Republic and Slovakia, concluding that the decision to separate reduced GDP by 2.2% in the Czech Republic and by 5.7% in Slovakia. Bertocchi and Canova (2002) rely on a difference-in-difference approach to establish, for a restricted number of former colonies, that there may be substantial growth gains from the elimination of extractive institutions. Somé (2013) relies on a synthetic control approach to demonstrate that former African colonies that declared independence through wars suffer larger income losses than African colonies that declared independence without conflict, at least in the short to medium run. Most recently, Rodríguez-Pose and Stermšek (2015) use panel data on the constituent parts of former Yugoslavia to estimate an independence dividend concluding that, once relevant factors such as war are taken into account, there is no statistically significant relation between achieving independence and economic performance while independence achieved by conflict seriously dents growth prospects. Small sample size and conflicting results, however, limit the extent to which these results can be extrapolated to other instances of state fragmentation. Moreover, these models generally do not account for omitted variable bias, simultaneity, anticipation effects and model uncertainty.

Other empirical studies have focused on estimating the economic effects of unification. In a cross-country set-up, Spolaore and Wacziarg (2005) propose a three-stage least squares approach to analyze the market size effect and the trade reduction effect of 123 hypothetical pairwise mergers between neighboring countries concluding that full integration, on average, would reduce annual growth by 0.11% while market integration would boost it by an estimated 0.12%. Abadie et al. (2007, 2014) use the synthetic control method to tease out the per capita economic payoff of the 1990 German reunification for West Germany, concluding that actual 2003 West German per capita GDP levels are about 12% below their potential level due to unification.

Finally, the link between country size and economic performance is scrutinized in a number of empirical studies which *"typically find that smaller country size is likely to be associated with higher concentration of the production structure, higher trade openness, higher commodity and geographic concentration of trade flows* [and] *larger government"* (Damijan, Damijan, & Parcero, 2013, p. 6). Whether country size affects growth remains disputed, as some studies fail to find any significant relationship (Backus, Kehoe, & Kehoe, 1992; Milner & Westaway, 1993) while others report a significant negative relation with either per capita GDP (Easterly & Kraay, 2000; Rose, 2006; Damijan et al., 2013) or economic growth (Alouini & Hubert, 2012).

The remainder of this paper is organized as follows. Section 2 describes the construction of the dataset, provides data sources and reports some descriptive statistics. Section 3 presents the results emanating from the semi-parametric route. This section also contains a variety of robustness checks. Section 4 presents empirical evidence on the channels through which secession affects economic growth potential. Section 5 concludes.

2 Data and descriptive statistics

To shed light on the relation between declarations of independence and the ensuing per capita GDP dynamics in newly formed states, we construct an annual panel comprising 196 countries and covering the period 1950-2013. In what follows, 80 of those countries will be referred to as 'established countries', in the sense that these are countries that already gained independence *before* 1950. The remaining 116 countries will be called 'newly independent countries' (NICs), reflecting that these countries declared independence anywhere between 1950 and 2013. To identify the year of independence of each country in the sample, we primarily rely on and extend data on state entry as reported in Gleditsch and Ward (1999). Table A2 provides a full list of all NICs and their year of independence.

Our dependent variable is the log of per capita GDP, which will proxy the economic performance of these countries, while our choice of control variables is primarily rooted in the growth literature. Depending on the specification, it includes the average years of education, life expectancy and population density to capture differences in terms of human capital and differential population effects. As it is argued to be a determinant of both economic performance and state fragmentation, we include a measure of trade openness.[10] Similarly, given that democratization processes appear to be both related to the decision to secede and (possibly) to economic outcomes, we also utilize a composite index of democracy. Furthermore, as independence is rarely achieved without some form of conflict, we include the per capita number of war deaths as reported by Bethany and Gleditsch (2005) to capture the adverse economic effects associated with the existence, intensity and duration of military conflict.[11] In addition, mimicking Gibler and Miller (2014a), we define a 'political instability'-dummy indicating whether a country experienced a two-standard-deviation change in its democracy score during the previous observation year. To control for the adverse effects of macroeconomic instability, we include dummy variables indicating banking and debt crises from Reinhart and Rogoff (2011).[12]

We draw on a wide variety of data sources to obtain a dataset that is as extensive as possible. Capitalizing on prior work by Fearon and Laitin (2003a), to address the potential issues of measurement error and misreporting of per capita GDP[13], we depart from the real per capita GDP information contained in The Madison Project (2013), we subsequently maximally extend these estimates forward and backwards relying on the growth rate of real per capita income provided by the World Bank (2015) and finally approximate remaining missing observations by use of a third-order polynomial in (i) a country's level of CO2 emissions (World Resources Institute, 2015; World Bank, 2015), (ii) a year dummy and

[10]See, for instance, Alesina and Spolaore (1997), Alesina et al. (2000) and Alesina and Spolaore (2003).

[11]We primarily rely on the 'best estimates' of each specific country-year number of battle deaths. In case these are unavailable, we take the simple average of the lowest and highest estimates instead.

[12]To preserve a maximal amount of observations in the analysis, missing values are set to 0 in both indexes.

[13]For a discussion of data variability and consistentization issues across successive versions of the Penn World Table, see Johnson, Larson, Papageorgiou, and Subramanian (2013); for a discussion on the reliability of pre-independence per capita income estimates of former Soviet states, see Fischer (1994).

(iii) a region dummy. To make sure that our results are not driven by the data construction procedure, we also construct an alternative index of real per capita GDP by aggregating per capita GDP information from multiple data sources, though this did not affect any of our conclusions.[14] With regard to the alternative growth determinants, we generally rely on a similar third-order polynomial approximation strategy to synthetize relevant information contained in various data sources. Appendix A reports all relevant data sources for these constructed variables, provides a more detailed description of the variable-specific data manipulation procedure utilized and reports some diagnostics.

Table 1, then, reports the most important descriptive statistics separately for established countries and (future) NICs while also assessing to what extent both groups significantly differ from each other in terms of these underlying growth determinants. The results confirm our prior findings: (future) NICs, on average, are significantly poorer in per capita terms and they also tend to have a less educated population, a lower life expectancy and less democratic institutions. In addition they tend to be somewhat more sensitive to military conflict and experience more instances of debt crises. As suggested in the existing literature, however, they also tend to more stable politically and favor a more liberal trade regime. All in all, these summary statistics thus suggest that NICs manifest less favorable growth determinants when compared to more established states.

Table 1: **Summary statistics**

	Established countries			**Newly independent countries**				
Variable	*Obs.*	*Mean*	*Std. Dev.*	*Obs.*	*Mean*	*Std. Dev.*	*Mean diff.*	*P-value*
GDP per capita	4999	9086.64	14225.64	6901	4011.41	5341.306	-5075.23***	0.00
Population (millions)	5118	46.22	143.853	7222	8.34	19.888	-37.88***	0.00
Population density	5118	265.84	1508.283	7222	128.29	432.939	-137.55***	0.00
Years of schooling	4874	6.22	3.123	6318	4.98	3.217	-1.23***	0.00
Life expectancy	4786	65.60	11.185	6836	57.92	12.053	-7.69***	0.00
Openness	4667	0.58	.51	5098	0.84	.482	0.27***	0.00
Battle deaths per capita	5118	0.00	.001	7222	0.00	.001	0.00*	0.09
Democracy	4937	15.65	14.194	4800	8.44	9.854	-7.21***	0.00
Political instability	4937	0.00	.049	4800	0.00	.032	-0.00*	0.10
Banking crisis	3520	0.10	.302	960	0.10	.295	-0.01	0.59
Debt crisis	3520	0.11	.313	960	0.20	.399	0.09*	0.00

Note: Data construction and sources provided in section 2 and appendix A. Statistics for NICs include information pertaining to the pre-independence period. The last column reports the p-value for the two-sided t-test that the two means are equal.

[14] As noted in Appendix A, baseline per capita GDP correlates strongly with the alternative estimates, at 0.99 for their 11214 common observations. Results based on these alternative per capita GDP estimates are available from the authors on request.

3 Semi-parametric estimation of the independence dividend

This section follows a semi-parametric route to identify the causal relation between declarations of independence and ensuing per capita GDP dynamics in NICs. After outlining the general estimation strategy, we first provide a motivating example. Subsequently, we derive baseline estimates of both country-specific and aggregate independence payoffs. A last subsection formulates an inferential framework to perform some robustness checks.

3.1 Estimation strategy

To mitigate both omitted variable bias, endogeneity and heterogeneity concerns and to deal with the potential problem of model uncertainty, we rely on the synthetic control method pioneered by Abadie and Gardeazabal (2003) and further developed in Abadie et al. (2007, 2010, 2014). In a nutshell, this method estimates the effect of a given policy shock (in this case, declaring independence) by comparing the evolution of an outcome variable of interest (in this case, log per capita GDP) for the affected country with the evolution of the same variable for a so-called 'synthetic control' country. This synthetic control country, then, is constructed as a weighted average of unaffected control countries (in this case, all other independent countries which did not recently gain independence themselves) that matches as closely as possible the country affected by the policy shock, before the shock occurs, for a number of unaffected predictors of the outcome variable. Intuitively, the trajectory of the outcome variable in the synthetic control country can be understood to mimic what would have been the path of this variable in the affected country, if the policy shock had never occurred.

To see why this works, suppose that in a sample containing $J+1$ countries, indexed by $i = \{1, \dots, J+1\}$, observed over T time periods, indexed by $t = \{1950, \dots, T_0, \dots, T\}$, country j decides to declare independence at time $t = T_0$ and that we are interested in determining the causal effect of this decision, if any, on its per capita GDP trajectory. To do so, denote by y_{jt}^N the level of log per capita GDP that would be observed in country j if it did not (yet) declare independence, and let y_{jt}^T denote the outcome that would be observed if country j declared itself independent prior to time $t+1$. Abstracting from anticipation effects, the causal economic effect of declaring independence at time $t \geq T_0$ is defined as $\beta_{jt} = y_{jt}^T - y_{jt}^N$.[15] The observed outcome for each country i can be written as

$$y_{i,t} = y_{i,t}^N + \beta_{i,t} NIC_{i,t} \tag{1}$$

where $NIC_{i,t}$ is an independence dummy equal to 1 for each NIC in each year after it gained independence and 0 otherwise while $\beta_{i,t}$ captures the economic impact of secession of country i at time t.

[15]If anticipation effects are at play, T_0 should be redefined to coincide with the first period these play a role. We will come back to this.

It follows that estimating the causal impact of country j's declaration of independence at time t, $\hat{\beta}_{jt}$, boils down to estimating the counterfactual, post-independence per capita GDP trajectory that would be observed in that country if it had never declared independence, $\hat{y}^N_{j,t}$:

$$\hat{\beta}_{j,t} = y_{j,t} - \hat{y}^N_{j,t} \ \ , \ \ t \geq T_0 \tag{2}$$

Although $y^N_{j,t}$ remains unobserved for $t \geq T_0$, suppose we do know $y^N_{i,t}$ to linearly depend on a number of observed growth determinants in each country i. More specifically, suppose we summarize the country-specific information on x observed growth determinants in a $(n \times 1)$ vector of unaffected observed covariates denoted by $\mathbf{X}_i = [x_{i,1}, \ldots, x_{i,n}]$, where $n \leq Tx$. Note that $\mathbf{X}_i$ may contain past or future values of the observed characteristics as long as these are unaffected by country j's decision to secede. In addition, assume that we do not observe all the relevant characteristics determining $y^N_{j,t}$ and denote by $\mathbf{Z}_i$ the $(m \times 1)$ vector collecting all of these, potentially time-varying, unobserved growth determinants, where $m \leq (T_0 - 1950)$. Note that $\mathbf{Z}_i$ may also subsume a country fixed effect. Finally, assume $y^N_{i,t}$ is subject to year fixed effects, η_t, and a mean-zero transitory shock, $\epsilon_{i,t}$. Summarizing, we assume $y^N_{j,t}$ to be given by

$$y^N_{j,t} = \theta_t \mathbf{X}_j + \lambda_t \mathbf{Z}_j + \eta_t + \epsilon_{j,t} \tag{3}$$

where θ_t and λ_t denote the $(1 \times n)$ and $(1 \times m)$ vectors of unknown, potentially time-varying, population parameters associated with $\mathbf{X}_j$ and $\mathbf{Z}_j$ respectively.

To simulate the counterfactual post-independence $y^N_{j,t}$-trajectory that would be observed in NIC j in absence of state fragmentation, consider a linear combination of the remaining J control countries defined by the weighting vector $\mathbf{W}^* = [w^*_1, \ldots, w^*_{j-1}, w^*_{j+1}, \ldots, w^*_{J+1}]$, in such a way that the following four conditions hold: (i) the resulting weighted vector of unaffected observed characteristics, $\sum_{i \neq j}^{J+1} w_i \mathbf{X}_i$, exactly mirrors that of country j, $\mathbf{X}_j$, (ii) the pre-independence outcome path is identical in the seceding country an its synthetic counterpart, (iii) control countries receiving positive weight were independent themselves at the time of country j's declaration of independence but (iv) none of them declared independence themselves in the 10 years preceding country j's declaration of independence. Note that this last condition is imposed to ensure that the control group itself is not contaminated by economic effects of secession and/or its anticipation stemming from one of its component parts. Formally, assume there exists a $\mathbf{W}^*$ such that:

Condition 1

$$\sum_{i \neq j}^{J+1} w^*_i \mathbf{X}_i = \mathbf{X}_j \ \ ,$$

$$\mathbb{E}\left[\mathbf{X}_i | NIC_{j,t}\right] \ = \ \mathbb{E}\left[\mathbf{X}_i\right] \ \ \forall i \in \{1, \ldots, J+1\} \ \ \& \ \ \forall t \in T$$

Condition 2

$$\sum_{i\neq j}^{J+1} w_i^* y_{i,1950}^N = y_{j,1950}^N \quad , \quad \dots \quad , \quad \sum_{i\neq j}^{J+1} w_i^* y_{i,T_0-1}^N = y_{j,T_0-1}^N$$

Condition 3

$$\exists t \in \{T_0 - 10, \quad \dots \quad , T\} : NIC_{i,t} - NIC_{i,t-1} = 1 \quad \Leftrightarrow \quad w_i^* = 0$$

Observe that, by use of equation (3), the value of the outcome variable of this synthetic control country can be written as

$$\sum_{i\neq j}^{J+1} w_i^* y_{i,t}^N = \theta_t \sum_{i\neq j}^{J+1} w_i^* \mathbf{X}_i + \lambda_t \sum_{i\neq j}^{J+1} w_i^* \mathbf{Z}_i + \eta_t + \sum_{i\neq j}^{J+1} w_i^* \epsilon_{i,t} \tag{4}$$

such that the discrepancy between the outcome path that would be observed in (future) NIC j in absence of state fragmentation (equation 3) and that of its synthetic counterpart (equation 4) satisfying conditions 1 through 3 is given by:

$$y_{j,t}^N - \sum_{i\neq j}^{J+1} w_i^* y_{i,t}^N = \lambda_t (\mathbf{Z}_j - \sum_{i\neq j}^{J+1} w_i^* \mathbf{Z}_i) + (\epsilon_{j,t} - \sum_{i\neq j}^{J+1} w_i^* \epsilon_{i,t}) \tag{5}$$

Note that this also holds in the pre-independence period and denote by $\mathbf{Y}_i^P$, λ^P and ϵ_i^P the $\Big((T_0 - 1950) \times 1\Big)$ vector, the $\Big((T_0 - 1950) \times m\Big)$ matrix and the $\Big((T_0 - 1950) \times 1\Big)$ vector with the tth row equal to $y_{i,t}^N$, λ_t and $\epsilon_{i,t}$ respectively. This implies that the pre-independence discrepancy between NIC j's (fully observed) $y_{j,t}^N$-trajectory and that of its synthetic version can be written as:

$$Y_j^P - \sum_{i\neq j}^{J+1} w_i^* Y_i^P = \lambda^P \Big(\mathbf{Z}_j - \sum_{i\neq j}^{J+1} w_i^* \mathbf{Z}_i\Big) + \Big(\epsilon_j^P - \sum_{i\neq j}^{J+1} w_i^* \epsilon_i^P\Big) \tag{6}$$

or, equivalently:

$$\lambda^P \Big(\mathbf{Z}_j - \sum_{i\neq j}^{J+1} w_i^* \mathbf{Z}_i\Big) = \sum_{i\neq j}^{J+1} w_i^* \epsilon_i^P - \epsilon_j^P \tag{7}$$

Pre-multiplying both sides of equation (7) by the inverse of λ^P , $(\lambda^{P\prime} \lambda^P)^{-1} \lambda^{P\prime}$, yields[16]

$$\mathbf{Z}_j - \sum_{i\neq j}^{J+1} w_i^* \mathbf{Z}_i = (\lambda^{P\prime} \lambda^P)^{-1} \lambda^{P\prime} \Big(\sum_{i\neq j}^{J+1} w_i^* \epsilon_i^P - \epsilon_j^P\Big) \tag{8}$$

Finally, inserting this expression for $\mathbf{Z}_j - \sum_{i\neq j}^{J+1} w_i^* \mathbf{Z}_i$ in equation (5) yields an expression for the discrepancy between the (partly unobserved) full outcome path that would be

[16]Note that assuming $m \leq T_0 - 1950$ ensures that λ^P is nonsingular and thus has a well-defined inverse.

observed in the seceding country, j, in absence of state fragmentation and the same (fully observed) outcome path for its synthetic version, $\mathbf{W}^*$:

$$y_{j,t}^N - \sum_{i \neq j}^{J+1} w_i^* y_{i,t}^N = \lambda_t (\lambda^{P'} \lambda^P)^{-1} \lambda^{P'} \sum_{i \neq j}^{J+1} w_i^* \epsilon_i^P - \lambda_t (\lambda^{P'} \lambda^P)^{-1} \lambda^{P'} \epsilon_j^P - \sum_{i \neq j}^{J+1} w_i^* \left(\epsilon_{j,t} - \epsilon_{i,t}\right) \quad (9)$$

Abadie et al. (2010) prove that under standard conditions, if the number of preintervention periods (T_0-1950) is large relative to the scale of the transitory shocks ($\epsilon_{i,t}$), the right-hand side of equation (9) will tend towards zero. This suggests using

$$\hat{\beta}_{j,T_0+s} = y_{j,T_0+s} - \sum_{i \neq j}^{J+1} w_i^* y_{i,T_0+s} \quad (10)$$

as an estimator for the independence dividend of country j, s years after independence.

Note that the primary strength of the synthetic control method is the lack of conditions imposed on the m unobserved characteristics, making it robust for the confounding effects of time-varying unobserved characteristics at the country level as long as the number of pretreatment periods is large and the pre-independence match is good. Moreover, note that as long as the aforementioned conditions are satisfied, this estimator is robust to endogeneity as well. For example, if secession partly happens as a reaction to falling per capita GDP levels, by definition, the per capita GDP levels of the synthetic control country match with those of the seceding country in the pre-independence period such that these unfavorable past GDP dynamics should manifest their potential economic effects in the synthetic control unit as well. In contrast to a panel regression framework, this method also safeguards against flattening out useful variation in the economic impact of secession across countries and time, by allowing the estimation of both country-specific and aggregate net independence dividends over time. Finally, this method does not require formal modeling nor estimation of any of the population parameters associated with the observed growth determinants, θ_t, making it more robust against model uncertainty.

In practice, since there often does not exist a set of weights that exactly satisfies conditions 1 through 3, standard practice is to construct the synthetic control such that these conditions hold approximately. In the empirical exercise below, we do so by relying on the nested optimalization algorithm developed by Abadie and Gardeazabal (2003, Appendix B), which defines the optimal weight vector $\mathbf{W}^*$ such that each synthetic control country minimizes the Root Mean Squared Prediction Error (RMSPE) of pre-independence outcomes (see equation (6)).[17] We restrict the pretreatment period to maximally 10 years prior to the declaration of independence for each NIC in the sample, discarding those NICs lacking sufficient pretreatment information.[18] Our choice of pretreatment characteristics stems from the growth literature and includes population size, population density, educational attainment, life expectancy, trade openness and per capita battle deaths.

[17]The synthetic control algorithm is implemented by Abadie et al.'s (2010) *synth*-command in Stata 13.1.
[18]Table A2 lists the NICs included in the synthetic control algorithm.

3.2 A motivating example

To illustrate this methodology, consider the example of Ukraine, which declared itself independent from the Soviet Union in 1991. To estimate what would have been the post-independence per capita GDP trajectory of Ukraine in absence of secession, we rely on the remaining 153 countries in our sample which were independent in 1991, but were not confronted with state state fragmentation between 1981 and 1991, to construct a weighted average country that best resembles Ukraine in the pre-independence period for a number of growth predictors. As it turns out, the optimal set of weights constructs this synthetic version of Ukraine as a weighted average of - in decreasing order of their corresponding weights - Panama, Romania, the United States and South Korea, see table 2.

Table 2: **Optimal weights for synthetic Ukraine**

Country	w^*
Panama	.405
Romania	.397
United States	.103
Korea Republic	.095

Table 3 below suggests that the synthetic version of Ukraine, in effect, provides a much better comparison for pre-independence Ukraine than the global average of our sample. As is apparent from the table, average pre-independence per capita GDP levels in Ukraine are practically indistinguishable from their synthetic counterpart, in contrast to the considerably higher levels witnessed in the rest of the world during this period. Moreover, the synthetic version of Ukraine is also much more similar to the actual pre-independence Ukraine in terms of population, population density, trade openness, educational attainment, life expectancy and the number of battle deaths suffered.

Table 3: **Predictor balance before secession (1981-1990)**

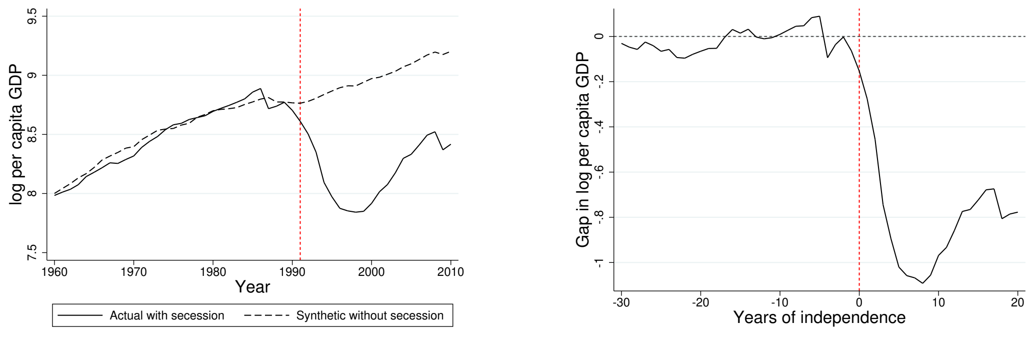
Predictor	*Ukraine*	*Synthetic Ukraine*	*World*
Per capita GDP	4357.760	4495.777	6608.467
log Population	17.745	16.293	15.175
Population density	84.317	84.253	216.558
Educational attainment	8.831	8.570	5.367
Health	70.048	70.994	62.988
Trade openness	1.019	.958	.721
Battle deaths (per 1000 heads)	0	.009	.107

Note: Growth predictors are averaged over the 1981-1990 period. The last column reports averages computed over all independent countries.

The central intuition behind the synthetic control method, then, is that the only potentially economically meaningful difference between Ukraine and its synthetic version post-1991 is that Ukraine declared independence whereas its synthetic version did not. Therefore, to derive the economic significance of the Ukrainian declaration of independence, we can compare the post-independence per capita GDP trajectories of now-independent Ukraine and its synthetic version. To do so, the left panel of figure 2 below plots the evolution of log per capita GDP in Ukraine (full line) as well as synthetic Ukraine (dashed line) between 1960 and 2011. Note, first, that both series are practically indistinguishable during the entire pre-independence period. Thus, even though this synthetic version of Ukraine was constructed by only taking into account the last 10 years prior to independence, it turns out to be well capable of assessing Ukranian per capita GDP dynamics over the entire 1960-1990 period.[19] Combined with the close fit obtained for the pre-independence growth predictors in both groups, as reported in table 3, this suggests that the proposed combination of other independent countries adequately reproduces the economic situation in Ukraine in absence of state fragmentation.

The estimated economic effect of the Ukraine declaration of independence is given by the difference between the actual and synthetic trajectories in the post-independence period. For this reason, the right panel of figure 2 plots the yearly gaps in per capita GDP between Ukraine and its synthetic counterpart for a period stretching from 30 years prior up until 20 after Ukraine's secession from the Soviet Union. Note that, since both series are expressed in logarithmic form, the discrepancy between both reflects the percentage per capita payoff of having declared independence.

Figure 2: **Trends in per capita GDP: Ukraine versus synthetic Ukraine**



(a) Per capita GDP: Ukraine vs. synthetic Ukraine (b) The economic impact of secession (Ukraine)

Note: The left figure plots the log per capita GDP trajectories in Ukraine (full line) and synthetic Ukraine (dashed line) between 1961 and 2011; the right figure plots the discrepancy between both trajectories during the same period. The Ukranian independence declaration is marked by the vertical red dashed line.

[19] The slight diversion between both series in the pre-independence period suggests the presence of anticipation effects in the two years preceding the Ukrainian declaration of independence. To take these into account, as suggested by Abadie et al. (2010), we redid the exercise redefining the timing of independence to have occurred three years prior to the actual decision to secede. None of the results are qualitatively affected by this.

The figure suggests that the Ukranian declaration of independence had an immediate and increasingly adverse impact on per capita GDP levels in the first five years after secession. After this initial negative payoff, however, our results indicate that Ukraine never fully recovered in the ensuing 15 years but, on the contrary, consistently underperformed *vis-á-vis* its synthetic counterpart. This suggests that, at least in the Ukranian case, the negative independence dividend is persistent. Moreover, the estimated long-run cost implies that, 20 years after its declaration of independence, Ukrainian per capita GDP lies around 78% below its potential level due to state fragmentation.

3.3 Baseline results

As explained in the previous section, a closer inspection of the Ukrainian case through the lens of the synthetic control method suggests that the net payoff of independence is large and negative. Nevertheless, Ukraine might be an outlier in terms of both the immediate and persistent effects of declaring independence, limiting extrapolation potential. Therefore, subject to data availability, this subsection applies the synthetic control method to each NIC in the sample and characterizes both country-specific and aggregate independence dividends as well as their evolution over time.

Figure 3 displays several different versions of the results of this exercise. First, consider the top-left panel which plots the results seperately for each available NIC in our sample. The gray lines represent the per capita GDP gaps between each NIC and its respective synthetic version (corresponding to the results displayed in figure 2b) in the period stretching from 10 years before up until 30 years after their declaration of independence. The superimposed black line depicts the yearly average gap in the sample while the superimposed red line captures the average gap computed over the entire pre- and the post-independence period respectively. Apparent from this figure is the large cross-country heterogeneity in the economic impact of secession, which clearly shows several examples of NICs appearing to have benefited in economic terms from having declared independence.[20]

As the figure also indicates, the synthetic control method provides a reasonably good fit for the (log) per capita GDP trajectories between NICs and their respective synthetic counterparts in the pre-independence period. The average pre-independence RMSPE in the full sample is about 0.105, which is quite small but does reflect that NICs already underperformed somewhat relative to their synthetic counterparts in the pre-independence period. More specifically, per capita GDP levels in NICs on average lie 0.5% below those of their synthetic versions even in the last 10 years *prior* to their respective declarations of independence. In the post-independence period, however, their under-performance clearly worsens and the average percentage discrepancy increases to -19.6%. Interestingly, NICs generally do not appear to recover in the longer run as the negative aggregate independence

[20]Country-specific results are reported in table A3, while appendix B connects the implications of our results to the existing literature on a number of historical instances of state fragmentation.

dividend equals -21.3% in the 30^{th} post-independence year. In other words, when their country celebrates its 30^{th} birthday, inhabitants of NICs typically experience per capita GDP levels which lie 21% below those of countries which, in all relevant aspects, most closely resembled their own country's economic situation just prior to its decision to secede.

Nevertheless, figure 3a also indicates that the synthetic control method fails to adequately reproduce per capita GDP trajectories for some NICs in the pre-independence period. Malawi, for instance, is the country with the worst pre-independence fit (RMSPE=0.33). Given its extraordinary low pre-independence per capita GDP trajectory, it should come as no surprise that its growth path cannot be adequately approximated by any linear combination of the available control countries. By extension, this complication applies to all NICs with more extreme values in their pre-independence characteristics. As the post-independence gaps of these poorly fitted cases may merely reflect differences in their underlying economic characteristics, rather than actual independence dividends[21], figures 3b to 3d plot the results when the sample is progressively restricted to include only the 50%, 20% and 10% best matched cases in terms of their pre-independence RMSPE. In each of these trimmed samples, the synthetic control method provides an excellent fit (the associated average RMSPE's equal 0.05, 0.034 and 0.02 respectively). Sacrificing quantity for quality, however, does not qualitatively affect our primary conclusions: each of these figures suggests that NICs face immediate and increasing costs of secession in the first 5 years after they gain independence, while these costs also appear quite persistent and reduce per capita GDP levels by anywhere between 32%-46% in the long run.

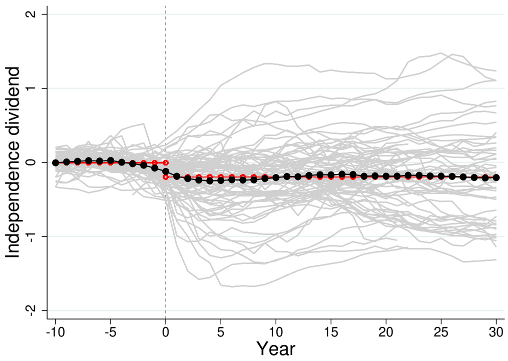
Since there does not appear to be a consensus on the optimal cut-off of pre-independence RMSPE to avoid biases stemming from poor-fit, the bottom figure utilizes a more data-driven procedure to impose a threshold value (or caliper) defining the maximal allowed RMSPE. More specifically, in the tradition of propensity-score matching, Rosenbaum and Rubin (1985) suggest using an optimal caliper of 0.25 times the standard deviation of the linear propensity score. Adapting this to the present context, figure 3e imposes a caliper amounting to 0.5 times the samplewide standard deviation in pre-independence RMSPE. Once again, this results in an excellent pre-independence fit as suggested by the average RMSPE, which now equals 0.024, while our primary conclusions remain robust.

Finally, as a first check on the significance of these results, figure A2 verifies whether a causal interpretation is warranted by their distribution. Plotting the same sequence of aggregate independence dividend estimates along with 95% confidence intervals, we find that the pre-independence per capita GDP discrepancy gradually erodes to become statistically indistinguishable when trimming the sample according to goodness-of-fit.[22] More importantly, these graphs confirm that - irrespective of the selected sample - NICs tend to underperform versus their synthetic versions in the entire post-independence period.

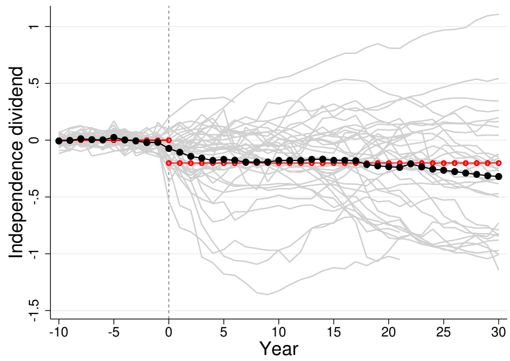
[21]Since they are unlikely to even approximately satisfy conditions 1 through 3.

[22]To take the potential presence of anticipation effects into account, we redid the analysis shifting the timing of independence to have occurred 3 years earlier, obtaining qualitatively similar results.

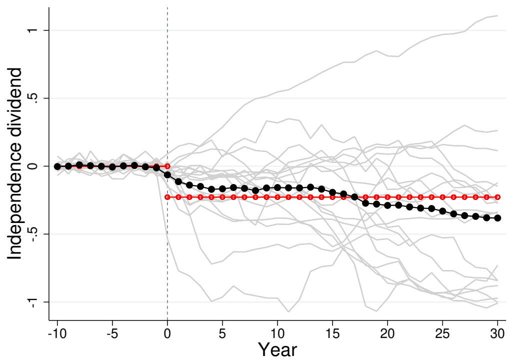
Figure 3: **Impact of secession in selected countries**



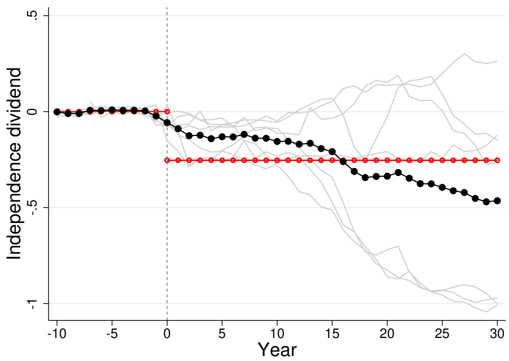
(a) All cases



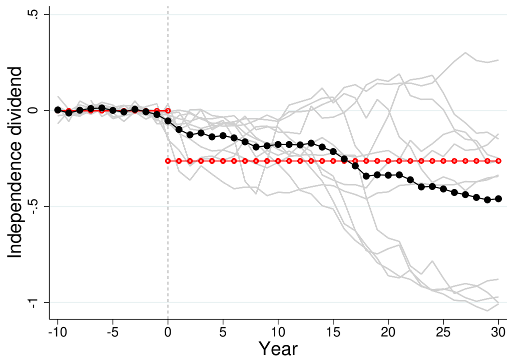
(b) 50% best matched cases



(c) 25% best matched cases



(d) 10% best matched cases



(e) All cases within caliper

Note: Each gray line plots the yearly percentage gap between the per capita GDP trajectory of a specific NIC and its synthetic counterpart around their declaration of independence. The black line depicts the yearly average gaps; the red line displays the pre- and post-independence average gaps. The number of years before (-) or after (+) independence are indicated on the horizontal axis. The top-left panel contains all available cases, subsequent panels include only results of the 50, 25 and 10% best matched cases in terms of their pre-independence RMSPE. The bottom figure includes only those cases for which the pre-independence RMSPE falls within the data-driven caliper cut-off amounting to 0.5 times the samplewide standard deviation in pre-independence RMSPE.

3.4 Statistical inference

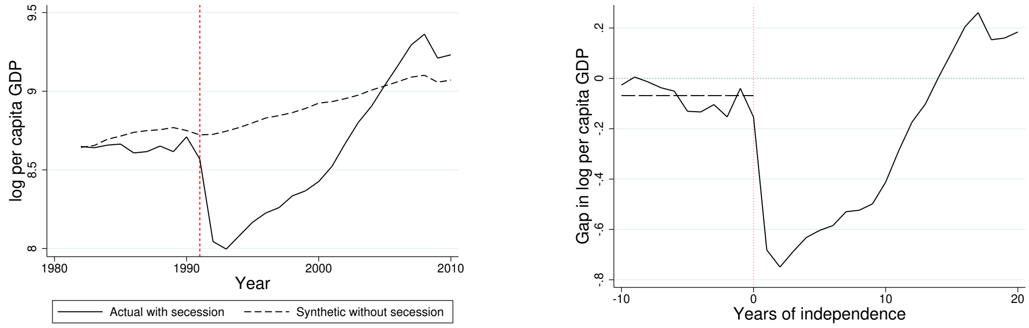
As noted in the introduction, one drawback of this estimation procedure lies in the absence of a systematic way to assess the degree of uncertainty surrounding synthetic control estimates of treatment effects. In this section, we propose an inferential procedure to sequentially account for three sources of uncertainty in the raw independence dividend estimates: *(i)* matching quality, which relates to the economic comparability of NIC and synthetic NIC in absence of state fragmentation; *(ii)* simulation quality, which depends upon the extent to which synthetic NICs adequately reproduce the counterfactual trajectories NICs would have experienced in absence of state fragmentation; and *(iii)* contamination effects, arising from the economic effects of independence in other recently formed states.

First, recall that the synthetic control method critically hinges upon the close similarity between countries in the pre-independence period to eliminate the potential bias of unobserved heterogeneity.[23] This motivates a closer inspection of the results in trimmed samples. As an alternative way to control for unobserved heterogeneity, one which avoids imposing arbitrary cut-offs to exclude poor-fitting cases, we develop a difference-in-difference estimator along the lines of Campos, Coricelli, and Moretti (2014) to assess whether the per capita GDP discrepancy between NICs and synthetic NICs in any given post-independence year statistically significantly exceeds its 10-year pre-independence average value. Indeed, as NICs are unaffected by state fragmentation in the pre-independence period by construction, the distribution of pre-independence per capita GDP discrepancies between NICs and synthetic NICs is taken to approximate the sampling distribution of the per capita GDP discrepancy between both emanating from their unobserved heterogeneity.

Further illustrating the rationale for this inferential exercise, figure 4 plots the year-on-year per capita GDP discrepancy between Armenia and synthetic Armenia in the period surrounding its 1991 secession from the Soviet Union. In analogy to the Ukranian example discussed in section 3.2, the figure suggests that the Armenian declaration of independence served to lower growth potential in the short to medium run, after which these adverse economic effects of independence slowly dissipate and even translate into a long run independence gain of around 20%. As can be seen in figure 4b, however, Armenia slightly under-performs compared to synthetic Armenia even in the pre-independence period. This suggests that the size and compositional limitations associated with the Armenian donor pool of potential control countries produce a synthetic counterfactual which only imperfectly approximates the economic situation of actual Armenia in absence of state fragmentation. More specifically, the dashed line signifies that the typical *pre-independence* per capita GDP discrepancy between both countries amounted to -7%.

[23] See equations (6) and (7).

Figure 4: **Unobserved heterogeneity: Armenia versus synthetic Armenia**

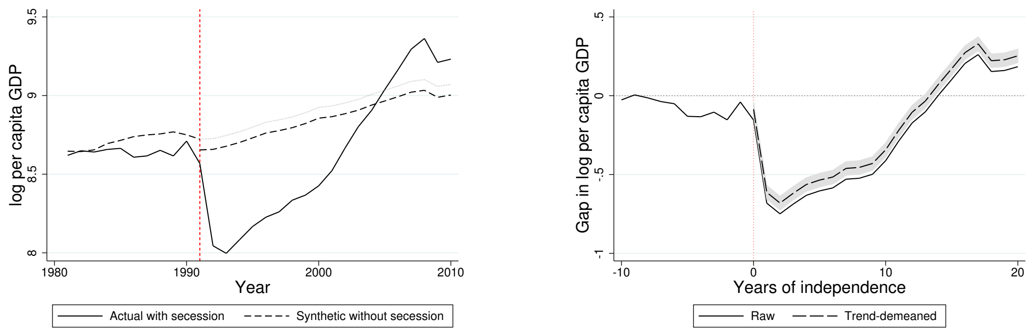


(a) Actual vs. synthetic per capita GDP (b) The economic impact of secession

Note: Figure 4a plots the log per capita GDP trajectories of Armenia (full line) and synthetic Armenia (dashed line) between 1981 and 2012; figure 4b plots the discrepancy between both trajectories during the same period. The dashed line in the right figure visualizes the average pre-independence discrepancy between both countries.

In this light, one can reasonably expect synthetic Armenia to continue to outperform Armenia in the post-independence period, at a rate determined by their unobserved heterogeneity, regardless of Armenia's decision to secede. To correct for matching quality, we proceed by assuming that the distribution of pre-independence outcome differences between both countries can be taken to reflect the outcome discrepancy emanating from their unobserved heterogeneity. Figure 5a purges the per capita GDP trajectory of synthetic Armenia from matching inaccuracies by removing this average pre-independence discrepancy in the post-independence period, while figure 5b plots the resulting trend-demeaned Armenian independence dividend trajectory. Reassuringly, the figure indicates that the post-independence per capita GDP discrepancy remains unusually large compared to the distribution of discrepancies typically observed in absence of state fragmentation.[24] Thus, the corrected Armenian independence dividend trajectory is unlikely to reflect unobserved heterogeneity but measures the economic impact of secession as intended.

Figure 5: **Accounting for matching quality: Armenia**



(a) Actual vs. synthetic per capita GDP (b) The economic impact of secession

Note: Figure 5a plots the log per capita GDP trajectory of Armenia (full line) and both the uncorrected (dotted line) and trend-demeaned (dashed line) versions of synthetic Armenia; figure 5b plots the raw (full line) and trend-demeaned (dashed line) independence dividend trajectory, defined in equations 10 and 11 respectively.

[24] The 95% confidence interval quantifies the uncertainty stemming from matching inaccuracy, where larger variations in the observed pre-independence discrepancies increase measured uncertainty.

To formalize this approach, denoting the weighting vector defining the synthetic counterpart of NIC j by $w^*_{ij} = [w^*_{1j}, \ldots, w^*_{Ij}]$, we define the *trend-demeaned* independence dividend for NIC j, s years after it declared independence as:

$$\hat{\beta_{j,s}}^{tDD} = \underbrace{\left(y_{j,T_0+s} - \sum_{i \neq j} w^*_{i,j} y_{i,T_0+s}\right)}_{\text{raw treatment effect}} - \underbrace{\left(\sum_{t=T_0-10}^{T_0-1} \left(y_{j,t} - \sum_{i \neq j} w^*_{i,j} y_{i,t}\right)\right)}_{\text{matching inaccuracy}} \tag{11}$$

Table A3 reports trend-demeaned independence dividend estimates for each available NIC in our sample. Compared to the raw estimates, trend-demeaned estimates tend to be slightly lower in absolute value. Hence, not correcting for matching quality slightly inflates the estimated independence dividend. Nevertheless, trend-demeaned estimates are quantitatively and qualitatively very similar to their uncorrected counterparts. A closer inspection of the results plotted in figure A3 reveals that, irrespective of the time-horizon, roughly 60 to 70% of NICs suffered economic costs of secession even after correcting for matching quality, with the remaining 20 to 30% experiencing a net independence gain.

Second, note that the confidence intervals plotted in figures A2 and A3a only express the uncertainty associated with the *magnitude* of the estimated gaps, either across NICs or relative to the pre-independence period. One additional source of uncertainty concerns their *reliability*, which critically hinges on the extent to which synthetic control countries adequately reproduce the per capita GDP trajectories NICs would have experienced in absence of state fragmentation. To the extent that they do not, estimated independence dividends may not only be attributed to the decision to secede but also to poor simulation quality.[25] To study the robustness of the results in this regard, we extend the placebo test approach developed by Abadie et al. (2010) to quantify the probability of obtaining estimates of this magnitude by pure chance. To do so, we reapply the synthetic control method to each potential control country in a particular NIC's donor pool.[26] As the countries involved are unaffected by state breakup by construction, the resulting distribution of 'placebo' dividends is taken to approximate the sampling distribution of the independence dividend estimate under the null hypothesis of a zero effect.

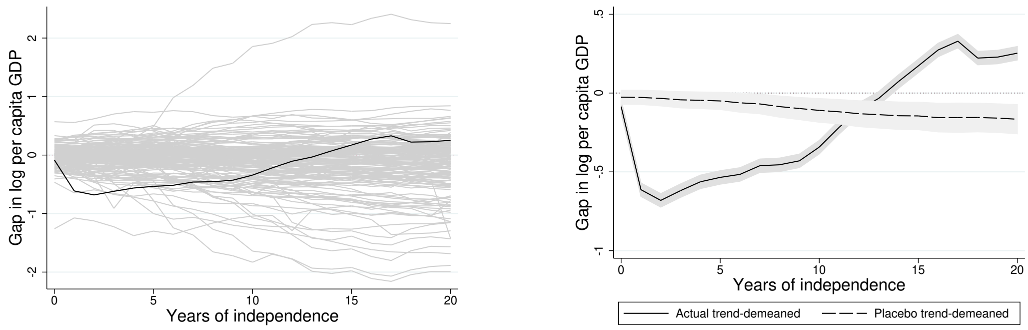
Reconsidering the Armenian example, figure 6 plots the actual trend-demeaned Armenian independence dividends against the distribution of trend-demeand placebo gaps, resulting from an application of the synthetic control algorithm to each of its 154 potential control countries. Although placebo countries tend to under-perform somewhat *vis-à-vis* their synthetic counterparts as well, their per capita GDP trajectories track each other much more closely, especially in the short- to medium run. Moreover, in stark contrast to actual Armenia, per capita GDP discrepancies in its placebo group typically do not react strongly, if at all, when their corresponding comparison country is assumed to

[25] In terms of our model, poor simulation quality primarily originates from differing transitory shocks or, equivalently, cross-country residual variability, see equation (9).

[26] Eliminating observations pertaining to the NIC itself in the process, to avoid contamination effects.

have declared independence. This underlines the capacity of the simulation procedure to approximate the economic behavior of countries in absence of state fragmentation.

Figure 6: **Trends in per capita GDP: Armenia versus placebo NICs**

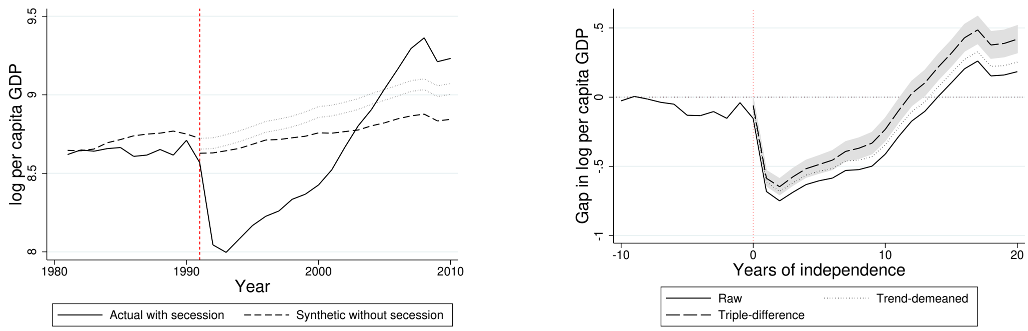


(a) Armenian vs. placebo trajectories (b) Armenian vs. placebo distributions

Note: Figure 6a plots trend-demeaned Armenian independence dividend estimates (black line) against the trend-demeaned placebo independence dividends pertaining to its 154 potential control countries (grey lines); figure 6b plots the corresponding distribution of the actual (full line) and placebo (dashed line) estimates.

Nevertheless, placebo countries have a tendency to under-perform vis-á-vis their synthetic counterparts as well. To account for simulation inaccuracies, we assume that the distribution of placebo estimates approximates the sampling distribution of independence dividend estimates under the null hypothesis of a zero effect. Figure 7a corrects the trend-demeaned trajectory of synthetic Armenia by also removing the typical trend-demeaned discrepancy observed in its placebo group. Once again, we find that the Armenian trend- and placebo-demeaned independence dividend trajectory plotted in figure 7b tends to lie well outside the distribution of its trend-demeaned placebo gaps and is unusually negative under the null hypothesis of a zero effect in the short to medium run.[27]

Figure 7: **Accounting for matching & simulation quality: Armenia**



(a) Actual vs. synthetic per capita GDP (b) The economic impact of secession

Note: Figure 7a plots the log per capita GDP trajectory in Armenia (full line), the uncorrected and trend-demeaned (dotted lines) as well as the triple-difference (dashed line) versions of synthetic Armenia; figure 7b plots the raw (full line), trend-demeaned (dotted line) and triple-difference (dashed line) independence dividend trajectory, defined in equations 10, 11 and 12 respectively.

[27]The 95% confidence interval quantifies uncertainty the stemming from matching & simulation inaccuracy, where both larger pre-independence discrepancies and greater post-independence outcome deviations in placebo countries increase measured uncertainty.

Formally, indexing the control countries in NIC j's donor pool by $k \in [1, \dots, K_j]$, the *triple-difference* estimate of the independence dividend s years after secession is given by

$$\begin{aligned}\hat{\beta}_{j,s}^{DDD} = & \Bigg[\underbrace{\Big(y_{j,T_0+s} - \sum_{i \neq j} w_{i,j}^* y_{i,T_0+s} \Big)}_{\text{raw treatment effect}} - \underbrace{\Big(\sum_{t=T_0-10}^{T_0-1} \Big(y_{j,t} - \sum_{i \neq j} w_{i,j}^* y_{i,t} \Big) \Big)}_{\text{matching inaccuracy}} \Bigg] - \\ & \underbrace{\frac{1}{K_j} \sum_{k \neq j}^{K_j} \Bigg[\Big(y_{k,T_0+s} - \sum_{i \neq k, i \neq j} w_{i,k}^* y_{i,T_0+s} \Big) - \Big(\sum_{t=T_0-10}^{T_0-1} \Big(y_{k,t} - \sum_{i \neq k} w_{i,k}^* y_{i,t} \Big) \Big) \Bigg]}_{\text{simulation inaccuracy}} \end{aligned} \quad (12)$$

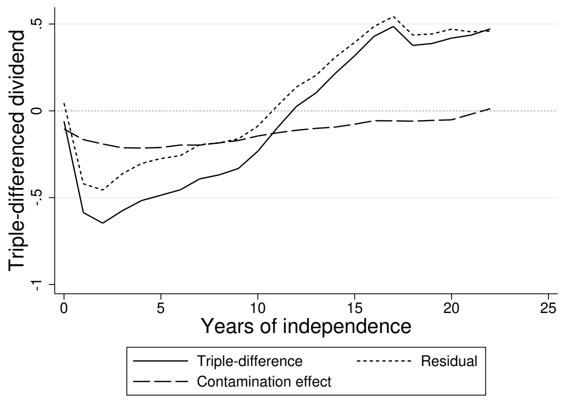
Country-specific triple-difference estimates of the independence dividend are reported in table A3. Compared to their uncorrected counterparts, triple-difference estimates of the independence dividend also tend to be lower in absolute value. That being said, a look at figure A3b reveals that correcting for matching as well as simulation quality does not qualitatively affect our previous conclusions. Thus, our estimates indicate that declaring independence tended to be costly in the long run for about 50% of the NICs in our sample whereas only 35% of them experienced a long run independence gain.

Third, note that the spatio-temporal clustering of state entry may give rise to spillover effects.[28] Indeed, although their respective governments may have had little influence over them, contamination effects may explain the severe independence costs estimated for former members of the Soviet and Yugoslav multi-state systems (see appendix B). To study their potential relevance, we disentangle the 'pure' independence effect from potential contamination effects by parametrically computing the 'pure' economic impact of independence as the residual from a regression of a specific NIC's triple-difference independence dividend trajectory on the triple-difference independence dividend trajectories of all other recently formed states. Indeed, as this residual vector is orthogonal to the included independence dividend trajectories by construction, it serves as a conservative estimate of the 'pure' economic impact of the isolated independence declaration.

Turning once again to the Armenian example, figure 8 plots the parametric decomposition of its triple-difference independence dividend trajectory into a contamination effect and the 'pure', residual economic impact of independence. The figure suggests that contamination effects were persistently negative, and thus partially explain the large Armenian independence cost, especially in the short to medium run. In addition, the decomposition indicates that the pure economic effect of the Armenian independence declaration served to lower growth potential only in the short to medium run, explaining why Armenia - despite suffering adverse contamination effects - benefited a long-run independence gain.

[28] Among other factors, contemporary state entry may affect growth potential in former country members through trade disruptions (Head, Mayer, & Ries, 2010), collapse of international payments systems (Åslund, 2012) or border wars (Bates et al., 2007).

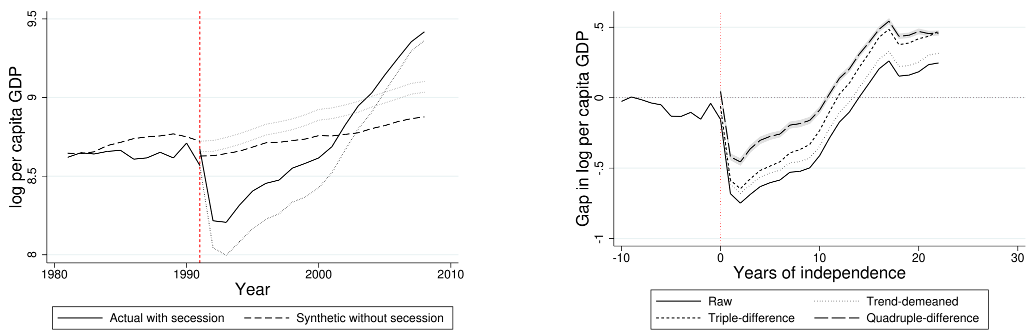
Figure 8: **Decomposing the net independence gain: Armenia**



Note: The figure plots the parametric decomposition of the triple-difference Armenian independence dividend trajectory (full line) into a contamination effect (long-dashed line) and a residual effect (short-dashed line).

Conceptually, one can think of this approach as purging the observed Armenian per capita GDP trajectory from contamination effects by removing parametrically estimated contamination effects in the post-independence period, as shown in figure 9a. Figure 9b indicates that the Armenian growth dip is partially driven by economic effects of independence in other recently formed states. In the long run, however, spillover effects peter out and converging evidence points towards a 50% (pure) independence gain.

Figure 9: **The pure economic effect of independence in Armenia**



(a) Actual vs. synthetic per capita GDP

(b) The economic impact of secession

Note: Figure 9a plots actual (dotted line) and contamination-corrected (full line) Armenian per capita GDP against uncorrected, trend-demeaned (dotted lines) and triple-difference (dashed line) GDP per capita in synthetic Armenia; figure 9b plots raw (full line), trend-demeaned (dotted line), triple-difference (short-dashed line) and pure (dashed line) independence dividend trajectories defined in equations 10, 11, 12 and 14 respectively.

Formally, to identify the contamination effects experienced by NIC j, we limit attention to NICs that became independent in a time window of 10 years around its own independence declaration. First, we regress NIC j's triple-difference independence dividend trajectory on those of the L_j other NICs. In order not to exhaust degrees of freedom[29], we estimate a parsimonious model that selects the included contamination effects through Efron, Hastie, Johnstone, and Tibshirani's (2004) least angle regression algorithm:[30]

[29] As the L_j concurrent trajectories may outnumber NIC j's available independence dividend estimates.

[30] The least angle regression estimator is implemented by Efron et al.'s (2004) *lars*-command in Stata 13.1.

$$\hat{\beta}_{j,s}^{DDD} = \lambda_0 + \sum_{l \neq j}^{L_j} \lambda_l \hat{\beta}_{l,s}^{DDD} + \epsilon_{j,s} \tag{13}$$

where the previous discussion clarifies that $\forall l \in L_j : T_l \in (T_j - 10, \ldots, T_j + 10)$.

Subsequently, we rely on the parametric approximation of the aggregated contamination effect, $\sum_{i \neq j}^{I} \hat{\lambda}_i \hat{\beta}_{i,s}^{DDD}$, to estimate the pure economic impact associated with the independence declaration of NIC j, s years after independence as

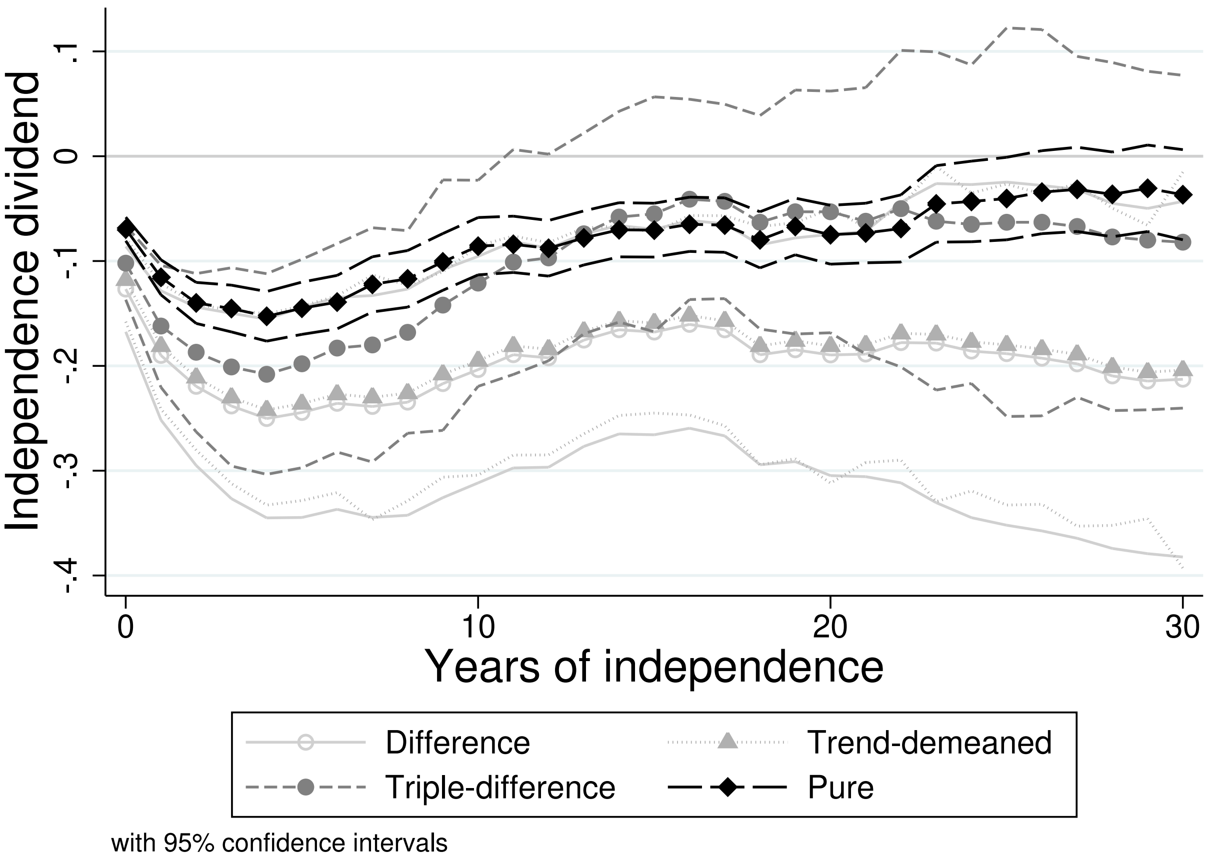
$$\begin{aligned} \hat{\beta}_{j,s}^{pure} = & \underbrace{\left[\left(y_{j,T_0+s} - \sum_{i \neq j} w_{i,j}^{*} y_{i,T_0+s}\right)\right.}_{\text{raw treatment effect}} - \underbrace{\left.\left(\sum_{t=T_0-10}^{T_0-1} \left(y_{j,t} - \sum_{i \neq j} w_{i,j}^{*} y_{i,t}\right)\right)\right]}_{\text{matching inaccuracy}} - \underbrace{\sum_{l \neq j}^{L_j} \hat{\lambda}_l \hat{\beta}_{l,s}^{DDD}}_{\text{contamination effect}} - \\ & \underbrace{\frac{1}{K_j} \sum_{k \neq j}^{K_j} \left[\left(y_{k,T_0+s} - \sum_{i \neq k, i \neq j} w_{i,k}^{*} y_{i,T_0+s}\right) - \left(\sum_{t=T_0-10}^{T_0-1} \left(y_{k,t} - \sum_{i \neq k} w_{i,k}^{*} y_{i,t}\right)\right)\right]}_{\text{simulation inaccuracy}} \end{aligned} \tag{14}$$

To estimate the degree of uncertainty, we bootstrap $\hat{\beta}_{j,s}^{pure}$ by bootstrapping (i) the time window utilized to remove matching inaccuracies where, in each bootstrap sequence, $\min t \in (T_0 - 10, \ldots, T_0 - 1)$; (ii) the subsample of potential control countries, $K \subseteq K_j$, considered to remove simulation inaccuracies; and (iii) the subsample of other NICs, $L \subseteq L_j$, included to remove contamination effects. Thus, measured uncertainty increases in the variability of pre-independence discrepancies, post-independence outcome deviations in placebo countries and estimates of aggregated contamination effects.

Country-specific estimates of the pure economic impact of secession, reported in table A3, tend to have the same sign as their triple-difference counterparts while also being slightly lower in absolute value in the short to medium run. Thus, spillover effects mainly appear to affect the economic outlook in NICs in the first 10 post-independence years. Figure A3c illustrates that 40% of NICs appear to have suffered a pure long run economic independence cost while a similar fraction experienced a pure independence gain.

Figure 10 summarizes the implications of our inferential exercise by plotting the various aggregate independence dividend estimates discussed in this section. Irrespective of the estimator, there is a clear pattern of negative independence dividends in the short to medium run while cross-country heterogeneity obscures a clear assessment of the long run independence payoff. The raw estimates seem more sensitive to simulation than to matching inaccuracy, as correcting for simulation quality yields the most pronounced upward correction. Contamination effects primarily seem to affect growth potential in the short to medium run but dissipate in the longer run, when the triple-difference and pure independence dividend estimates become statistically indistinguishable. Interestingly, estimates of the pure economic impact of secession are fairly stable across bootstrap iterations and do not depend strongly on the time window considered to remove matching inaccuracy, the available potential control countries or the potential contamination effects considered.

Figure 10: **Semi-parametric estimates of the economic impact of secession**



Note: The figure plots the yearly average *uncorrected* synthetic control estimates of the independence dividend (hollow dots), as defined in equation (10), against the corresponding trend difference-in-difference (triangles), triple-difference (squares) and pure (diamonds) estimates related to equations (10), (11), (12) and (14). 95% confidence intervals of the trend-demeaned and triple-difference independence dividend are robust against heteroskedasticity and serial correlation at the country level. Bootstrapped confidence interval of the pure independence dividend based on 1000 replications. The number of years after secession is indicated on the horizontal axis.

4 Two-step estimates of the determinants of the independence dividend

So far, our findings suggest that the independence dividend tends to be substantial, negative and fairly persistent. Yet, there also is considerable heterogeneity in the economic impact of secession across countries and time. From a policy perspective, one lingering issue concerns understanding the economic channels through which secessionist processes affect growth potential in NICs. This extension builds on prior results to propose a two-step approach to shed some light on the primary economic channels determining both the sign as well as the magnitude of country-specific independence payoffs. After outlining the estimation strategy, we present the baseline results and discuss some robustness checks.

4.1 Estimation strategy

To evaluate the various channels through which the decision to secede might affect per capita GDP trajectories in newly formed states, we refine the methodology put forward by Campos et al. (2014) and regress the semi-parametric independence dividend estimates on several potential determinants. Doing so, we limit our attention to the first 30 years following a declaration of independence and consider the potential channels most commonly cited in the theoretical literature, see section 1: the presence of (dis)economies of scale, as proxied by state size (in square kilometers), the extent of surface area loss and trade openness; the impact of persistent conflict, as captured by the per capita number of battle deaths; the relevance of ongoing processes of democratization, incarnated in an index of democracy; and the effect of macroeconomic uncertainty, as reflected in a dummy variable indicating episodes of debt and/or banking crises.

In determining the relative importance of these potential determinants, one obvious difficulty is that the interpretation of the regression coefficients is sensitive to the scale of the inputs. Therefore, all continuous predictor variables are standardized to convert them to a common scale.[31,32] Another complication stems from the possibility that the independence dividend trajectories themselves, as well as their relation to their underlying determinants, may change over time.[33] To capture these dynamics, we include dummies for each post-independence year as well as their interaction with all other predictor variables. Finally, to take into account that global patterns in trade liberalization may have gradually reduced the economic cost of secession, in addition to region dummies, all specifications also include (calendar) year dummies to capture region as well as year fixed effects.

More specifically, denoting the estimated net gain of independence of NIC i located in

[31] Dummy variables remain unchanged since their coefficients can already be interpreted directly.

[32] As noted by Schielzeth (2010), there has been some controversy about this approach to measure the relative importance of predictor variables since there is no unique way to partition the variation in the dependent variable when predictor variables are correlated. Firth (1998) provides a more comprehensive overview of the relevant literature.

[33] Our prior results, for instance, suggest that the adverse effects of independence tend to erode over time.

region r pertaining to the s^{th} post-independence year, which coincides with calendar year t, by $\hat{\beta}_{i,r,t,s}$, we estimate the following model:

$$\hat{\beta}_{i,r,t,s} = \lambda X_{i,r,t,s} + \lambda_s \Big(X_{i,r,t,s} \times s \Big) + \eta_s + \delta_r + \mu_t + \epsilon_{i,r,t,s} \qquad (15)$$

where $X_{i,r,t,s}$ denotes the $(1 \times X)$ vector of standardized predictors of the independence dividend; $\Big(X_{i,r,t,s} \times s \Big)$ denotes their interaction with the S years-of-independence dummy, which allows for a differential relation in each post-independence year; η_s captures the S years-of-independence fixed effects; δ_r denotes the R region fixed effects; μ_t contains the T year fixed effects; and the error term, $\epsilon_{i,r,t,s}$, collects all random, transitory shocks to the independence dividend.

Note that, in the current set-up, the coefficients collected in λ and λ_s reflect the standard deviation elasticity of the independence dividend with respect to its predictors in the s^{th} post-independence year, such that larger coefficients are taken to identify more influential predictors. In this light, it makes sense to define the *relative importance* of each predictor $x \in X$ in a given post-independence year s, $\Delta_{x,s}$, as the expected percentage change in the independence dividend associated with its standard deviation increase:

$$\Delta_{x,s} = \frac{\partial \hat{\beta}_{i,r,t,s}}{\partial x} = \hat{\lambda}_x + \hat{\lambda}_{s,x} \qquad (16)$$

where $\hat{\lambda}_x$ and $\hat{\lambda}_{s,x}$ refer to the parameter estimates associated with the x^{th} predictor in the vector of standardized predictors in equation 15. As noted by Gelman and Pardoe (2007), if one is willing to consider the X included predictors causally, $\Delta_{x,s}$ corresponds to an expected causal effect under a counterfactual assumption.

4.2 Baseline results

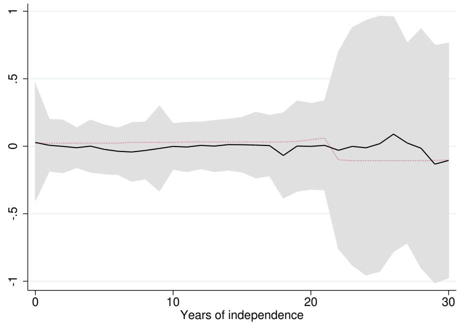
Figure 11, then, provides the results of an investigation of the economic channels influencing the most conservative triple-difference estimates of the independence dividend. More specifically, the black lines plot the evolution of the relative importance of these potential determinants along with their 90% confidence intervals, while the red dotted lines indicate the yearly average values of these standardized predictors actually observed in our sample.

Several explanations to account for the observed variation in the estimated net gains of secession are confirmed. First, our results indicate that the adverse effect of declaring independence is increasing in the extent of surface area loss, at least in the short to medium run. In line with the endogenous growth literature, these results are thus consistent with the hypothesis that separation from larger-sized entities entails more pronounced adverse effects due to a larger reduction in scale economies. We obtain positive estimates for the effect of trade openness throughout the period under consideration, corroborating previous theoretical findings which suggest that trade openness counteracts the adverse effects of decreased domestic market size. Note that, by this reasoning, the negative trade shock typically observed in the immediate post-independence period (indicated by the red line in figure 11c) is expected to aggravate the short-run effect of independence on economic performance and may co-explain the typical post-independence dip in per capita GDP also visible in figure 10. Finally, we fail to discern a meaningful effect of state size since smaller-sized NICs do not appear to be outperformed by their larger-sized counterparts.

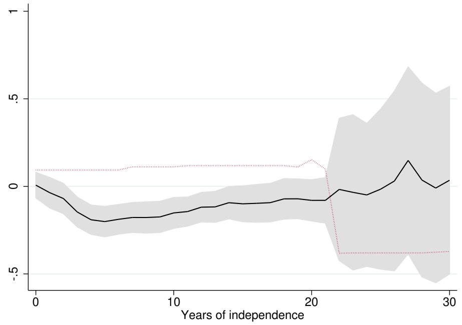
Second, although the point estimates indicate that it is negatively related to the independence dividend, the effect of military conflict cannot be precisely estimated and, hence, the intensity of military violence does not seem meaningfully related to the magnitude of the independence dividend. More interesting is that our results are consistent with democratization being a second channel through which newly formed states can reduce the adverse effects of secession. Compared to the beneficial effect of opening up to trade, however, our results indicate that the impact of the democratization process is only visible in the longer run while its relative importance tends to be more modest. Note that the fact that NICs tend to regress to more authoritarian rule in the immediate post-independence period potentially contributes to more pronounced short-run independence costs. Finally, we also find tentative evidence that the adverse effects of declaring independence may be severely aggravated when these decisions are followed by instances of sovereign debt default or banking crises, although the coefficients tend to be imprecisely estimated.

It may be useful to compare these standard deviation elasticities with the region, year and years-of-independence fixed effects. Doing so, figure 11g is indicative of a small amount of regional heterogeneity in the economic impact of secession: Sub Saharan NICs appear to have benefited the most from their declaration of independence while North African NICs suffered the worst effects. In contrast to the existing literature, we find no evidence of global trade liberalization gradually lowering the economic costs of independence. Quite the contrary, our results indicate that declaring independence became *more* costly over time, reducing per capita independence dividends by approximately 20% in 2013 in comparison to 1980. Finally, the last figure shows that independence dividends, all else equal, tend to worsen in the short to medium run but do not erode in the longer run.

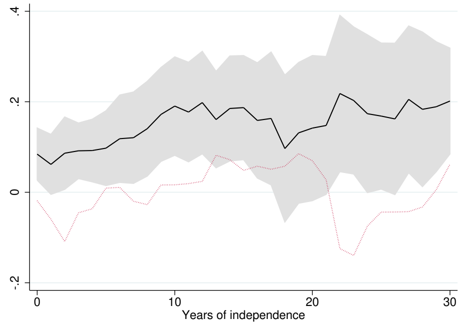
Figure 11: **Determinants of the triple-difference independence dividend**



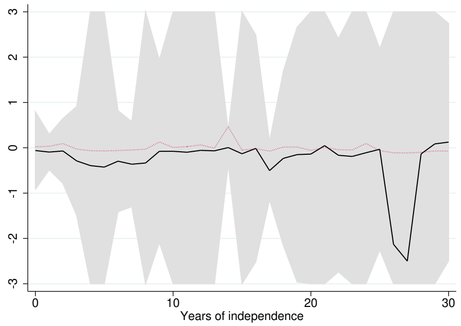
(a) Surface area



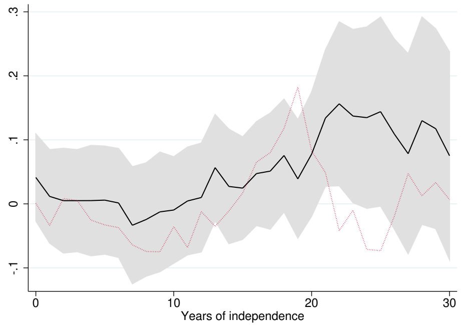
(b) Surface area loss



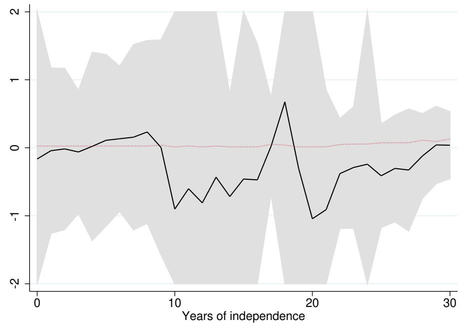
(c) Trade openness



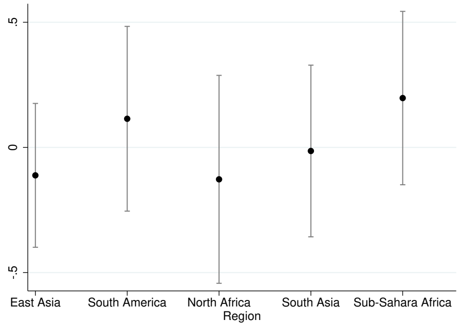
(d) Battle deaths



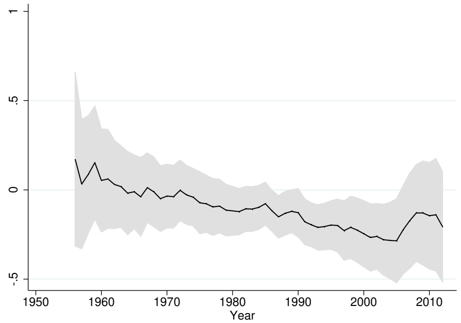
(e) Democracy



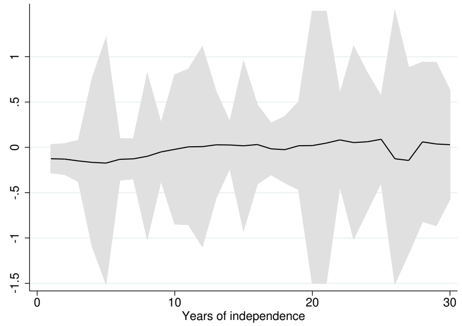
(f) Macroeconomic uncertainty



(g) Region fixed effects



(h) Year fixed effects



(i) Years-of-independence fixed effects

Note: The top and the middle row plot yearly estimates of the relative importance, as defined in equation 16, of several determinants of the triple-difference independence dividend (black line) against their sample-average values (red lines). 90% bootstrapped confidence intervals, clustered at the country level and based on 250 replications, are plotted in gray. For reference, the bottom row plots the region, year and years-of-independence fixed effects: region fixed effects are relative to Europe & Central Asia; year fixed effects are relative to 1980; years-of-independence fixed effects are relative to the year of independence.The number of years after secession is indicated on the horizontal axis.

4.3 Robustness checks

As a first robustness check, we consider the sensitivity of our estimates with respect to the specific first-step estimation procedure utilized to estimate the independence dividend, by sequentially replacing the triple-difference independence dividend with its raw, trend-demeaned and pure counterpart, see figures A4 through A6. Doing so, however, we obtain broadly similar results. Therefore, our prior conclusions hold irrespective of the first-step estimation procedure utilized to estimate the independence dividend.

In figure A7, we display the results of adding educational attainment, life expectancy and the level of per capita GDP as potential determinants. While the former serve to control for the potential effects of human capital differences between NICs, the latter addition allows us to verify whether the impact of secession differs in the degree of economic development. As can be seen, the effect of human capital remains somewhat elusive while we find tentative evidence that richer regions experience less pronounced independence costs. Nevertheless, adding these controls does little to affect our prior conclusions.

In a next step, we extend the original model and also include pre-independence RMSPE and the absolute value of the average contemporary placebo independence dividend to control for matching and simulation quality, see figure A8. Although we find some evidence that simulation inaccuracies cloud the short-run triple-difference estimates, when large inaccuracies in the placebo group coincide with more negative independence dividend estimates, it also turns out that our prior conclusions are not sensitive to explicitly controlling for simulation and matching quality in our estimation model.

Finally, notice that we can also estimate a more restrictive model that eliminates all the - potentially confounding - variation in time-invariant covariates. Figure A9, therefore, re-estimates the original model but now includes country instead of region fixed effects. Unsurprisingly, this manipulation causes the relative importance of our time-constant predictors to be less precisely estimated. However, the beneficial effect of increased trade openness and democratization remains visible in this model.

All in all, while the second-step results are less clear-cut than our first-step findings, they suggest that the post-independence per capita GDP dip observed in our sample is initially mainly driven by decreasing scale economies and trade flows and a short-term regression towards more authoritarian institutions, while the longer-run cost may be brought about by increased costs of macroeconomic uncertainty. Nevertheless, increased trade openness and ongoing processes of democratization appear to have bolstered growth potential in these newly formed states, mitigating - at least partially - independence costs. Although this strategy does not allow for a conclusive identification and ranking of all the channels influencing the independence payoff, due to the unresolved issues of omitted variable bias and endogeneity, the consistent patterns of variation in the independence payoffs certainly make these channels prime candidates for further research.

5 Conclusion

In tandem with the recent surge in secessionist tendencies, independence movements from all over the world increasingly tend to defend their cause based on economic considerations. However, whether or not there are economic benefits from declaring independence remains largely unexplored. This study is the first of its kind to examine the economic impact of secession for a broad sample of newly independent countries, focusing on a large time period covering the years 1950 to 2013.

Relying on a semi-parametric estimation strategy to control for the confounding effects of past GDP dynamics, anticipation effects, unobserved heterogeneity between newly formed and more established states, model uncertainty as well as effect heterogeneity, we present robust evidence that secession statistically significantly hampers growth potential in newly formed states. Our central results suggest that the decision to secede reduced per capita GDP in NICs anywhere between 20% and 46% in the long run. From a methodological perspective, we develop a novel quadruple-difference procedure that sequentially accounts for matching quality, simulation quality and contamination effects, providing informative statistical inference on the reliability of synthetic control estimates of treatment effects. Applying this procedure, we confirm the existence of a statistically significant negative independence dividend in the short to medium run, with cross-country heterogeneity obscuring the average long-run impact of independence.

Another novelty is the construction of a two-step estimator to identify the primary channels through which secessionist processes influenced per capita GDP trajectories, combining both parametric and semi-parametric techniques. In line with much of the existing literature, we find robust evidence that the adverse effects of independence increase in the extent of surface area loss, pointing to the presence of economies of scale, but that NICs can mitigate at least some of the adverse effects of declaring independence by opening up to trade and improving democratic institutions.

In light of these findings, two questions naturally arise. First, do these results generalize to other regions contemplating independence today? Indeed, since we estimate the average treatment effect on the treated, extrapolation to contemporary and future NICs may be problematic to the extent that these differ non-trivially from the historical cases of state fragmentation considered in this analysis.[34] Second, do these findings generalize to the non-economic spectrum? This also remains an open question, as independence may come with compensating political (Alesina & Spolaore, 1997, 2003), re-distributional (Bolton & Roland, 1997) or other effects.

[34] The two-step findings discussed in the previous paragraph, however, are intended to offer a partial answer to this question.

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A Data construction and sources

In order to ensure a dataset that is as complete as possible, we draw on a wide variety of data sources to construct several variables used in the empirical analysis. This section describes in more detail the variable-specific data manipulation procedure utilized to construct these variables. Table A1 summarizes the data sources and construction while also, where relevant, reporting some diagnostics.

GDP per capita (baseline): To construct our baseline estimates of the country-specific per capita GDP trajectories, we rely on a third-order polynomial approximation procedure that builds on Fearon and Laitin (2003a). We depart from the estimates for per capita GDP measured in 1990 Geary-Khamis dollars and reported by The Madison Project (2013). This series starts in 1950 and ends in 2010 and provides 8794 (70.1%) of our 12544 country years. Subsequently, we maximally extend these estimates forward to 2013 and backwards to 1960 using the growth rate of real per capita GDP provided by the World Bank (2015), thereby adding another 1956 (15.6%) country-year observations. Afterward, we remove 14 isolated country-year observations pertaining to the pre-independence situation in the group of former Soviet states. In a next step, we regress these baseline log per capita GDP estimates on log per capita CO2 emissions, as reported by the World Resources Institute (2015), a vector of year dummies, a region dummy for each of the seven regions distinguished by the World Bank (2015), their squared and cubic values as well as all possible third-order interactions. We then use the growth rate of the predicted per capita GDP trajectories to maximally extend the baseline series forward and backwards, adding another 1107 (8.8%) country-year observations.[35] Data on the country-specific emission levels of CO2 are available between 1950 and 2012 and, in itself, these correlate fairly strongly with the baseline per capita income estimates, at 0.86 for their 9840 common observations. That being said, with a correlation coefficient of 0.9, predicted per capita GDP levels correlate even more strongly with the baseline estimates. Finally, evaluating this least squares third-order polynomial model's predictive accuracy on an observation-by-prediction basis, we find that 58% of the baseline log per capita GDP observations fall within the 99% confidence intervals of their predicted counterparts. Although this indicates a fairly good match between the model's data-generating process and our reference series, this further motivates extending the reference data by relying on the growth rates implied in these alternative predictions, rather than the predicted values themselves.

In order to further extend the existing data series, we repeat this exercise using information on log per capita CO2 emissions contained in World Bank (2015). The World Bank (2015) data on CO2 emissions runs from 1960-2013 and also shows a strong correlation with baseline log per capita GDP (0.86 for their 8227 common observations). Neverthe-

[35]There remain several countries lacking any income estimates in the baseline series, but for which data on the level of CO2 emissions are available. For these countries, we use the predicted per capita GDP trajectories instead.

less, the third-order polynomial predicted per capita GDP trajectories once again correlate even more strongly with their baseline counterparts, yielding a correlation coefficient of 0.9, while the predictive accuracy of this model attains 57%. Once again using the growth rate of predicted real per capita GDP to further extend the existing series forward and backwards adds another 56 (0.05%) observations. The remaining 644 (5.1%) country-year observations remain missing.[36]

GDP per capita (alternative): In order to make sure that our findings are not driven by the data construction process, we also construct alternative per capita GDP estimates. To do so, we synthetize a wide variety of data sources containing information on country-specific levels of real per capita GDP. More specifically, we consider the information in Barro and Lee (1994); Heston, Summers, and Aten (1994); The Madison Project (2013); Gibler and Miller (2014b); CLIO Infra (2015); Feenstra, Inklaar, and Timmer (2015); The Conference Board (2015); World Bank (2015).

To derive our alternative per capita GDP trajectory, we apply the following so-called regular data construction procedure: *(i)* linearly interpolate missing observations in all available data sources, *(ii)* selecting the most complete source (i.e. the source with the most country-year observations) as the baseline series. Subsequently, *(iii)* from the alternative data sources, select the dataset for which the overlapping path is most strongly correlated with that of the base series and *(iv)* use the variation in the alternative source to approximate as much missing values in the base series as possible. First, if the non-overlapping observations in the alternative source pertain to a country already appearing in the base series, use the growth rates in the alternative source to maximally extend the base series forward and backwards. Second, if the non-overlapping observations in the alternative data source pertain to a country not covered in the base series, express its per capita GDP relative to that of the United States to approximate missing observations in the base series. Finally, *(v)* repeat steps *(iii)*-*(v)* for each remaining data source.

Table A1, then, summarizes the percentage contribution of each data source to the total number of observations as well as the correlation with the base series. Interestingly, the correlation between the common 11214 baseline and alternative per capita GDP estimates equals 0.988, giving further credence to our polynomial approximation approach to construct our baseline estimates. Unsurprisingly, our empirical results are not sensitive to which measure of economic performance we use. Therefore, to economize on space, further results pertaining to the alternative per capita GDP estimates are not reported.

Population: Data on the evolution of country-specific population size between 1950 and 2013 are obtained from Barro and Lee (1994); Heston et al. (1994); The Madison Project (2013); CLIO Infra (2015); Feenstra et al. (2015); United Nations Population Division (2015); World Bank (2015). Aggregation across datasets is obtained by applying the

[36]In each data source, we only rely on non-zero observations and treat zero observations as missing.

regular data construction procedure outlined earlier. Doing so, our consolidated indicator of population size is constructed by: *(i)* linearly interpolating missing observations in all data sources; *(ii)* selecting the most complete as the baseline series; *(iii)* selecting the alternative dataset for which the overlapping path is most strongly correlated with that of the base series; *(iv)* using the variation in the alternative source to approximate as much missing values in the base series as possible; and *(v)* repeating steps *(iii)*-*(v)* for each remaining data source. As the correlation between all these different sources is nearly perfect (cf. Table A1), our population variable is not sensitive to the selection of the base series or the specific sequence of extensions.

Educational attainment: In order to construct a consolidated index representing the average years of education attained in each country-year, we first gather data on the average years of education as reported by Barro and Lee (1994, 2012); CLIO Infra (2015); United Nations Development Program (2015); secondary education enrollment rates from Barro and Lee (1994); World Bank (2015); and enrollment in tertiary education from the World Bank (2015). In a second step, since most of these data are only reported five-yearly, we linearly interpolate missing observations in each dataset. This seems reasonable, as far as educational attainment evolves gradually over time. Subsequently, as it is the most extensive data series, the Barro and Lee (2012) data on average years of education is selected as baseline series. Covering the period 1950-2010, it provides 8723 (69.5%) country-year estimates for the average years of education. In a next step, we maximally extend these estimates forward to 2013 and backwards to 1980 using the growth rates implied in the average years of education data reported by United Nations Development Program (2015), adding another 849 (6.8%) estimates. Subsequently, we rely on the least squares third-order polynomial approximation strategy outlined earlier to further extend this baseline series where possible. Afterward, we linearly interpolate interrupted time series to add 103 (0.8%) more country-years. 1352 (10.8%) country-years remain missing.

As detailed in Table A1, the correlation with the baseline values is fairly strong for both the overlapping raw alternative estimates as well as the third-order polynomial predictions, with correlation coefficients ranging from 0.74 to 0.98. In addition, the predictive accuracy of our various third-order polynomial models generally is fairly high, where the number of baseline estimates falling within the 99% confidence intervals of their predicted counterparts range from 56.6% to 71.4%.

Life expectancy: Data on life expectancy is obtained from Barro and Lee (1994); CLIO Infra (2015); World Bank (2015), where linear interpolation is first employed to add a small number of missing observations. Since the correlation between the overlapping observations in these datasets is near perfect, as detailed in Table A1, our consolidated variable of interest is constructed by averaging across all available data sources, leaving 965 (7.7%) country-year observations missing.

Trade openness: Data on trade openness, defined as the value of imports and exports relative to GDP, are obtained from Heston et al. (1994); Feenstra et al. (2015); World Bank (2015). After linearly interpolating missing observations in each dataset, we select the Feenstra et al. (2015) data as our baseline. This dataset covers the period 1950-2011 and provides us with 9143 (72.9%) country-year observations. Subsequently, we maximally extend the existing data forward and backwards using the growth rates implied in the World Bank (2015) data for an additional 503 (4%) country-year observations. Finally, relying on the least squares third-order polynomial approximation procedure outlined above, we fill another 119 (0.9%) country-year observations based on the Heston et al. (1994) data. 2779 (22.2%) country-year observations remain missing.

Democracy: In order to construct a composite index of democracy, we incorporate information on 8 measures of democracy: Melton, Meserve, and Pemstein (2010); Giuliano, Mishra, and Spilimbergo (2013); Center for Systemic Peace (2014); Gibler and Miller (2014b); Vanhanen (2014); CLIO Infra (2015); Freedom House (2015); Skaaning, Gerring, and Bartusevičius (2015).[37] After linearly interpolating missing observations in each data set, as it is the most extensive data source, we consider Vanhanen (2014) as our baseline series. Vanhanen's (2014) continuous measure of democracy, which is based on a country's degree of political competition and political participation, provides us with 9240 (73.7%) democracy estimates. Subsequently, sequentially relying on the alternative democracy measures, we apply the third-order polynomial approximation approach described earlier to maximally extend this baseline series forward and backwards. After this procedure, 2807 (22.4%) country-year observations remain missing.

The fairly high correlation between both raw alternative as well as third-order polynomial predicted democracy values and baseline values reported in Table A1, where correlation coefficients range from 0.78 to 0.98, serves to motivate this approach. In addition, the high predictive accuracy of our various third-order polynomial models, ranging from 59.9% to 87.7%, provides further evidence that these alternative democracy indexes provide useful information to assess missing values in the baseline series.

[37] For a comparison of various democracy indices, see among others Munck and Verkuilen (2002) and Melton et al. (2010)

Table A1: **Constructed variables: data sources and components**

Variable	*Data source*	*Description*	*% Obs. [% Int.]*	*r / r̂*	*Accuracy*
GDP per capita*** (baseline)	**The Madison Project (2013)**	GDP per capita (1990 int. GK $)	70.11 [.]	1 / .	.
	World Bank (2015)	GDP per capita (constant 2005 $)	15.59 [.]	0.91 / .	.
	World Resources Institute (2015)	Total CO2 emissions (Metric Tons)	8.82 [.]	0.86 / 0.90	58.00
	World Bank (2015)	Per capita CO2 emissions (Metric Tons)	0.45 [.]	0.86 / 0.90	57.15
	n.a.	missing	5.13 [.]	. / .	.
GDP per capita** (alternative)	**The Madison Project (2013)**	GDP per capita (1990 int. GK $)	72.05 [1.95]	1 / .	.
	CLIO Infra (2015)	GDP per capita (1990 int. GK $)	0.02 [0.00]	1 / .	.
	The Conference Board (2015)	GDP per capita (1990 int. GK $)	6.42 [0.00]	0.99 / .	.
	Barro and Lee (1994)	GDP per capita (1985 int. prices)	1.28 [0.96]	0.98 / .	.
	Heston et al. (1994)	Real GDP per capita	0.31 [0.01]	0.96 / .	.
	World Bank (2015)	GDP per capita (constant 2005 $)	8.46 [0.00]	0.91 / .	.
	Feenstra et al. (2015)	GDP per capita (chained PPPs, 2005$)	0.58 [0.00]	0.90 / .	.
	Gibler and Miller (2014b)	Real GDP per capita (1985 $)	0.43 [0.00]	0.77 / .	.
	n.a.	missing	10.47 [.]	. /.	.
Population**	**CLIO Infra (2015)**	Total population	90.94 [67.08]	1 / .	.
	Heston et al. (1994)	Total population	0.47 [0.00]	1 / .	.
	Feenstra et al. (2015)	Total population	2.12 [0.00]	1 / .	.
	Barro and Lee (1994)	Total population	0.08 [0.06]	1 / .	.
	World Bank (2015)	Total population	4.21 [0.00]	1 / .	.
	The Madison Project (2013)	Total population	0.40 [0.00]	1 / .	.
	United Nations Population Division (2015)	Total population	0.16 [0.00]	1 / .	.
	n.a.	missing	1.63 [.]	. / .	.
Education***	**Barro and Lee (2012)**	Average years of education	69.54 [54.72]	1 / .	.
	United Nations Development Program (2015)	Average years of education	6.77 [0.61]	0.98 / .	.
	Barro and Lee (1994)	Average years of education	0.89 [0.74]	0.96 / 0.98	71.39
	CLIO Infra (2015)	Average years of education	4.75 [4.24]	0.95 / 0.97	65.19
	World Bank (2015)	Secondary enrollment rate	6.18 [2.54]	0.88 / 0.93	57.59
	Barro and Lee (1994)	Secondary enrollment rate	0.27 [0.19]	0.87 / 0.92	65.14
	World Bank (2015)	Tertiary enrollment rate	0.53 [0.26]	0.74 / 0.87	56.65
	Linearly interpolated	.	0.82 [0.82]	. / .	.
	n.a.	missing	10.78 [.]	. / .	.
Health*	**CLIO Infra (2015)**	Life expectancy	84.50 [0.65]	1 / .	.
	World Bank (2015)	Life expectancy	77.57 [0.03]	0.99 / .	.
	Barro and Lee (1994)	Life expectancy	23.48 [18.06]	0.97 / .	.
	n.a.	missing	7.35 [.]	. / .	.
Trade Openness***	**Feenstra et al. (2015)**	(imports + exports)/GDP	72.89 [0.00]	1 / .	.
	World Bank (2015)	(imports + exports)/GDP	4.01 [0.00]	0.84 / .	.
	Heston et al. (1994)	(imports + exports)/GDP	0.95 [0.00]	0.70 / 0.83	67.98
	n.a.	missing	22.15 [.]	. / .	.
Democracy***	**Vanhanen (2014)**	Vanhanen Index of Democracy	73.66 [0.15]	1 / .	.
	CLIO Infra (2015)	Vanhanen Index of Democracy	1.27 [0.00]	0.97 / 0.98	87.73
	Gibler and Miller (2014b)	Combined Polity2 Index	0.81 [0.00]	0.90 / 0.94	68.38
	Melton et al. (2010)	Unified Democracy Scores	0.29 [0.16]	0.89 / 0.93	66.43
	Giuliano et al. (2013)	Freedom House Index	0.33 [0.18]	0.81 / 0.92	65.62
	Freedom House (2015)	Freedom House Index	1.07 [0.49]	0.82 / 0.91	59.91
	Skaaning et al. (2015)	Lexical Index of Electoral Democracy	0.10 [0.00]	0.79 / 0.90	66.08
	Center for Systemic Peace (2014)	Revised Combined Polity Score	0.02 [0.00]	0.78 / 0.89	97.66
	n.a.	missing	22.38 [.]	. / .	.

Note: Baseline sources in bold. * indicates that the consolidated variable is obtained by averaging across all available data sources, ** indicates that the consolidated variable is obtained by applying the regular data construction procedure outlined in appendix A, *** indicates that the consolidated variable is obtained by applying the third-order polynomial approximation procedure outlined in appendix A. The percentage of linearly interpolated country-years contributions by each data source in square brackets. r reports the correlation between baseline and alternative values, $\hat{r}$ reports the correlation between baseline and third-order polynomial predicted values. Where relevant, the last column reports the percentage of baseline observations falling withing the 99% confidence intervals of their third-order polynomial predicted counterparts.

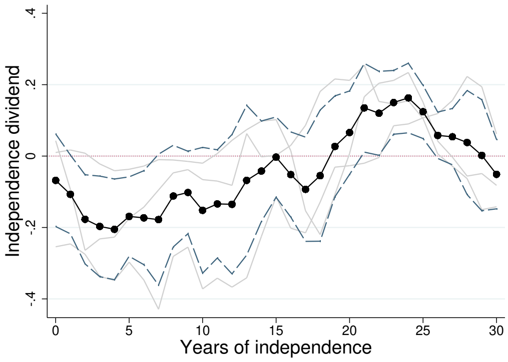
B Selected results

To put more empirical flesh on the bones, this appendix supplements the large-scale econometric analysis of section 3 by highlighting the results pertaining to a number of historical instances of state fragmentation and connecting them to the existing literature on this topic. More specifically, figure A1 characterizes the economic consequences associated with the disintegration of the Belgian, British, French and Portuguese colonial empires, comparing these with the implied economic effects stemming from the dissolution of the Soviet Union, Yugoslavia and - most recently - Czechoslovakia.

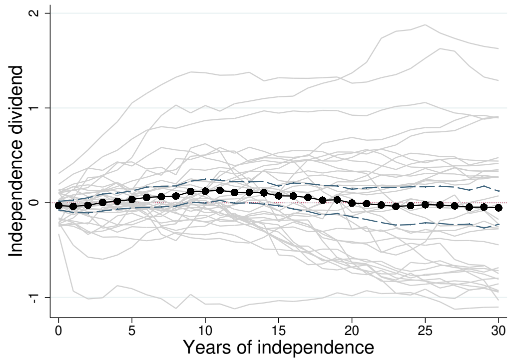
Recall that the identity of the mother country is thought to play an important role in explaining cross-country heterogeneity in the economic impact of secession, see section 1. In this regard, it is often argued that former British colonies prospered relative to their French, Spanish, Portuguese and Belgian counterparts because the British left behind better institutions (Acemoglu et al., 2001; Acemoglu & Robinson, 2009) and were more successful in educating their dependents (Grier, 1999). Interestingly, our results are largely consistent with this story and suggest that, in sharp contrast to NICs with other colonial heritages, former British colonies did not tend to suffer adverse economic consequences as a result of becoming independent and even enjoyed an independence gain of around 10% in the medium run. More surprisingly, although Belgian and Portuguese dominations are often considered the most detrimental and exploitative (Bertocchi & Canova, 2002), former French colonies appear to have suffered the most adverse economic consequences of colonial demise in the form of a persistent 20% reduction in per capita GDP. While Portuguese colonies seem largely unaffected by their decision to go it alone, former Belgian colonies and protectorates appear to have suffered a short-run cost of independence but were able to revert this to a longer term independence gain. The latter suggests that there may be economic gains associated with the elimination of colonial drain.

In the same vein, Roland (2002), Svejnar (2002) and Fidrmuc (2003) maintain that the extent of state capture and rent-seeking was more pervasive in the Soviet Union than in other Eastern and Central European countries and that these differential initial conditions, often proxied by the distance from Western Europe, go a long way in explaining the underperformance of former Soviet states vis-á-vis other NICs in the region. Furthermore, they argue that this mechanism may have been amplified by differential prospects of EU membership, which enhanced incentives for law enforcement and protection of property rights in potential member states. Our results are testimony to this, indicating that the group of former Soviet members suffered the most adverse and persistent effects of state breakup. In comparison, the economic costs associated with the Czechoslovakian 'Velvet Divorce' were both more modest and much less persistent while the post-independence performance of the Yugoslavian successor states seems least affected by state fragmentation.

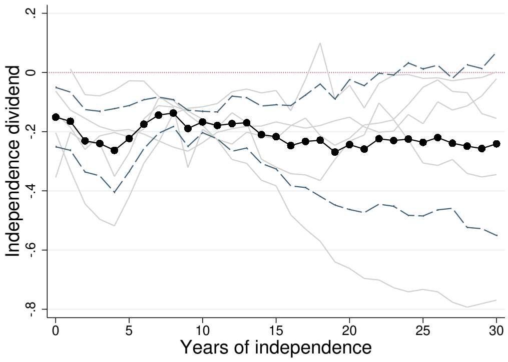
Figure A1: **Triple-difference estimates: historical instances of state fragmentation**



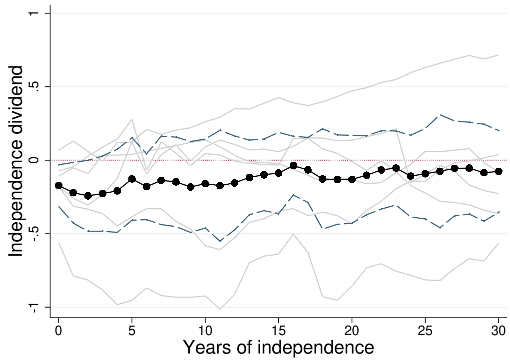
(a) Belgian colonial empire



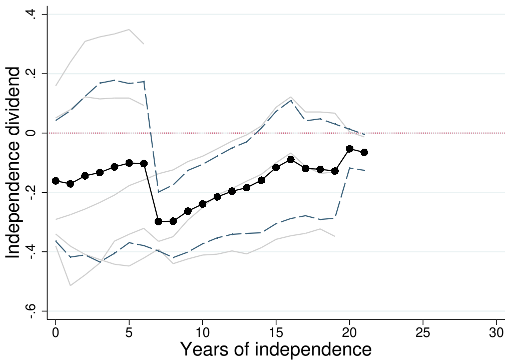
(b) British colonial empire



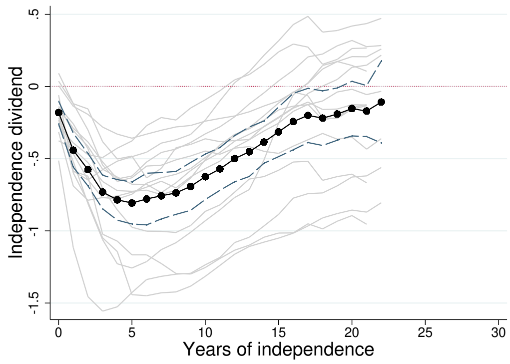
(c) French colonial empire



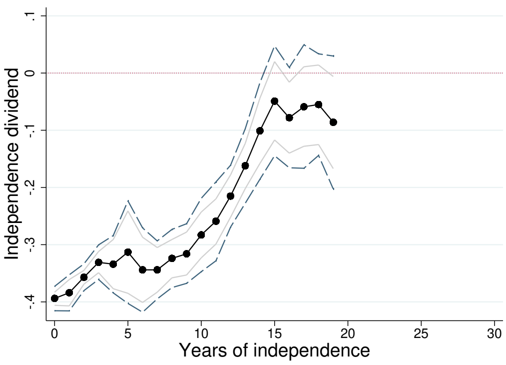
(d) Portuguese colonial empire



(e) Yugoslavia



(f) Soviet Union



(g) Czechoslovakia

Note: The figures plot yearly, triple-difference estimates of the independence dividend trajectories associated with selected historical instances of state fragmentation. Each gray line plots the trajectory of a specific former member state; the black lines depict the aggregate independence dividend trajectory; the dashed lines depict the 90% bootstrapped confidence interval, clustered at the country level and based on 250 replications. The number of years after independence are indicated on the horizontal axis.

Table A2: **Newly Independent Countries: 1950-2015**

Country	*Year*	*Country*	*Year*	*Country*	*Year*
Libya	1951	Uganda$^{\diamond}$	1962	Saint Lucia$^{\diamond}$	1979
Cambodia*	1953	Kenya$^{\diamond}$	1963	Saint Vincent & the Grenadines$^{\diamond}$	1979
Lao PDR	1953	Malawi$^{\diamond}$	1964	Antigua & Barbuda$^{\diamond}$	1981
Vietnam	1954	Malta*$^{\diamond}$	1964	Belize$^{\diamond}$	1981
Morocco$^{\diamond}$	1956	Zambia$^{\diamond}$	1964	Vanuatu$^{\diamond}$	1981
Sudan	1956	Gambia$^{\diamond}$	1965	Saint Kitts & Nevis$^{\diamond}$	1983
Tunisia	1956	Maldives	1965	Brunei Darussalam$^{\diamond}$	1984
Ghana$^{\diamond}$	1957	Singapore*$^{\diamond}$	1965	Marshall Islands	1986
Malaysia$^{\diamond}$	1957	Zimbabwe$^{\diamond}$	1965	Micronesia*	1986
Guinea*	1958	Barbados$^{\diamond}$	1966	Namibia$^{\diamond}$	1990
Benin$^{\diamond}$	1960	Botswana$^{\diamond}$	1966	Yemen	1990
Burkina Faso	1960	Guyana$^{\diamond}$	1966	Armenia*$^{\diamond}$	1991
Cameroon	1960	Lesotho$^{\diamond}$	1966	Azerbaijan$^{\diamond}$	1991
Central African Republic	1960	South Yemen	1967	Belarus$^{\diamond}$	1991
Chad	1960	Equatorial Guinea	1968	Estonia*$^{\diamond}$	1991
Congo$^{\diamond}$	1960	Mauritius$^{\diamond}$	1968	Georgia*$^{\diamond}$	1991
Congo Republic	1960	Swaziland$^{\diamond}$	1968	Kazakhstan$^{\diamond}$	1991
Cote d'Ivoire	1960	Fiji$^{\diamond}$	1970	Kyrgyz Republic$^{\diamond}$	1991
Cyprus$^{\diamond}$	1960	Bahrain$^{\diamond}$	1971	Latvia*$^{\diamond}$	1991
Gabon	1960	Bangladesh$^{\diamond}$	1971	Lithuania*$^{\diamond}$	1991
Madagascar	1960	Oman	1971	Moldova$^{\diamond}$	1991
Mali	1960	Qatar$^{\diamond}$	1971	Russian Federation$^{\diamond}$	1991
Mauritania	1960	United Arab Emirates$^{\diamond}$	1971	Tajikistan$^{\diamond}$	1991
Niger	1960	Bahamas$^{\diamond}$	1973	Turkmenistan*$^{\diamond}$	1991
Nigeria$^{\diamond}$	1960	Grenada$^{\diamond}$	1974	Ukraine*$^{\diamond}$	1991
Senegal	1960	Guinea-Bissau$^{\diamond}$	1974	Uzbekistan*$^{\diamond}$	1991
Somalia	1960	Angola$^{\diamond}$	1975	Croatia*$^{\diamond}$	1992
Togo	1960	Cabo Verde$^{\diamond}$	1975	Slovenia$^{\diamond}$	1992
Kuwait	1961	Comoros$^{\diamond}$	1975	Czech Republic$^{\diamond}$	1993
Sierra Leone	1961	Mozambique$^{\diamond}$	1975	Eritrea*	1993
Syrian Arab Republic$^{\diamond}$	1961	Papua New Guinea$^{\diamond}$	1975	Macedonia*$^{\diamond}$	1993
Tanzania$^{\diamond}$	1961	Sao Tome & Principe$^{\diamond}$	1975	Slovak Republic$^{\diamond}$	1993
Algeria*$^{\diamond}$	1962	Suriname$^{\diamond}$	1975	Palau*$^{\diamond}$	1994
Burundi$^{\diamond}$	1962	Seychelles$^{\diamond}$	1976	Timor-Leste*$^{\diamond}$	2002
Jamaica*$^{\diamond}$	1962	Djibouti$^{\diamond}$	1977	Montenegro*$^{\diamond}$	2006
North Yemen	1962	Dominica	1978	Serbia$^{\diamond}$	2006
Rwanda$^{\diamond}$	1962	Solomon Islands$^{\diamond}$	1978	Kosovo	2008
Samoa*	1962	Tuvalu	1978	South Sudan*	2011
Trinidad and Tobago$^{\diamond}$	1962	Kiribati$^{\diamond}$	1979		

Note: * indicates countries that gained independence following a successful independence referendum. Data on historical independence referendums and their outcomes are taken from Qvortrup (2014).
$^{\diamond}$ indicates countries included in the synthetic control algorithm (see section 3).

Table A3: **Semi-parametric estimates of the economic impact of secession**

	t = T_0 + 1				**t = T_0 + 5**				**t = T_0 + 20**			
Country	$\hat{\beta}_{jt}$	$\hat{\beta}_{jt}^{tDD}$	$\hat{\beta}_{jt}^{DDD}$	$\hat{\beta}_{jt}^{pure}$	$\hat{\beta}_{jt}$	$\hat{\beta}_{jt}^{tDD}$	$\hat{\beta}_{jt}^{DDD}$	$\hat{\beta}_{jt}^{pure}$	$\hat{\beta}_{jt}$	$\hat{\beta}_{jt}^{tDD}$	$\hat{\beta}_{jt}^{DDD}$	$\hat{\beta}_{jt}^{pure}$
Algeria	-.219	-.216***	-.202***	-.098***	-.304	-.301***	-.272***	-.13***	-.285	-.282***	-.222***	.012***
Angola	-.77	-.792***	-.788***	-.496***	-.963	-.985***	-.953***	-.441***	-.975	-.997***	-.856***	-.748***
Antigua & Barbuda	.424	.409***	.418***	.25***	1.04	1.024***	1.053***	.791***	1.127	1.111***	1.262***	.96***
Armenia	-0.682	-.613***	-.586***	-.442***	-.604	-.535***	-.486***	-.3***	.184	.253***	.419***	.444***
Azerbaijan	-.528	-.547***	-.52***	-.326***	-1.288	-1.306***	-1.257***	-.979***	-.002	-.021	.146**	.093***
Bahamas	-.347	-.447***	-.448***	-.408***	-.385	-.485***	-.469***	-.453***	-.44	-.54***	-.425***	-.383***
Bahrain	-.071	-.068***	-.05***	.215***	-.069	-.066***	-.052**	.191***	-.861	-.859***	-.743***	.734***
Bangladesh	-.316	-.309***	-.298***	-.244***	-.373	-.366***	-.361***	-.269***	-.424	-.417***	-.303***	-.385***
Barbados	.068	.071***	.083***	.105***	.12	.123***	.144***	.264***	-.085	-.082***	-.024	.169***
Belarus	-.33	-.317***	-.289***	-.145***	-0.683	-.67***	-.62***	-.407***	.14	.153***	.319***	.24***
Belize	-.09	-.092***	-.081***	-.008	-.262	-.264***	-.233***	-.14***	.088	.087***	.22***	.243***
Benin	-.008	-.006	.012	-.123***	-.063	-.062***	-.028	-.238***	-.271	-.269***	-.232***	-.485***
Botswana	-.132	.186***	.197***	.171***	.14	.457***	.478***	.659***	.995	1.313***	1.37***	1.497***
Brunei Darussalam	-.1	-.246***	-.21***	-.009	-.305	-.451***	-.381***	-.045***	-.615	-.761***	-.575***	.021*
Burundi	-.402	-.261***	-.246***	-.185***	-.468	-.327***	-.297***	-.214***	-.23	-.088**	-.027	.02***
Cabo Verde	-.256	-.267***	-.259***	-.125***	.099	.087***	.126***	.288***	.336	.324***	.473***	.886***
Comoros	-.336	-.334***	-.33***	-.352***	-.455	-.452***	-.42***	-.426***	-.187	-.184***	-.043	-.138***
Congo	.002	.004	.017	.032***	-.066	-.065***	-.037*	-.021***	-.028	-.026***	.007	-.06***
Croatia	-.429	-.549***	-.514***	-.365***	-.286	-.406***	-.341***	-.188***				
Cyprus	.025	.046	.06*	.043***	-.008	.013	.042	.034***	.481	.502***	.535***	.504***
Czech Republic	-.523	-.435***	-.407***	-.158***	-.518	-.43***	-.385***	-.064***				
Djibouti	-.206	-.211***	-.185***	-.228***	-.259	-.264***	-.218***	-.129***	-0.825	-.831***	-.662***	-.328***
Estonia	-.313	-.419***	-.391***	-.178***	-.321	-.427***	-.377***	-.134***	.202	.097**	.263***	.278***
Fiji	-.178	-.007	0	-.096***	-.163	.008	.017	-.051***	-.12	.051	.158***	.091***
Gambia	.147	.153***	.17***	.177***	.068	.074***	.092***	.114***	-.171	-.166***	-.1**	.078***

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Country	$\hat{\beta}_{jt}$	$\hat{\beta}_{jt}^{tDD}$	$\hat{\beta}_{jt}^{DDD}$	$\hat{\beta}_{jt}^{pure}$	$\hat{\beta}_{jt}$	$\hat{\beta}_{jt}^{tDD}$	$\hat{\beta}_{jt}^{DDD}$	$\hat{\beta}_{jt}^{pure}$	$\hat{\beta}_{jt}$	$\hat{\beta}_{jt}^{tDD}$	$\hat{\beta}_{jt}^{DDD}$	$\hat{\beta}_{jt}^{pure}$
	t = T_0 + 1				**t = T_0 + 5**				**t = T_0 + 20**			
Georgia	-1.121	-1.146***	-1.116***	-.712***	-1.459	-1.484***	-1.427***	-.846***	-.772	-.797***	-.627***	-.444***
Ghana	-.096	-.097***	-.108***	-.073***	-.035	-.035**	-.017	.05***	-.665	-.665***	-.626***	-.495***
Grenada	-.209	-.211***	-.211***	-.051***	-.142	-.144***	-.111***	-.227***	-.024	-.026	.109**	-.263***
Guinea-Bissau	.16	.121***	.13***	.188***	.118	.08***	.122***	.064***	.023	-.016	.137***	-.11***
Guyana	-.041	-.021	-.01	.059***	-.069	-.049*	-.026	.054***	-.746	-.726***	-.643***	-.466***
Jamaica	-.043	-.043	-.031	-.068***	-.065	-.064	-.04	-.092***	-.639	-.638***	-.59***	-.659***
Kazakhstan	-.457	-.457***	-.43***	-.345***	-.776	-.776***	-.726***	-.538***	-.186	-.186***	-.019	-.112***
Kenya	-.081	-.06**	-.052**	-.037***	.005	.026	.04	.054***	-.199	-.178***	-.132***	-.252***
Kiribati	-.988	-.959***	-.933***	-.9***	-.986	-.957***	-.907***	-.888***	-1.174	-1.145***	-.982***	-1.035***
Kyrgyz Republic	-.164	-.146***	-.119***	-.086***	-0.699	-.681***	-.632***	-.559***	-.535	-.517***	-.351***	-.58***
Latvia	-.548	-.716***	-.689***	-.491***	-.627	-.795***	-.746***	-.512***	-.155	-.323***	-.157***	-.198***
Lesotho	-.133	.157***	.169***	.208***	-.175	.115***	.136***	.122***	-.118	.173***	.23***	.148***
Lithuania	-.467	-.493***	-.466***	-.165***	-.755	-.781***	-.732***	-.307***	-.283	-.309***	-.143***	.019**
Macedonia	-.353	-.409***	-.381***	-.266***	-.437	-.493***	-.448***	-.331***				
Malawi	-.44	-.121***	-.11***	-.056***	-.324	-.005	.009	.001	-.478	-.16***	-.138***	-.134***
Malaysia	-.097	-.094***	-.105***	-.051***	-.081	-.078***	-.06**	.071***	.136	.14***	.179***	.269***
Malta	.043	.034	.045*	.04***	.063	.054**	.07***	.023***	.406	.397***	.442***	.18***
Mauritius	-.263	-.258***	-.248***	-.244***	-.218	-.212***	-.2***	-.27***	.024	.029	.097**	-.292***
Moldova	-0.576	-.613***	-.586***	-.518***	-1.178	-1.216***	-1.166***	-1.111***	-1.022	-1.06***	-.894***	-.907***
Montenegro	.276	.226***	.239***	.228***	.378	.329***	.349***	.301***				
Morocco	-.12	-.122***	-.127***	-.059***	-.205	-.207***	-.193***	-.121***	-.208	-.21***	-.151***	-.211***
Mozambique	-.236	-.317***	-.313***	-.335***	-.337	-.418***	-.385***	-.408***	-.492	-.573***	-.432***	-.428***
Namibia	-.247	-.176***	-.153***	-.216***	-.141	-.07*	-.02	-.153***	-.121	-.05	.13**	.075***
Nigeria	-.043	-.039***	-.025	-.008***	-.052	-.048***	-.019	.033***	.006	.01	.043	.014***
Palau	-.084	-.019	.01	.164***	-.182	-.117**	-.069	.162***				
Papua New Guinea	-.171	-.183***	-.179***	-.174***	-.354	-.366***	-.335***	-.254***	-.451	-.464***	-.324***	-.077***

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Country	**t = T_0 + 1**				**t = T_0 + 5**				**t = T_0 + 20**			
	$\hat{\beta}_{jt}$	$\hat{\beta}_{jt}^{tDD}$	$\hat{\beta}_{jt}^{DDD}$	$\hat{\beta}_{jt}^{pure}$	$\hat{\beta}_{jt}$	$\hat{\beta}_{jt}^{tDD}$	$\hat{\beta}_{jt}^{DDD}$	$\hat{\beta}_{jt}^{pure}$	$\hat{\beta}_{jt}$	$\hat{\beta}_{jt}^{tDD}$	$\hat{\beta}_{jt}^{DDD}$	$\hat{\beta}_{jt}^{pure}$
Qatar	.257	.029	.047	-.021***	.645	.417***	.431***	.386***	-.168	-.396***	-.28***	-.255***
Russian Federation	-.31	-.334***	-.306***	-.157***	-.709	-.732***	-.677***	-.512***	-.283	-.307***	-.126**	-.285***
Rwanda	-.107	-.108***	-.093***	-.137***	-.203	-.204***	-.174***	-.29***	.152	.151***	.212***	-.099***
Saint Kitts & Nevis	.335	.283***	.303***	.292***	.659	.607***	.673***	.629***	.787	.735***	.924***	.729***
Saint Lucia	-.097	-.133***	-.103***	-.018**	-.057	-.094***	-.034	.062***	.182	.146***	.33***	.058***
Saint Vincent & the Grenadines	.032	.054*	.084***	-.152***	.148	.17***	.23***	-.183***	.484	.506***	.689***	-.011*
Sao Tome & Principe	-.027	-.047*	-.045	-.122***	.271	.251***	.277***	-.008	-.11	-.13***	-.01	-.205***
Serbia	.009	.065***	.079***	.031***	.047	.103***	.118***	.028***				
Seychelles	.095	.108***	.132***	-.043***	.032	.045**	.089***	-.095***	.302	.315***	.479***	.02**
Singapore	.036	.058***	.075***	-.046***	.287	.31***	.327***	.235***	0.812	.834***	.899***	.595***
Slovak Republic	-.467	-.388***	-.361***	-.004	-.366	-.287***	-.241***	.149***				
Slovenia	-.317	-.31***	-.275***	-.12***	-.249	-.242***	-.177***	-.031*	-.148	-.141***	.004	.032***
Solomon Islands	-.004	.023	.058**	-.058***	.08	.106***	.152***	-.043***	.148	.174***	.336***	-.189***
Suriname	-.118	-.151***	-.147***	-.215***	-.28	-.313***	-.281***	-.386***	-.716	-.749***	-.608***	-.873***
Swaziland	.129	.126*	.129**	-.038***	.386	.383***	.388***	.282***	.457	.454***	.524***	.383***
Syrian Arab Republic	.076	.077*	.083**	.046***	-.208	-.207***	-.188***	-.24***	.257	.258***	.295***	.174***
Tajikistan	-.791	-.624***	-.598***	-.38***	-1.658	-1.491***	-1.442***	-1.224***	-1.196	-1.028***	-.856***	-.925***
Tanzania	-.244	-.233***	-.228***	-.036***	-.283	-.273***	-.253***	-.084***	-.326	-.315***	-.278***	-.214***
Timor-Leste	-.429	-.116	-.092	.179***	-.587	-.274*	-.244***	-.146***				
Trinidad & Tobago	-.053	-.054**	-.042*	.008**	-.111	-.112***	-.085***	-.04***	-.244	-.245***	-.203***	.042***
Turkmenistan	-.157	-.146***	-.119***	-.044***	-.543	-.531***	-.482***	-.294***	-.045	-.033	.133**	.062**
Uganda	-.026	-.026***	-.014	.004**	-.033	-.033***	-.005	-.015***	-.72	-.719***	-.678***	-.626***
Ukraine	-.276	-.287***	-.259***	-.068***	-1.02	-1.031***	-.975***	-.789***	-.777	-.788***	-.607***	-.565***
United Arab Emirates	-.147	-.211***	-.193***	-.173***	-.047	-.111***	-.097***	.079***	-.735	-.799***	-.683***	.085***
Uzbekistan	-.217	-.164***	-.137***	-.146***	-.459	-.407***	-.358***	-.456***	-.012	.04**	.207***	-.161***
Vanuatu	-.132	-.171**	-.16***	-.013*	.016	-.023	.008	.135***	-.725	-.764***	-.631***	-.033***

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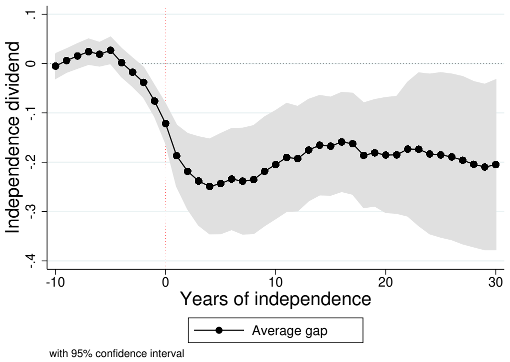
	$\mathbf{t = T_0 + 1}$				$\mathbf{t = T_0 + 5}$				$\mathbf{t = T_0 + 20}$			
Country	$\hat{\beta}_{jt}$	$\hat{\beta}_{jt}^{tDD}$	$\hat{\beta}_{jt}^{DDD}$	$\hat{\beta}_{jt}^{pure}$	$\hat{\beta}_{jt}$	$\hat{\beta}_{jt}^{tDD}$	$\hat{\beta}_{jt}^{DDD}$	$\hat{\beta}_{jt}^{pure}$	$\hat{\beta}_{jt}$	$\hat{\beta}_{jt}^{tDD}$	$\hat{\beta}_{jt}^{DDD}$	$\hat{\beta}_{jt}^{pure}$
Zambia	.133	.13***	.143***	.174***	-.039	-.042**	-.025	.029***	-.737	-.739***	-.682***	-.613***
Zimbabwe	-.124	-.139***	-.127***	-.03***	.079	.064***	.083***	.156***	-.463	-.479***	-.411***	-.149***

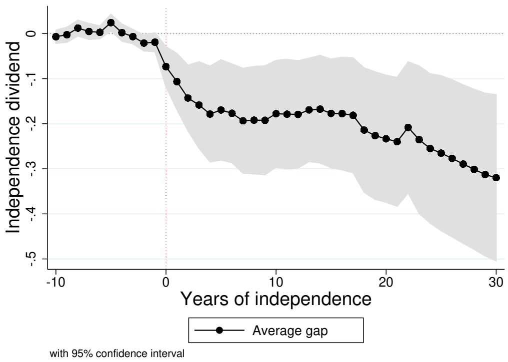
Note: This table reports country-specific, semi-parametric estimates of the independence dividend. Results are reported for all available NICs and pertain to the 1^{st}, 5^{th} and 20^{th} year after independence respectively. Columns headed by $\hat{\beta}_{jt}$ report the estimated percentage difference between per capita GDP for the NIC listed in the first column and its synthetic control version, corresponding to equation 10 ; columns headed by $\hat{\beta}_{jt}^{tDD}$ report the trend-demeaned independence dividend estimate, net of its 10-yearly pre-independence average, as outlined in equation 11 ; columns headed by $\hat{\beta}_{jt}^{DDD}$ report the trend- and placebo-demeaned independence dividend estimate, as defined in equation 12 ; columns headed by $\hat{\beta}_{jt}^{pure}$ report the quadruple independence dividend estimate, as defined in equation 14. Standard errors are robust against heteroskedasticity and serial correlation at the country level. Bootstrapped standard errors of the pure independence dividend based on 250 replications. The number of years after secession is indicated on the horizontal axis.

*** p<0.01, ** p<0.05, * p<0.1.

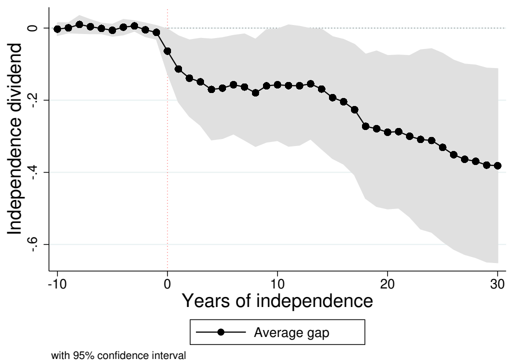
Figure A2: **Average impact of secession in selected countries**



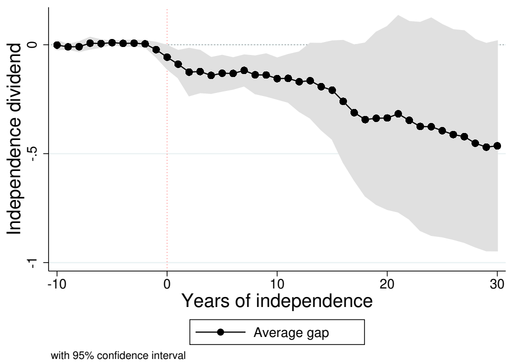
(a) All cases



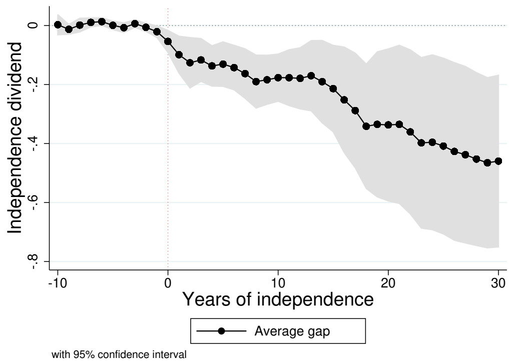
(b) 50% best matched cases



(c) 25% best matched cases



(d) 10% best matched cases

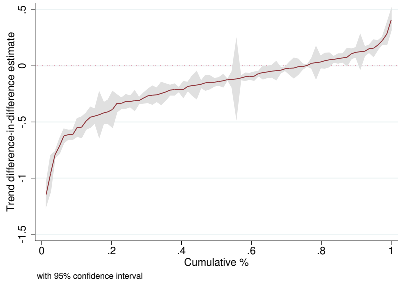


(e) All cases within caliper

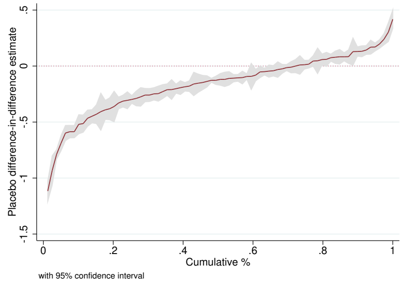
Note: This figure plots the yearly average percentage gap between NICs and their synthetic counterparts, along with the 95% confidence interval. The number of years before (-) or after (+) independence are indicated on the horizontal axis. The top-left panel contains all available cases, subsequent panels include only results of the 50, 25 and 10% best matched cases in terms of their pre-independence RMSPE. The bottom figure includes only those cases for which the pre-independence RMSPE falls within the data-driven caliper cut-off amounting to 0.5 times the samplewide standard deviation in pre-independence RMSPE.

Figure A3: **Cumulative estimates of independence dividends at selected time-points**

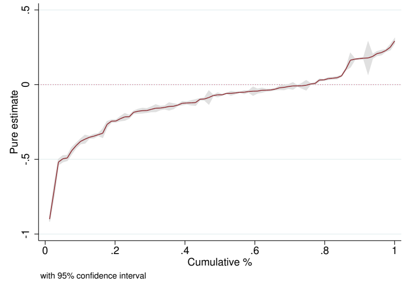
1^{st} year after independence



(a) Trend-demeaned

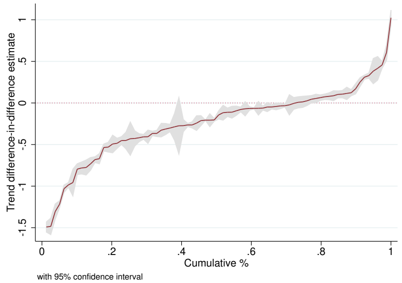


(b) Triple-difference

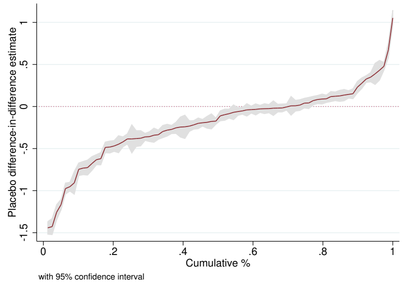


(c) Pure

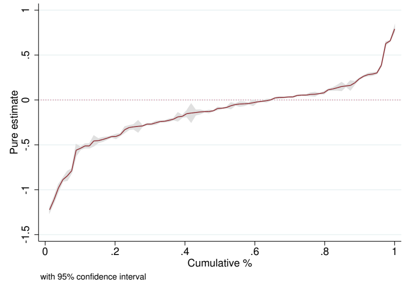
5^{th} year after independence



(a) Trend-demeaned

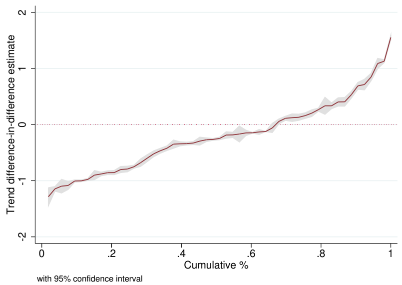


(b) Triple-difference

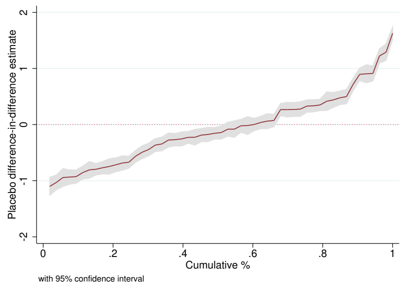


(c) Pure

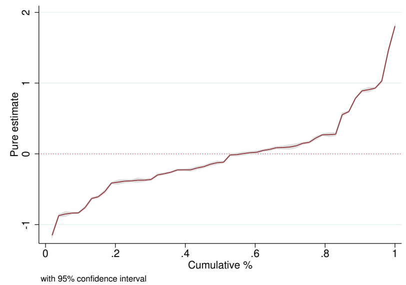
30^{th} year after independence



(a) Trend-demeaned



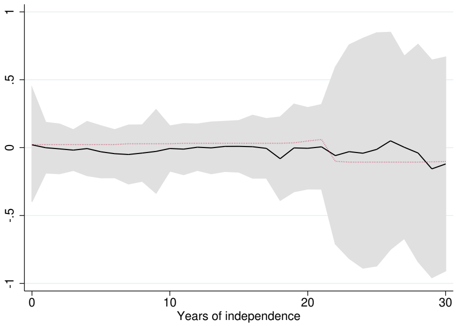
(b) Triple-difference



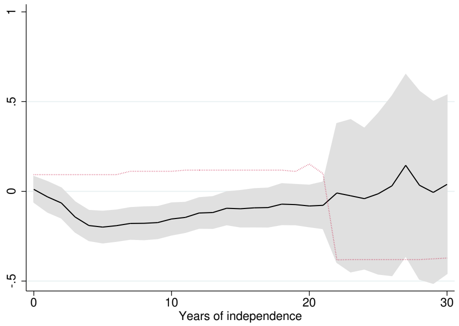
(c) Pure

Note: This figure plots the cumulative distribution of the country-specific trend-demeaned, triple-difference and pure independence dividend estimates reported in table A3, along with 95% confidence intervals. The horizontal axis indicates the proportion of NICs with an independence dividend estimate below the cut-off value indicated on the vertical axis. Estimated independence dividends pertain to the 1^{st}, 5^{th} and 30^{th} post-independence year respectively.

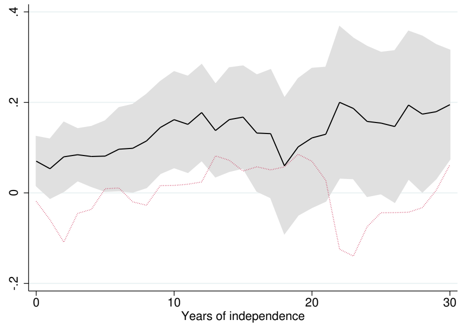
Figure A4: **Determinants of the raw independence dividend**



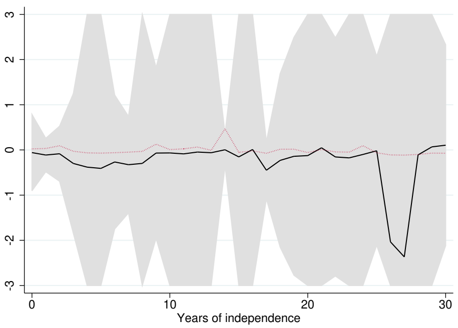
(a) Surface area



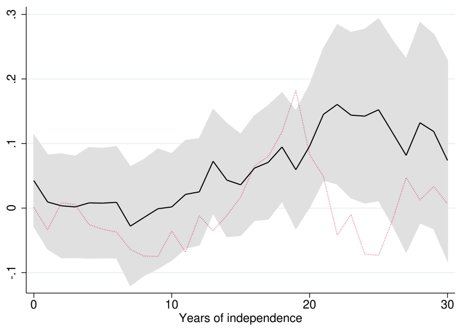
(b) Surface area loss



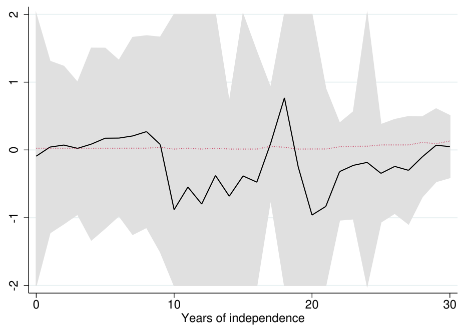
(c) Trade openness



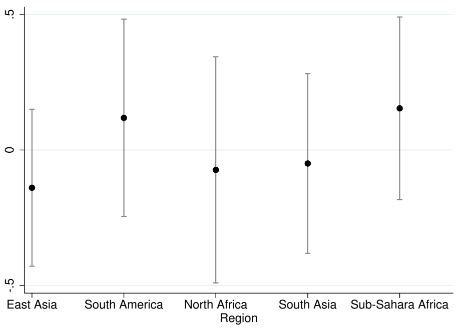
(d) Battle deaths



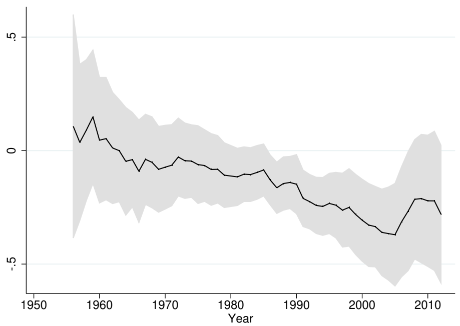
(e) Democracy



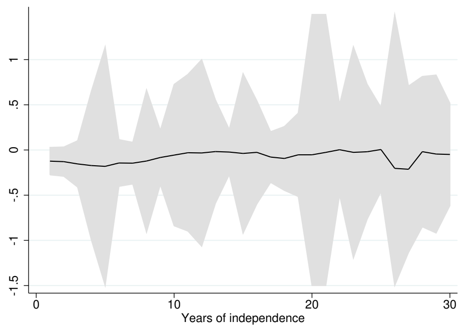
(f) Macroeconomic uncertainty



(g) Region fixed effects



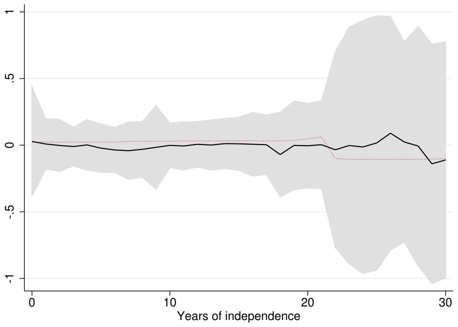
(h) Year fixed effects



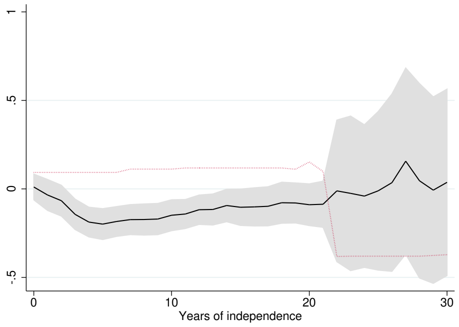
(i) Years-of-independence fixed effects

Note: The top and the middle row plot yearly estimates of the relative importance, as defined in equation 16, of several determinants of the raw independence dividend (black line) against their sample-average values (red lines). 90% bootstrapped confidence intervals, clustered at the country level and based on 250 replications, are plotted in gray. For reference, the bottom row plots the region, year and years-of-independence fixed effects: region fixed effects are relative to Europe & Central Asia; year fixed effects are relative to 1980; years-of-independence fixed effects are relative to the year of independence.The number of years after secession is indicated on the horizontal axis.

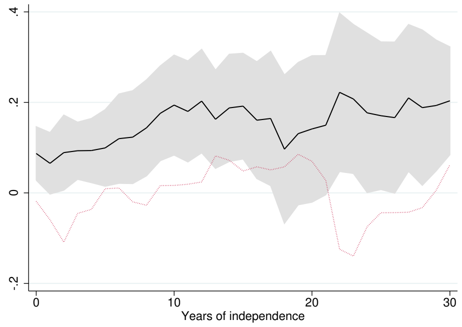
Figure A5: **Determinants of the trend-demeaned independence dividend**



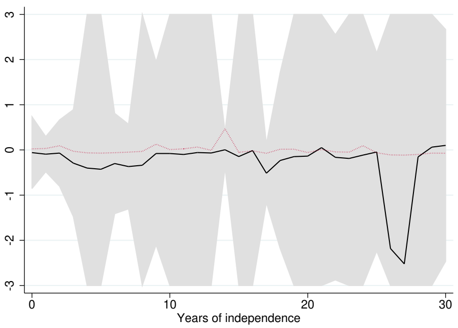
(a) Surface area



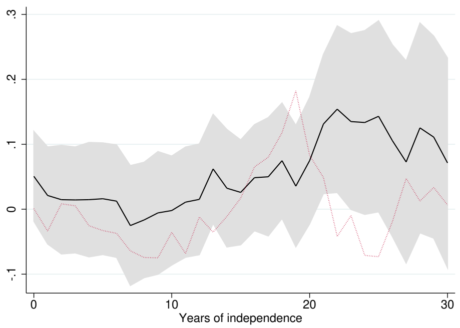
(b) Surface area loss



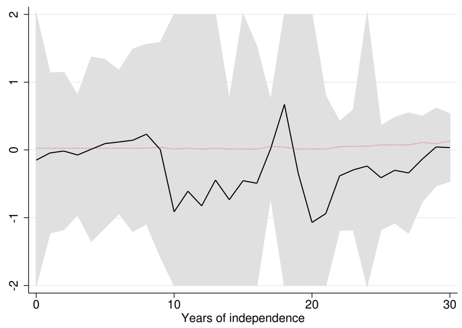
(c) Trade openness



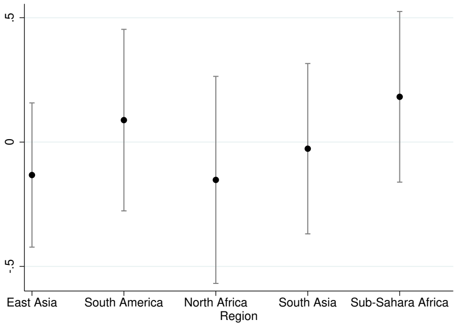
(d) Battle deaths



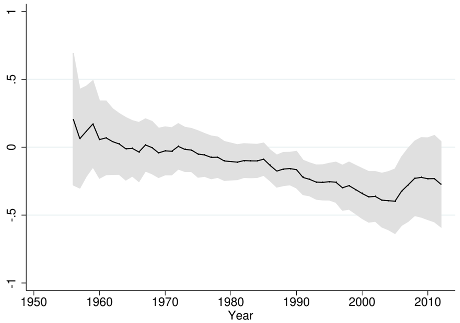
(e) Democracy



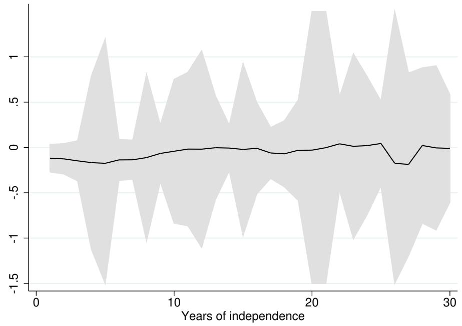
(f) Macroeconomic uncertainty



(g) Region fixed effects



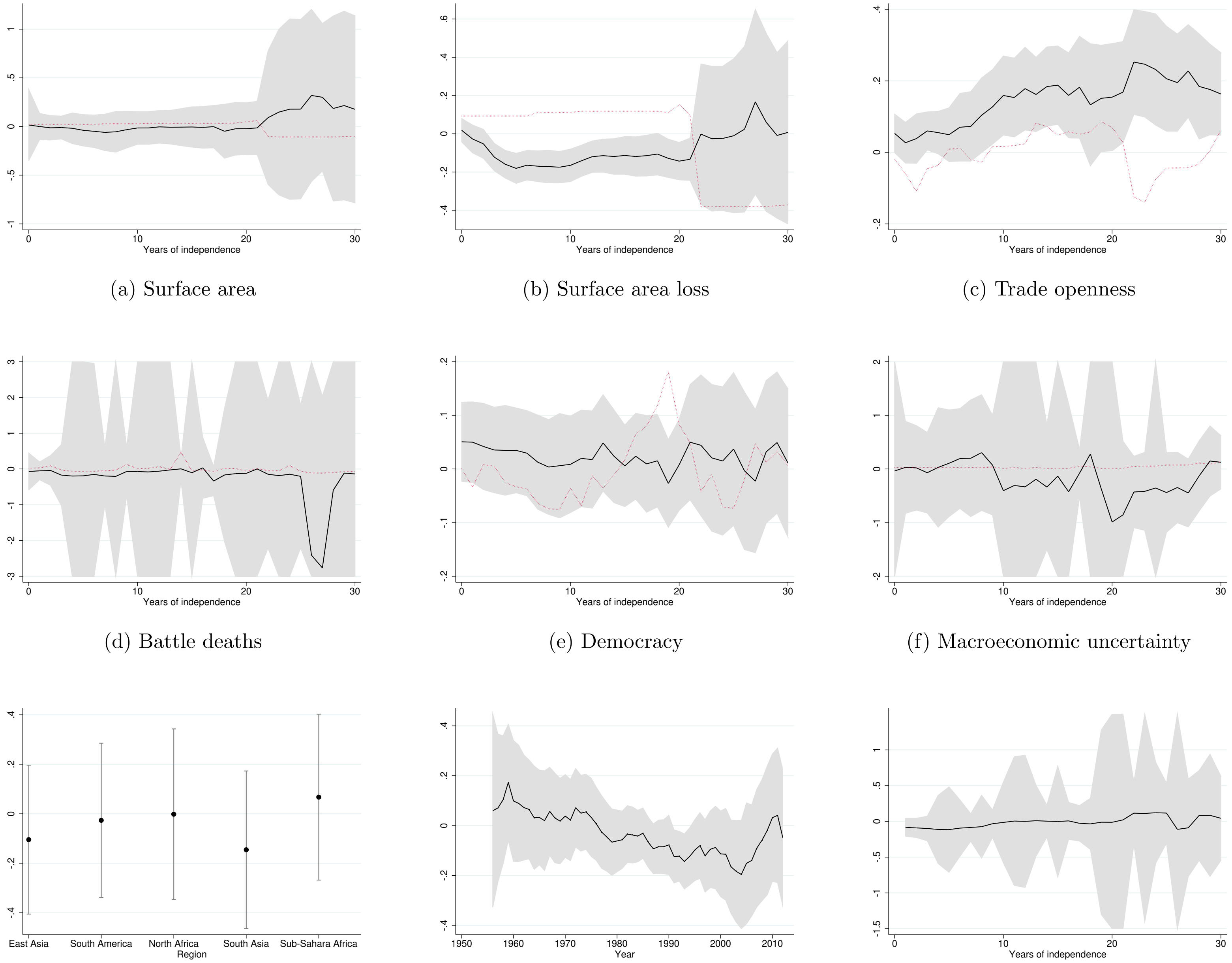
(h) Year fixed effects



(i) Years-of-independence fixed effects

Note: The top and the middle row plot yearly estimates of the relative importance, as defined in equation 16, of several determinants of the trend-demeaned independence dividend (black line) against their sample-average values (red lines). 90% bootstrapped confidence intervals, clustered at the country level and based on 250 replications, are plotted in gray. For reference, the bottom row plots the region, year and years-of-independence fixed effects: region fixed effects are relative to Europe & Central Asia; year fixed effects are relative to 1980; years-of-independence fixed effects are relative to the year of independence.The number of years after secession is indicated on the horizontal axis.

Figure A6: **Determinants of the pure independence dividend**



(a) Surface area

(b) Surface area loss

(c) Trade openness

(d) Battle deaths

(e) Democracy

(f) Macroeconomic uncertainty

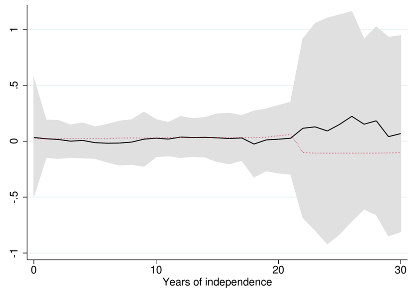
(g) Region fixed effects

(h) Year fixed effects

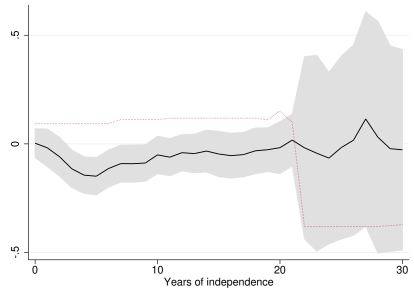
(i) Years-of-independence fixed effects

Note: The top and the middle row plot yearly estimates of the relative importance, as defined in equation 16, of several determinants of the pure independence dividend (black line) against their sample-average values (red lines). 90% bootstrapped confidence intervals, clustered at the country level and based on 250 replications, are plotted in gray. For reference, the bottom row plots the region, year and years-of-independence fixed effects: region fixed effects are relative to Europe & Central Asia; year fixed effects are relative to 1980; years-of-independence fixed effects are relative to the year of independence.The number of years after secession is indicated on the horizontal axis.

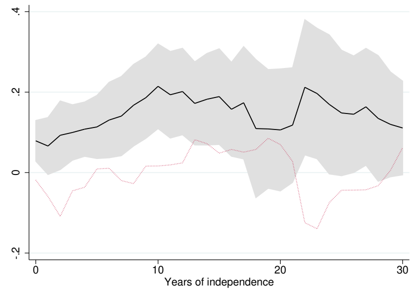
Figure A7: **Determinants of the triple-difference independence dividend: robustness *(1)***



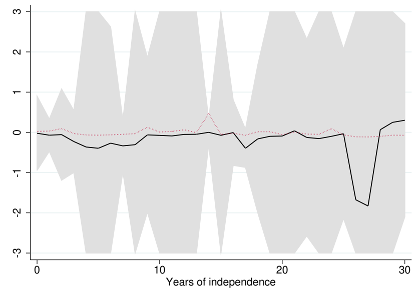
(a) Surface area



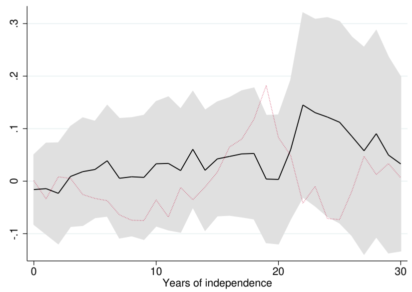
(b) Surface area loss



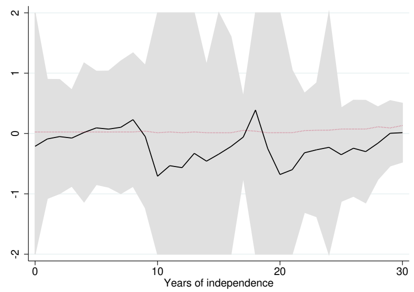
(c) Trade openness



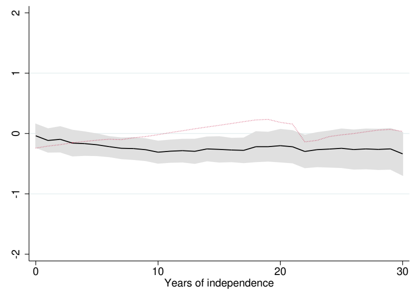
(d) Battle deaths



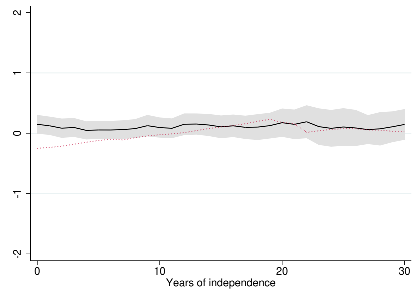
(e) Democracy



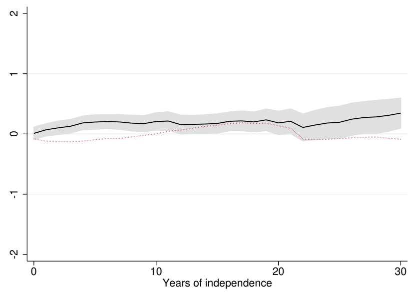
(f) Macroeconomic uncertainty



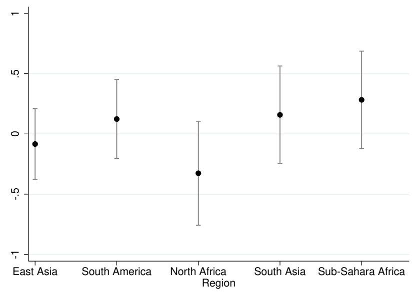
(g) Educational Attainment



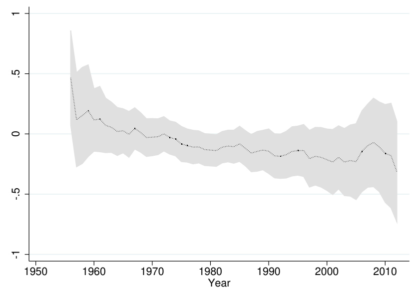
(h) Life expectancy



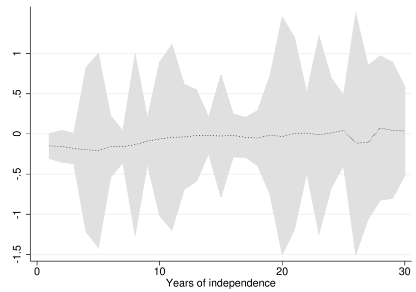
(i) log Per capita GDP



(j) Region FE



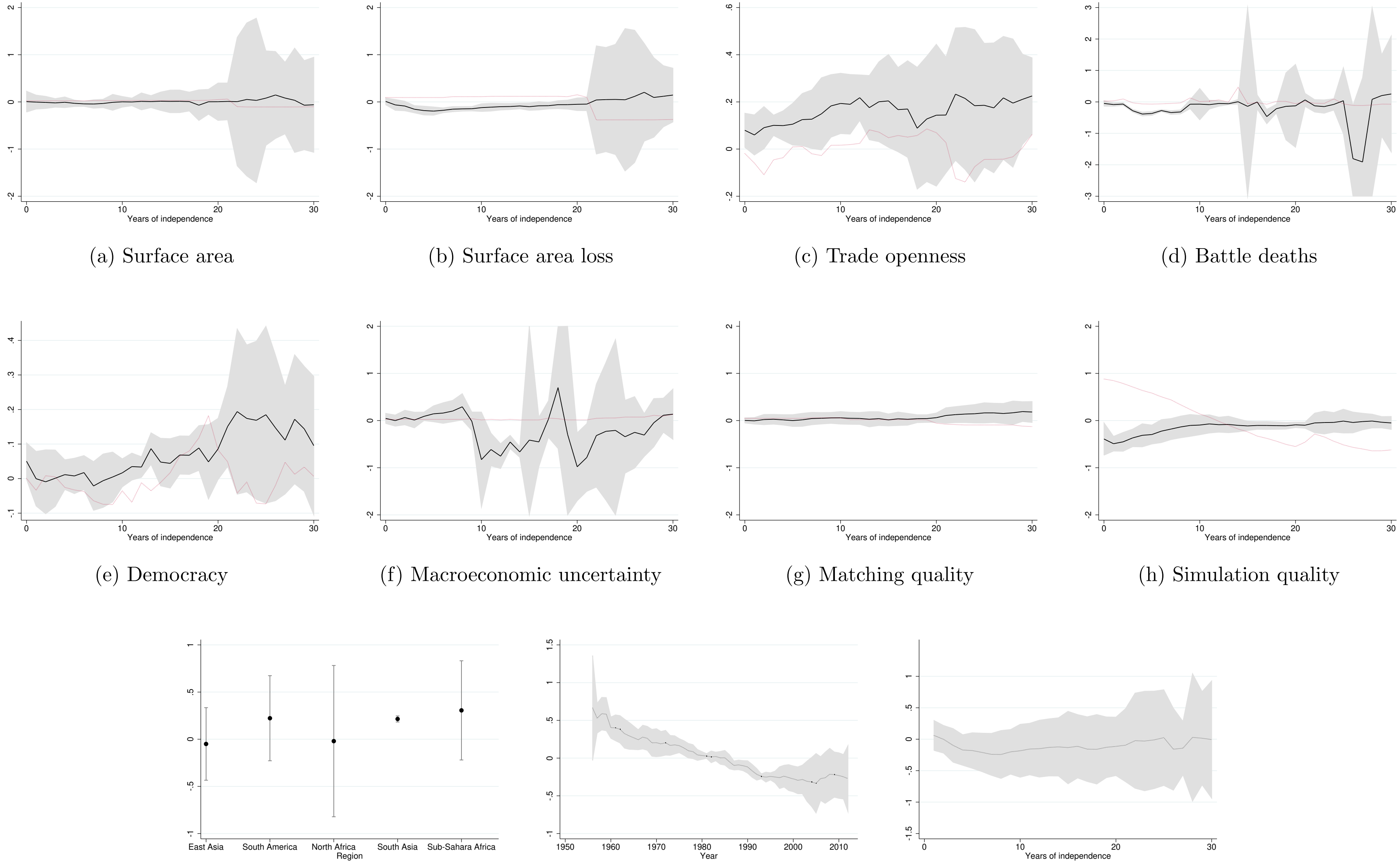
(k) Year FE



(l) Years-of-independence FE

Note: The top and the middle row plot yearly estimates of the relative importance, as defined in equation 16, of several determinants of the triple-difference independence dividend (black line) against their sample-average values (red lines). 90% bootstrapped confidence intervals, clustered at the country level and based on 250 replications, are plotted in gray. For reference, the bottom row plots the region, year and years-of-independence fixed effects: region fixed effects are relative to Europe & Central Asia; year fixed effects are relative to 1980; years-of-independence fixed effects are relative to the year of independence.The number of years after secession is indicated on the horizontal axis.

Figure A8: **Determinants of the triple-difference independence dividend: robustness *(2)***



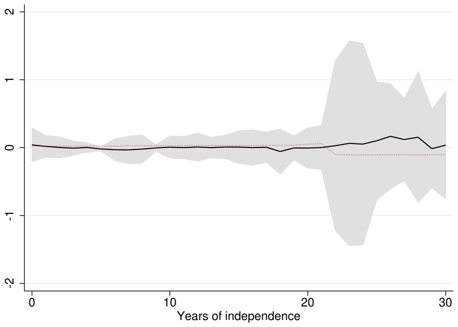
(a) Surface area (b) Surface area loss (c) Trade openness (d) Battle deaths

(e) Democracy (f) Macroeconomic uncertainty (g) Matching quality (h) Simulation quality

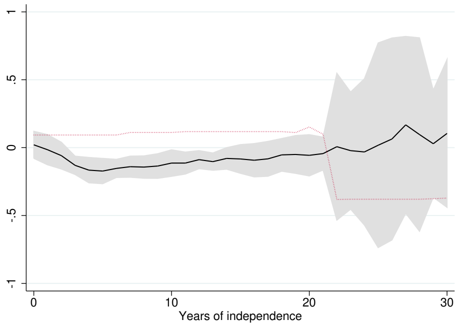
(i) Region FE (j) Year FE (k) Years-of-independence FE

Note: The top and the middle row plot yearly estimates of the relative importance, as defined in equation 16, of several determinants of the triple-difference independence dividend (black line) against their sample-average values (red lines). 90% bootstrapped confidence intervals, clustered at the country level and based on 250 replications, are plotted in gray. For reference, the bottom row plots the region, year and years-of-independence fixed effects: region fixed effects are relative to Europe & Central Asia; year fixed effects are relative to 1980; years-of-independence fixed effects are relative to the year of independence.The number of years after secession is indicated on the horizontal axis.

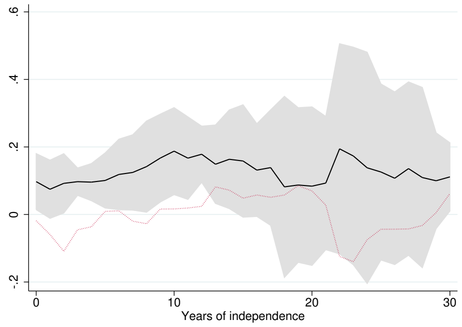
Figure A9: **Determinants of the triple-difference independence dividend: robustness *(3)***



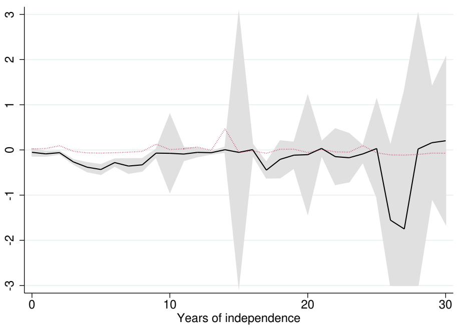
(a) Surface area



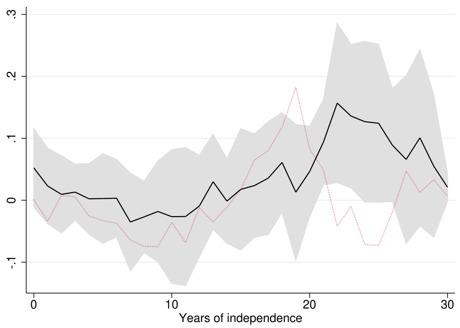
(b) Surface area loss



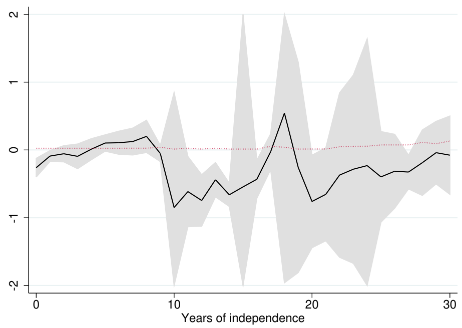
(c) Trade openness



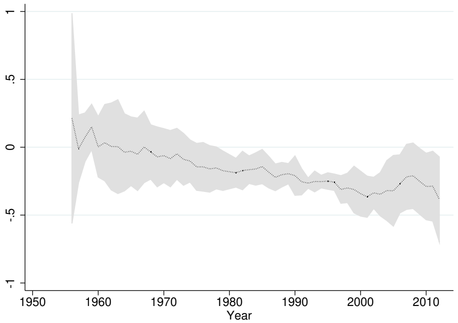
(d) Battle deaths



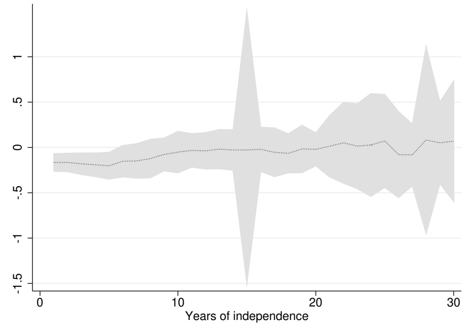
(e) Democracy



(f) Macroeconomic uncertainty



(g) Year fixed effects



(h) Years-of-independence fixed effects

Note: The top and the middle row plot yearly estimates of the relative importance, as defined in equation 16, of several determinants of the triple-difference independence dividend (black line) against their sample-average values (red lines). 90% bootstrapped confidence intervals, clustered at the country level and based on 250 replications, are plotted in gray. For reference, the bottom row plots year and years-of-independence fixed effects: year fixed effects are relative to 1980; years-of-independence fixed effects are relative to the year of independence. Country fixed effects are included but not shown. The number of years after secession is indicated on the horizontal axis.