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# The Economic Legacy of General Velasco: Long-Term Consequences of Interventionism

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## Abstract

We apply synthetic control methods to study the long-term consequences of the interventionist and collectivist reforms implemented by the Peruvian military junta of 1968–1975. We compare long-term outcomes for the Peruvian economy following the radical reforms of the early 1970s with those of two controls made of similar countries, one chosen in the Latin American region and another one chosen from the world at large. We find that the economic legacy of the junta includes sizable losses in GDP along two decades, beyond those that can be attributed to adverse international circumstances. The evidence suggests that those losses can be attributed both to a decline in capital accumulation and to a fall in productivity.

*Keywords:* Output loss, synthetic controls, military nationalism, populism, collectivism, Peruvian Revolution

*JEL codes:* E52, E58, E62

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# 1 Introduction

The Peruvian military junta, presided by General Velasco from 1968 to 1975, represents a very unusual experiment in economic policy. The military engaged in a wide range of reforms restructuring ownership of economic assets in favor of the public sector and generally increasing the role of the state in the economy. Underpinning the policies was the belief—commonly associated with Latin American nationalism and populism—in the ability of a reform-minded state to orient business activity toward national goals and to eliminate foreign dependence via the adoption of command-and-control policies, including state-managed foreign trade. What is peculiar of the episode is that the military were able to implement the reforms untrammelled by institutional, political or legal constraints.<sup>1</sup> Moreover, the reforms were expected to be long-lasting, and to some extent they succeeded in being so, at least until pro-market reforms in the 1990s. Thus, the episode is a test-case for the economic policy recommendations of Latin American state-centered nationalist and populist creeds.

In this paper, we evaluate the long-term consequences of Velasco’s reforms on GDP per capita, capital stock per capita, and total factor productivity. In particular, we compare the performance of the Peruvian economy with that of two synthetic controls made of similar countries—one chosen in Latin America and the other in the world at large. The idea of the controls is to isolate the effects of the policies from those of the changing international circumstances. From 1975, Peru, like other Latin American and developing economies, suffered almost two decades of declining terms of trade. In the 1980s, the region was shocked again by the drying out of international lending. Indeed, both synthetic controls exhibit stagnating GDP and capital stock per capita, and either stagnating or declining TFP, since the 1980s. The Peruvian economy does considerably worse than both controls in all cases. That is, the performance of the country under adverse circumstances was greatly hindered by the extent of state intervention in the economy that resulted from Velasco’s reforms.

The synthetic control method was introduced in [Abadie and Gardeazabal \(2003\)](#) in the

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<sup>1</sup>In fact, Velasco’s regime was dubbed by social scientists as the “Peruvian experiment” ([Lowenthal 1975](#); [McClintock and Lowenthal 1983](#); [Aguirre and Drinot 2017](#)) by the combination of very radical reforms implemented in fast succession by a government with an extraordinary degree of autonomy from society.

context of a study on the economic cost of conflict, and it was extended in [Abadie et al. \(2010\)](#) and [Becker and Klößner \(2018a\)](#). It has been used to study, among others, the effects of economic liberalization ([Billmeier and Nannicini 2013](#)), the economic effects of natural disasters ([Cavallo et al. 2013](#)) and, closer to this paper, the economic consequences of Hugo Chavez regime ([Grier and Maynard 2016](#)). The contrast with the case of Chavez is interesting. [Grier and Maynard \(2016\)](#) finds that the nationalist military regime of Chavez did worse than the controls while enjoying an export price boom, while we find that the economy under Velasco and his successors performed worse than the controls under unfavorable export prices.<sup>2</sup> In both cases, the economic consequences have been bleak.

Velasco took power in 1968, after deposing an elected president who did not deliver on his campaign promises about land reform and a nationalist stance regarding a particularly irksome foreign oil enclave.<sup>3</sup> Velasco’s regime ended in turn in 1975 with a palace coup, motivated in part by the deteriorating health of the dictator and in part by a looming balance-of-payments crisis.<sup>4</sup> The successor military junta nominally shared the revolutionary project, but got bogged down by the crisis. Political power was transferred back to elected civilians in 1980—actually to the same president deposed by the military in 1968. Yet, there were important elements of continuity in economic regime under the successor elected administrations. Economic decision making remained in the hands of an expansive bureaucracy in public enterprises and government agencies.<sup>5</sup> A half-hearted attempt at trade liberalization was abandoned in the early 1980s.<sup>6</sup> A change in economic regime only came after the market-oriented reforms of the 1990s.

We use 1968–1975, 1968–1985, and 1968–1990 as alternative periods of analysis. The first one corresponds to the period of reforms under General Velasco. The second considers as well the successor military junta and the democratically elected administration that followed (1980–1985). The third one includes the “heterodox” democratically elected Garcia administration

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<sup>2</sup>According to [Gott \(2005, p. 95\)](#), Chavez visited Peru in 1974 as a young cadet, and claimed to have been inspired by the Peruvian example.

<sup>3</sup>See the semi-official account of the coup by [Zimmermann \(1975\)](#).

<sup>4</sup>[Zapata \(2018\)](#).

<sup>5</sup>[Lowenthal \(1983\)](#), for instance, refers to the Peruvian state as “one of the strongest in Latin America.” [Fitzgerald \(1983\)](#) calculates that the share of the corporate sector owned by the government or cooperatives was around 43% by 1975, with 40% in the hands of domestic private business and the rest in the hands of foreign firms.

<sup>6</sup>See [Nogues \(1986\)](#).

(1985–1990); this last choice is admittedly controversial since Garcia administration embarked in extreme fiscal and monetary mismanagement.<sup>7</sup> We find that GDP losses associated with the change in economic regime were around 10% by 1975, 30% by 1980 and 1985 up to 50% of GDP by 1990 using either the Latin American or the world synthetic control. The gap with respect to the synthetic controls can be attributed both to lower productivity and slower capital accumulation. In terms of productivity, the loss in TFP was between 10% by the years 1980 and 1985 and reached 30% by 1990. In term of capital accumulation, the loss in capital stock per capita reaches 30% in 1980 to 1990. These performance results are stronger in the robustness case where we use a larger set of control countries.

We focus the analysis on the long term implications of Velasco’s regime on economic growth, investment, and productivity. Of course, these are not the only metrics of interest. Some of the reforms implemented by the regime, and in particular land reform, were in the wish list of the major political parties before the 1968 coup and were likely very popular. The political regime before the 1968 coup was far from a full-fledged democracy. The electoral franchise was restricted to those deemed literate, but political representation was based on total population, which gave a strong hand to landed interests in the legislative. The concentration of land property was the historical result of the despoliation of the peasantry. When a new constitution was drafted by an elected assembly in 1978–1979 the old franchise restrictions were left firmly in the past. Indeed, one of the motivations of the junta was breaking the political and economic power of the traditional oligarchic families which were popularly perceived as a barrier to the modernization of the country. This was arguably accomplished.

One can trace a parallel between the politics of the state-centered reforms of 1968–1975 and the market-oriented reforms of the early 1990s. In both cases, the formal political institutions of the country were unable to process in a legal manner changes in the economic regime which at the time appeared urgent.<sup>8</sup> A politically negotiated reform process, respecting the constitution, would have made for a less clean experiment but would have likely eliminated some of the worse economic follies associated to the expansion of the role of the state in the economy.

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<sup>7</sup>Martinelli and Vega (2018).

<sup>8</sup>The parallel between Velasco and Fujimori’s governments is one of the themes in the essays collected by Cameron and Mauceri (1997).

The remainder of the paper is organized as follows. In section two we discuss the economic reforms of Velasco’s regime, as well as their persistence through the 1970s and 1980s. In section three we summarize the synthetic control approach as applied in this paper. In section four we describe our data, empirical design, and estimated controls. In section five we present our results. In section six we explain the robustness exercise and in section seven we gather concluding remarks.

## 2 The Peruvian Revolution

General Velasco took power in Peru as head of a military junta in October 3 of 1968, after deposing an elected president and disbanding the congress. Peruvian military were disappointed with respect to the government stance regarding a foreign oil firm which notoriously managed an oil-rich area as an enclave.<sup>9</sup> They were disappointed also about the slow pace of the land reform, promised by the civilian administration but perennially blocked or diluted in congress.<sup>10</sup> In October 9, the government expropriated and occupied the disputed oil fields. The military junta soon announced their aim of effecting a “vast process of transformation” with the purpose of ending Peru’s “structural disequilibrium” and “foreign dependence.”<sup>11</sup>

The diagnosis of Peru’s troubles and the reforms embraced by the military junta were inspired by military nationalism, by traditional Latin American structuralism, which prescribed land reform and industry promotion as means to eliminate internal “structural” barriers to growth, and by the “dependency school,” a branch of Marxian thought in vogue in Latin America in the 1960s, which emphasized the deleterious effects of foreign ownership of assets on resource allocation decisions.<sup>12</sup> There was at the time a general interventionist spirit among development economists and practioners; the Little’s report ([Arthur D. Little, Inc. 1960](#)), for instance, recommended an active industrial policy, making use of selective tariffs.

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<sup>9</sup>[Cotler \(2018\)](#) discusses the ideological changes in the military that preceded the coup.

<sup>10</sup>Land reform was a historic demand of the left in Peru. [Mariátegui \(1928\)](#), for instance, considered that land reform should have been part of a liberal, capitalist transformation of Peru, that nonetheless had not happened. In the 1960s, belief in the need of a land reform in precisely that sense was widely shared in development circles (see e.g. [Alianza para el Progreso 1961](#)).

<sup>11</sup>[Velasco Alvarado \(1972\)](#), speech to the 1969 meeting of CEPAL (United Nations Economic Commission for Latin America and the Caribbean).

<sup>12</sup>See e.g. [Thorp and Bertram \(1978, pp. 10–13\)](#).

The economic regime embraced by the military was described by a sympathetic economist as “state capitalism.” In his words,

Historically, the process of transforming an export-led economy based on natural resources to one based on industry serving domestic markets requires an extensive restructuring of capital, involving change not only in the pattern of production (sectoral balance, input use, and so on) but also in the ownership of assets on the one hand and in the relationship between capital and labor on the other.

...

By “state capitalism” in this context we mean that the state takes responsibility for organizing production and accumulation in the modern sector of the economy and that public ownership replaces private ownership in key branches. (Fitzgerald 1983, p. 67)

Unlike other nationalist-military episodes in Latin America, such as Peron in Argentina or Chavez in Venezuela, Velasco’s regime never enjoyed organized popular support. The junta shunned “the false participation” of traditional political parties, and professed a belief in the “unity between people and armed forces.”<sup>13</sup> Reforms were introduced by decree, without any effective opposition. The military tolerated very little dissent, going to the length of confiscating most of the press. The relative autonomy of the regime relative to the society is one of the salient characteristics of the “Peruvian experiment” with revolution-from-above.

We summarize the reforms and their persistence after Velasco’s regime in table 1. A sweeping agrarian reform was announced in June 1969. The reform aimed to transfer most of arable land mainly to cooperatives and other collective entities under state tutelage. Land transfers continued during the so-called “second phase of the Peruvian Revolution,” the successor military junta in 1976–1980. By 1980, 42% of arable land had been reallocated to collective entities and to peasants.<sup>14</sup> A database built in Espinoza et al. (2019) show that the great bulk of expropriations occurred in the period 1969–1980 and up 68% of land transferred was private and in use. In parallel, state-owned enterprises with legal monopoly rights over trading in rice and other food

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<sup>13</sup>Velasco Alvarado (1972), speech for the second anniversary of the revolution.

<sup>14</sup>Hunefeldt (1997).

staples and on agricultural inputs were created. Land re-privatization via breaking down the associative enterprises started with the return of a civilian administration in 1980. State-owned enterprises in food commerce were privatized in the early 1990s, after the abolition of state monopolies.

The Planning Office (INP) became an important government agency from 1969 on, acquiring budget authority, drafting directives for the spreading public enterprises, and producing a five-year national development plan with detailed production goals.<sup>15</sup> It lost influence after 1975, when the management of recurrent balance-of-payment crisis took center stage in the economic policy of the “second phase.” The Planning Office was very active again during the “heterodox” civilian administration of 1985–1990. Pointedly, an economist from the Planning Office was recruited as general manager of the central bank in 1987; the central bank was seen as a harbinger of market-friendly ideas. The Planning Office helped organize the expansion of credit that preceded hyperinflation.<sup>16</sup> It was disbanded in 1992.

In terms of foreign trade, like in other Latin American countries, average tariffs were already high before the military took over. In addition, the military introduced in 1969 a list of forbidden imports, the National Registry of Manufacturing. Any industrial producer could call for the prohibition of imports of competitor goods from abroad. A complex web of import duties and export subsidies resulted from discretionary interventions. In addition, state-owned enterprises were granted monopoly status over imports of food staples.<sup>17</sup> There was a failed attempt to liberalize trade during the civilian administration of 1980–1985,<sup>18</sup> with trade liberalization happening in earnest in the 1990s.

The industrial reform decreed in 1969 altered labor-management relations in the industry, introducing worker participation in the administration and profits of industrial firms through the “industrial communities.” In addition, a social property industrial sector, consisting of collectively owned enterprises, was supposed to be created and promoted. Industrial communities,

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<sup>15</sup>Cleaves and Pease-García (1983).

<sup>16</sup>See Martinelli and Vega (2018) on the Peruvian hyperinflation.

<sup>17</sup>Torres (1982).

<sup>18</sup>In Nogues’s (1986) account, trade liberalization in the 1980s was attempted in an economy ridden with distortions and by a government with very little commitment toward it.



**Table 1.** *Revolutionary military junta's main economic reforms: 1968–1975*

<b>Year started</b>	<b>Reform</b>	<b>Policies</b>	<b>Persistence</b>
1969	Agrarian reform	42% of arable land reallocated to peasant cooperatives, state monopoly in several food staples	land privatization since 1980s, state-owned enterprises privatized in the 1990s
1969	Economic planning	Planning Office (INP) acquired budget authority and set sectoral priorities	INP influential in 1985–1990, disbanded in 1992
1969	Trade	import prohibition of goods similar to domestic production, export subsidies	failed reversal in early 1980s, liberalization in the 1990s
1970	Industrial reform	participation of labor in firm management, creation of social property sector	scaling down of labor participation in 1977, social property never took off
1970s	Banking	nationalization of foreign and some domestic banks	privatizations through the 1990s
1969	Oil, mining, steel	nationalization of foreign interests, creation of state-owned enterprises: PetroPerú, MineroPerú, Centromín, HierroPerú, SiderPerú	partial privatizations through the 1990s
1969, 1972	Telecom, electricity, water	nationalization of various companies, creation of EntelPerú, ElectroPerú, Sedapal	privatizations of telecom and electricity and decentralization of water utilities through the 1990s
1974	Fisheries	nationalization of the sector and creation of PescaPerú	privatizations through the 1990s
1970, 1974	Media	nationalization of newspapers and TV channels	devolution to previous owners in 1980

Sources: See text; elaboration by the authors.

which had a chilling effect on the private sector, were deactivated in the late 1970s,<sup>19</sup> and the social property sector, one of the most utopian elements of the military reforms, never really took off.<sup>20</sup>

Starting in 1969, the military implemented a wave of nationalizations, including a takeover of most of the banking sector, the nationalization of major foreign oil and mining interests, and the nationalization of telecommunications, electricity and water services—all of them considered strategic sectors by the military. Large state-owned enterprises were introduced in each sector. A bad “El Niño” year and overfishing led to a crisis in the fishing industry in 1973; the response by the military junta was to nationalize the entire sector and create a state-owned enterprise with legal monopoly status. The nationalization of some TV channels and newspapers in 1970 and the nationalization of all remaining mass media in 1974 was likely primarily motivated by the desire to stifle dissent, and it was reversed as soon as power was returned to civilians.

State-owned enterprises created by the military junta in the “strategic” sectors, just like extensive state intervention in foreign trade, were going to be a lasting legacy. Figures 1 and 2 illustrate the expansion of state-owned enterprises in the aftermath of Velasco’s reforms.<sup>21</sup> Privatizations of most of these state owned-enterprises happened during the 1990s.<sup>22</sup>

### 3 The synthetic control approach

In assessing the long-term effects of the military junta’s reforms, the main problem is to define a counterfactual. The synthetic control method, introduced in Abadie and Gardeazabal (2003) and extended in Abadie et al. (2010) and Becker and Klößner (2018a), provides a way around this difficulty. Under this approach, a synthetic control is obtained by means of weighted

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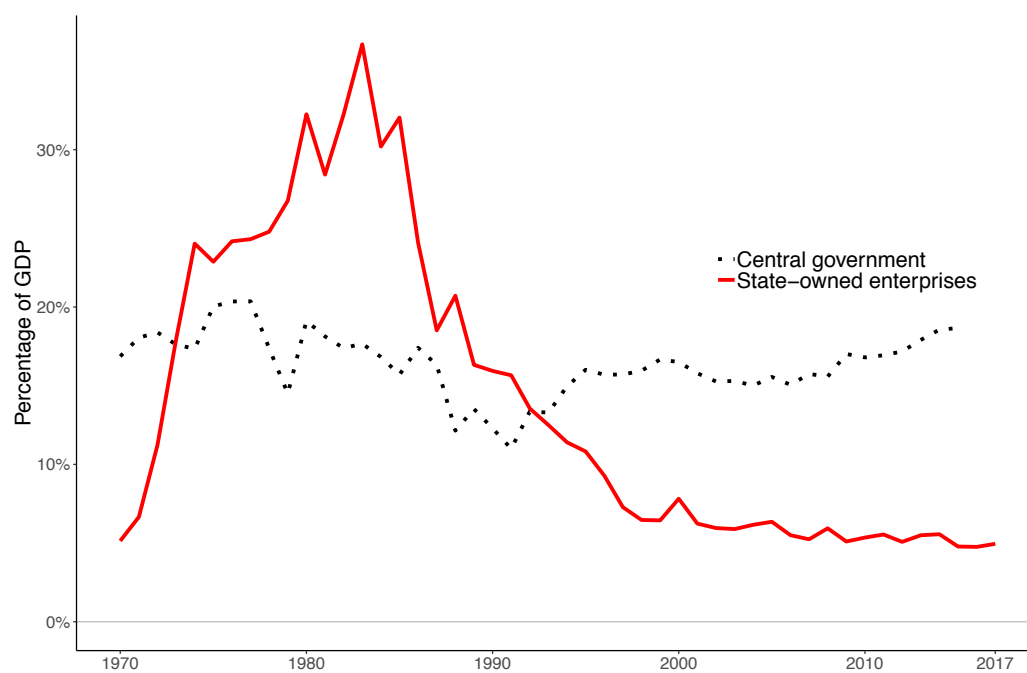
<sup>19</sup>Abusada (1977).

<sup>20</sup>The education reform undertaken by the military in 1972 also had an important utopian element. It intended to create a “new type of man” and “raise political awareness” (Salazar Bondy 1975). On a positive note, it also attempted to revalorize Peruvian indigenous languages and to use them in public education. It was resisted by teachers and parents, and rolled back in 1982.

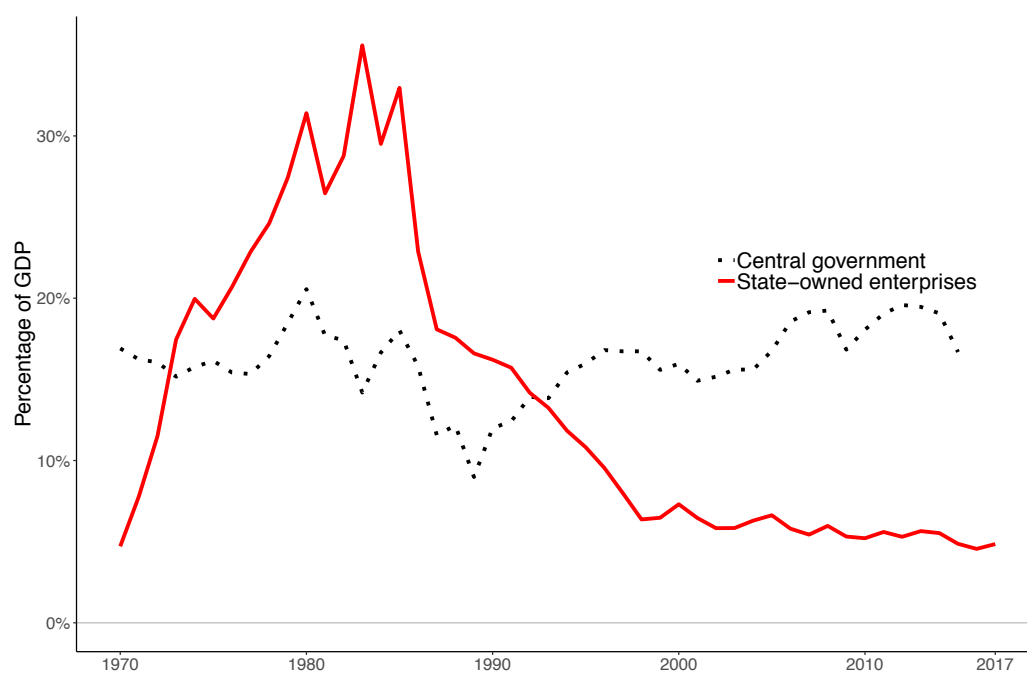
<sup>21</sup>Revenues and costs of state-owned enterprises are expressed as percentage of GDP for comparison purposes, though a more precise measurement of the size of the state in the economy would require to estimate the value added of state-owned enterprises. Of course, such calculation is fraught with difficulties.

<sup>22</sup>As seen in the figures, both revenues and expenditures of state-owned enterprises started shrinking before the privatizations, as a result of the hyperinflation (Martinelli and Vega 2018). The disorderly retreat of the state from the economy is described by Webb (1991).

**Figure 1.** *Expenditure of central government and state-owned enterprises*



**Figure 2.** *Revenue of central government and state-owned enterprises*



Source: Martinelli and Vega (2018).

combination of  $J$  potential control countries. It is essential that the synthetic control approaches the treated unit in terms of the pre-treatment values. Following the notation of [Abadie et al. \(2010\)](#), if  $J + 1$  units (countries) are observed, the first unit is the treated country exposed to the policies, while others remain isolated to the policy and called the donor pool.

Outcomes are observed for  $T$  periods and the policy starts in  $T_0 + 1$ . The observed outcome vector for each country is  $Y_j = (Y_{j,1}, \dots, Y_{j,T_0}, \dots, Y_{j,T})$ . The observed outcome is expressed as the sum of a treatment-free potential outcome  $Y_{j,t}^N$  and the effect of the treatment  $\alpha_{j,t}$ , such that

$$Y_{j,t} = Y_{j,t}^N + \alpha_{j,t}D_{j,t} \quad (1)$$

and

$$Y_{j,t}^N = \delta_t + \lambda_t\mu_j + \theta_t Z_j + \epsilon_{j,t}, \quad (2)$$

where  $\delta_t$  is a time fixed effect,  $Z_j$  is a time-invariant vector of predictors with time-varying coefficient  $\theta_t$ ,  $\mu_j$  is a time-invariant unobserved predictor with time-varying coefficients  $\lambda_t$ ,  $D_{j,t}$  is an indicator variable that takes the value of 1 for the treated unit after  $T_0$  and is zero otherwise, and  $\epsilon_{j,t}$  is an unobserved shock.

From periods 1 to  $T_0$ , the treatment-free potential outcome  $Y_{j,t}^N$  should be similar to the observed outcome for both the treated and the control countries. For periods after  $T_0$ , the treatment-free counterfactual for the treated country ( $Y_{1,t}^N$ ) is unobserved. To estimate the treatment effect for the post-intervention periods, the synthetic control approach approximates the unobserved  $Y_{1,t}^N$  by a synthetic control unit. This control is a weighted combination of potential controls that best approximates the relevant pre-intervention characteristics of the treated country. Let the weighting vector be  $W = (w_2 \dots w_{J+1})'$ , where the elements are the contribution of each control country to the synthetic control unit. The weights obey the constraints  $w_j \geq 0$  and  $w_2 + \dots + w_{J+1} = 1$ . The estimator of the counterfactual comes from a linear combination of the observed outcomes of the potential control regions:  $\hat{Y}_{1,t}^N = \sum_{j=2}^{J+1} w_j Y_{j,t}$ . The estimated treatment effect for the treated country for each time period after  $T_0$  is  $\hat{\alpha}_{1,t} = Y_{1,t} - \hat{Y}_{1,t}^N$ .

According to [Abadie et al. \(2010\)](#), if the weighted value of the observed covariates and

pre-treatment outcomes for the control pool equals those of the treated region,

$$Z_{1,t} = \sum_{j=2}^{J+1} w_j Z_{j,t} \quad \text{and} \quad Y_{1,t}^N = \sum_{j=2}^{J+1} w_j Y_{j,t}^N,$$

for the periods  $t = 1, \dots, T_0$  and the outcome is a linear function of observed and unobserved potential confounders, then  $\hat{\alpha}_{1,t}$  is an approximately unbiased estimator of  $\alpha_{1,t}$ .

The vector  $W^*$  is chosen to minimize the distance in the observed and unobserved confounders between the treated and the synthetic control country, measured before the intervention. The distance is measured according to the metric  $\sqrt{(X_1 - X_0 W)' V (X_1 - X_0 W)}$  where  $X_1$  is a  $k \times 1$  vector including  $k$  covariates and pre-treatment outcomes for the treated region, while  $X_0$  is the corresponding  $k \times J$  matrix of the control countries.  $V$  is a  $k \times k$  positive definite diagonal matrix which assigns weights according to the relative importance of the covariates and the pre-intervention outcomes. The choice of variables in  $X_0$  and  $X_1$  vectors needs to be justified on economic grounds. [Abadie and Gardeazabal \(2003\)](#) and [Abadie et al. \(2010\)](#) propose a procedure to determine the  $V$  matrix among all positive definite and diagonal matrices such that the mean squared prediction error (MSPE) of the outcome variable is minimized over some set of pre-intervention periods.

## 4 Empirical design and estimated controls

We select as outcomes of interest GDP per capita, capital stock per capita and TFP. Predictors are listed in table 2. Data sources and construction of the variables is explained in the appendix. In every case, data is available since 1960.

We work with two different control groups. The first comprises countries in the Latin America and the Caribbean region, henceforth LAC countries. These countries have similar political and cultural characteristics to the treated country.<sup>23</sup> This group of countries make up our benchmark case. To perform a robustness check, we use a second control group that comprises all the countries in the world with data available to perform the exercise. Countries

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<sup>23</sup>A control group with countries in the same region as the treated unit is also used by [Billmeier and Nannicini \(2013\)](#) in a study of economic liberalization episodes.

**Table 2.** *Variables*

Outcomes
Log of GDP per capita
Log of capital stock per capita
Log of TFP
Predictors
Openness
Share of gross capital formation at current PPP
Log of terms of trade
Labor force participation
Human capital index
General government investment
Private investment

in the control group should have GDP, TFP and capital stock data from at least 1953 onwards. Control groups are detailed in the appendix.

In both control groups we leave out Argentina, Chile and Jamaica, which had extreme policy variations during the period, including similar policies to Peru in the case of Chile and Jamaica in the early 1970s. An important issue is the determination of the treatment year. The radical policy shift in Peru arguably started with the 1968 coup but the reforms were introduced in 1969–1974. In successive years policy swings and external factors introduced confounding factors. We explore different treatment starting dates in the appendix. The pre-treatment predictor fitness criteria as well as average post treatment losses favors a treatment year before 1974 in almost all cases, and preferably in the years 1970, 1971, or 1972. Statistically, the starting year of treatment seems to be 1972 which happens to be the middle point of General Velasco’s term.

For the following exercises we use 1970 as starting year, which follows from the main economic reforms described in section 2 and provides a conservative estimation versus 1972. We use the set of predictors in table 2 to estimate weights to approximate mean performance in the period 1960–1969, and use those weights to construct the synthetic controls. We calculate two types of weights; ADH weights are based on the standard procedure documented in [Abadie et al. \(2010\)](#) while the efficient BK weights are based on [Becker and Klößner \(2018a\)](#). Both

**Table 3.** *Estimated synthetic control weights (LAC control group)*

country	GDP		TFP		Capital	
	ADH	BK	ADH	BK	ADH	BK
Bolivia	2.3	24.1	0.1	14.2	32.7	28.4
Brasil	1.8	17.4	35.0	29.7	0.6	0
Colombia	1.2	0.0	0.1	0	0.05	0
Costa Rica	37.6	0.0	51.5	0	24.6	37.7
Dominican R.	1.6	8.0	0.3	0	13.0	12.8
Ecuador	1.0	0.0	0.1	0	0.03	0
Guatemala	1.2	0.0	8.8	56.0	1.0	0
Honduras	1.4	0.0	NA	NA	NA	NA
Mexico	15.6	41.0	3.9	0	16.6	4.6
Panama	1.6	0.0	NA	NA	NA	NA
Paraguay	2.4	0.0	NA	NA	NA	NA
Trinidad and T.	21.7	0.0	NA	NA	0.02	0
Uruguay	10.7	0.0	0.01	0	0.03	0
Venezuela	0.03	9.6	0.1	0	11.4	16.5

NOTE: NA means that data is not available to estimate the weight.

methods are run in the R packages provided respectively by [Abadie et al. \(2011\)](#) and [Becker and Klößner \(2018b\)](#).

The estimated weights for the LAC and the world control groups are reported in tables 3 and A-2 respectively. In the efficient BK weights for GDP using the LAC control group, Bolivia, Brazil and Mexico account for 83% of synthetic Peru. With respect to TFP and capital stock per capita, Costa Rica, the Dominican Republic and Venezuela are also large contributors. In the efficient BK weights for GDP using the world control group, Uruguay, Egypt and Trinidad and Tobago account for 74.2% of synthetic Peru. With respect to TFP and capital stock per capita, Bolivia, Brazil and Venezuela are also large contributors. The same set of countries appears as large contributors in the ADH weights.

## 5 Results

### 5.1 Effects on GDP

The first row of figure 3 illustrates the estimated effects of the change in economic regime of 1968–1975 over GDP per capita using the LAC control group. Note that synthetic Peruvian GDP does stagnate and fall in the 1980s. This reflects the negative external and supply shocks that affected Peru as well as Latin American and Caribbean countries alike. The drop in synthetic GDP in 1982 is clearly visible. Observed GDP stagnates sooner than its synthetic and falls sharply towards the end of the 80’s.

Hence, observed GDP is always below its synthetic after the implementation of Velasco’s radical policy shift. Just at the end of the first phase of the military regime in 1975, observed GDP is 10% lower than synthetic GDP. But, as mentioned above, the core of reforms persisted across the following three administrations. By 1980, ten years after the implementation, the negative gap reached 30%. After the next five years the negative 30% GDP gap persisted. Recall that during this 1980-1985 period the synthetic also falls.

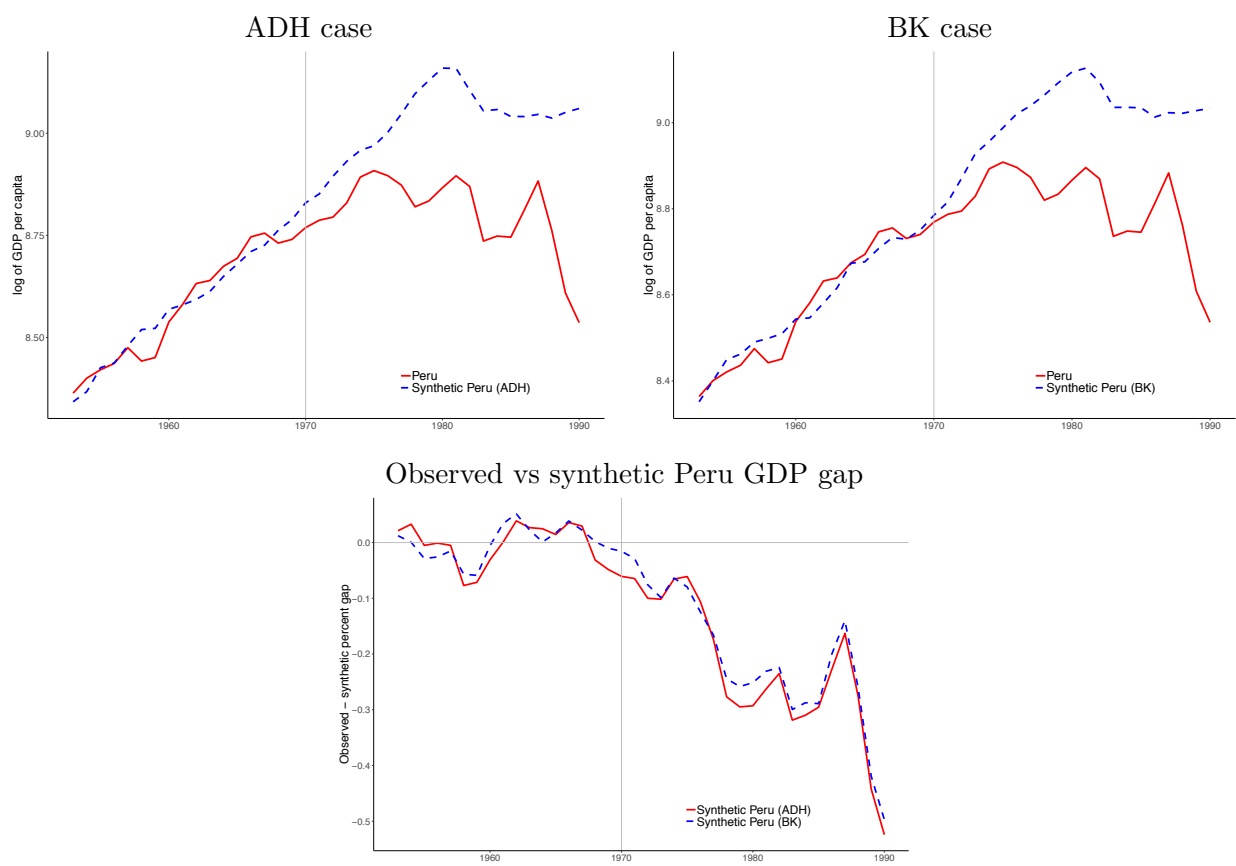
The strongest effect occurs towards 1990 (see second row of figure 3), when GDP dropped to only about 50% of the synthetic control. However this 1990 result may not be entirely attributed to the Velasco’s treatment. Even though its core reforms persisted and shaped the fabric of economic structure up to 1990, heterodox populism of the 80’s might have worsen the observed 1990 outcome. Nevertheless, it is key to highlight that the negative 50% gap compares to commonly used simple loss estimations of output loss brought about by radical policy shifts. The first is the loss relative to a previous last GDP peak, which was recorded in 1974. The loss relative to 1974 is 37%. The second loss estimation can be performed by projecting the GDP trend observed in 1969 up to 1990. The loss relative to this trend counterfactual is about 81%.

In figure 3 we see that both methods provide evidence that the military junta’s reforms, though possibly well-meaning, had persistent negative consequences. The GDP loss against both synthetic counterfactuals in every case is stark.

**Significance of estimates:** Following [Abadie and Gardeazabal \(2003\)](#), we also performed placebo exercises for the two estimation methods. We run the synthetic control method for each



**Figure 3.** *GDP performance in Peru 1953–1990 (LAC control group)*



country in the control group, one by one, as if it received the treatment. Figure 4 shows the trajectories of country GDP gaps before and after the treatment for the LAC control group. Countries with higher gap variance before treatment are omitted from both figures.

The Peruvian fall in GDP per capita appears to be in effect attributed to the specific radical policy shift observed in the country. Honduras and Bolivia also experienced extreme output falls albeit unrelated to the sort of policies implemented in Peru. The downfall in Honduras and Bolivia is stronger in the 80's due to regionwide debt problems that hit specially these two countries. Bolivia accumulated too much debt and had exchange rate and balance of payment crisis after a boom period (Kehoe et al. 2019). The case of Honduras is also related more to how deeply it was hit by the external shocks of the 1980's due to a vulnerable economic position.

**Figure 4.** GDP gaps against synthetic counterfactuals: placebo treatments (LAC)

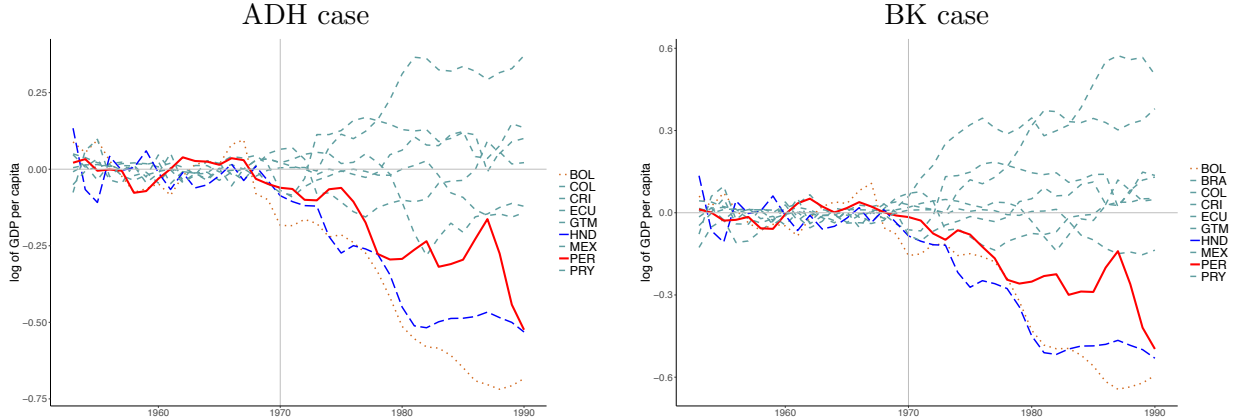
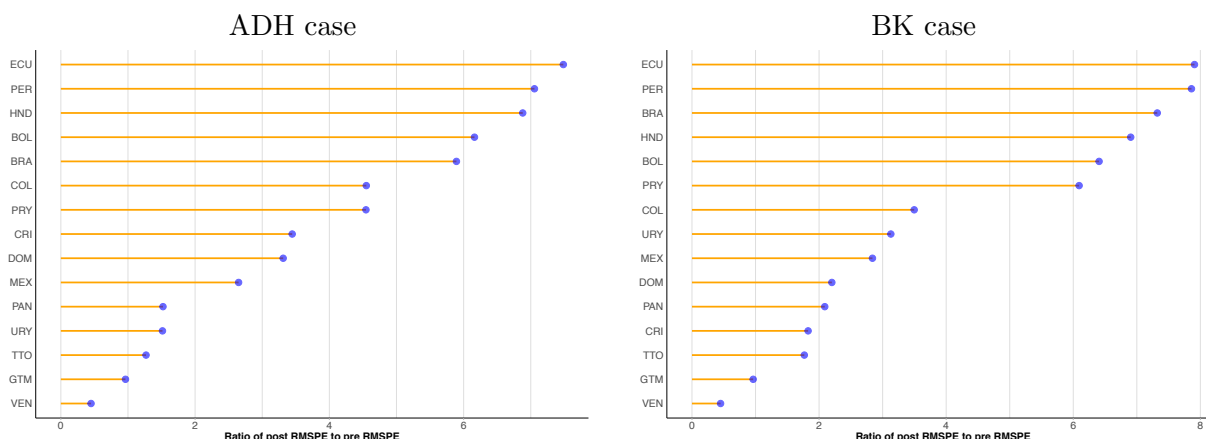


Figure 5 reports the ratios between the post-treatment root mean squared prediction error (RMSPE) and the pre-treatment RMSPE for Peru and all the donor countries. Here the prediction error comes from the difference between the observed GDP and its counterfactual. We expect the prediction error to be small in the pre-treatment period and to be large in the post-treatment period. In our analysis, Honduras and Bolivia for example have large post RMSPE as see in figure 4 but they also have a large pre-intervention RMSPE which means that the synthetic does not reproduce pre-treatment GDP in Honduras and Bolivia well enough.

As in Abadie et al. (2015), we divide the post-treatment RMSPE by the pre-treatment RMSPE. Peru and Ecuador have the highest ratio reaching up to 8 times. This means that,

giving this set of countries, the probability of obtaining a ratio as high as high as 8 is only about 0.13 and therefore there is support to conclude that the economic effects of Velasco’s radical policies on GDP are strongly negative. Indeed, it is difficult to have obtained this outcome just by chance.

**Figure 5.** *GDP: Root mean squared prediction error (RMSPE) ratios*



## 5.2 Effects on total factor productivity

The growth accounting exercise performed in [Martinelli and Vega \(2018\)](#) supports the idea that the radical reforms of the 1970s led to a misallocation of resources that led to a heavy drop in total factor productivity. The reforms affected total factor productivity possibly via a crowding out of private investment stemming from increased participation of public investment that turned out less efficient. The usual sources of inefficiency of the public sector, soft budget constraints and reduced monitoring, were likely compounded by the authoritarian nature of military rule in 1968–1980.<sup>24</sup> Productivity in the private sector may have been affected by the web of taxes and subsidies, discretionary intervention, uncertainty about property rights, and policy uncertainty.<sup>25</sup>

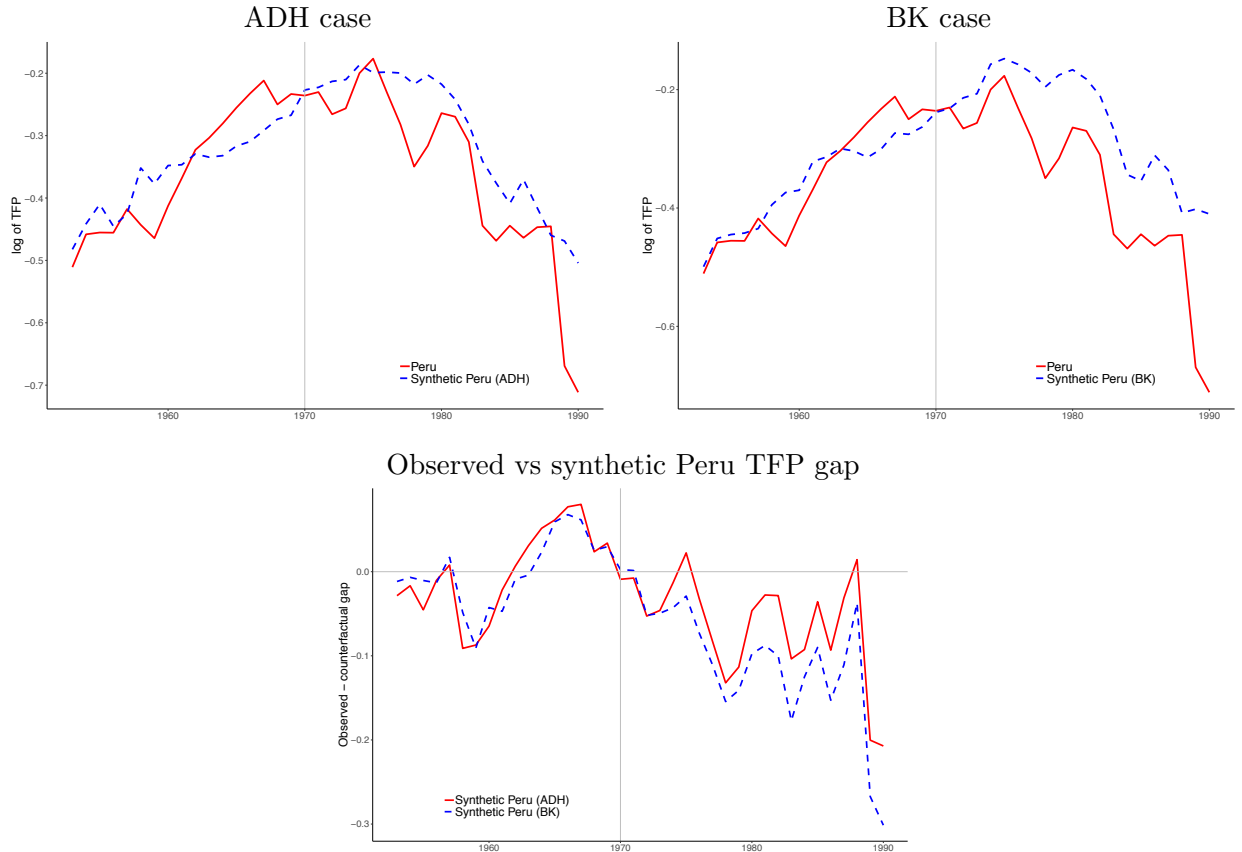
<sup>24</sup>[Quiroz \(2008, p. 330–332\)](#) notes that the watchdog role of the free press was severely curtailed, limiting the uncovering of corruption scandals. The largest such scandals involved the state enterprise in charge of food staples and the state fisheries enterprise, run by generals close to Velasco.

<sup>25</sup>An example is that of “fake” exports engineered to benefit from export subsidies, particularly during the “second phase” ([Quiroz 2008, p. 333](#)). In the words of [Schydrowsky and Wicht \(1983\)](#), “Public officials believed that by establishing ‘controls’ they would effectively direct the economic activity of the country; in fact they made it only more complicated, slower, and more inclined than ever to by-pass regulations.”

To shed more light on the dynamics of total factor productivity, we perform the synthetic control approach on TFP levels at current PPP (ctfp) as provided by the Penn World Table (PWT). This variable is measured relative to USA TFP. We consider this variable is better suited to make cross-country comparisons than the alternative TFP at constant national prices set to unity at 2011 for all countries.

The results for the LAC control group are shown in figure 6. The top row shows the TFP path under both methods, the synthetic TFP mildly grows over the first years of the 1970s to achieve a plateau and then to fall down during the 1980s. Instead, the observed TFP does not increase during the first half of the 1970s and starts falling sharply after 1975.

**Figure 6.** *TFP performance in Peru 1953–1990 (LAC control group)*



The gap between the observed and both synthetic TFP levels are shown in the second row of figure 6. Even though the gap is negative after the Velasco treatment, its size is of the same order of magnitude as that observed in the pre-treatment gap. This might reflect a poor

performance of the predictors during the pre-treatment period or else, that the treatment did not push PTF further down in addition to the negative external factors that hit LAC countries in the period.

In section 6 we perform the same exercise but with a larger control group. The result provides more evidence on the negative effect of the reforms on total factor productivity.

**Significance of TFP estimates:** The evidence that the Velasco treatment did have a negative effect on total factor productivity is weak in the benchmark case with LAC controls. Figure 7 shows the placebo trajectories of country TFP gaps before and after the treatment for the LAC control group. As before, countries with higher gap variance before treatment are omitted from both figures. The negative gap result is somewhat more visible in the BK case where Costa Rica and Peru have the worst performance (The Dominican Republic is not plotted because it did pass the variance threshold).

**Figure 7.** *TFP gaps against synthetic counterfactuals: placebo treatments (LAC)*

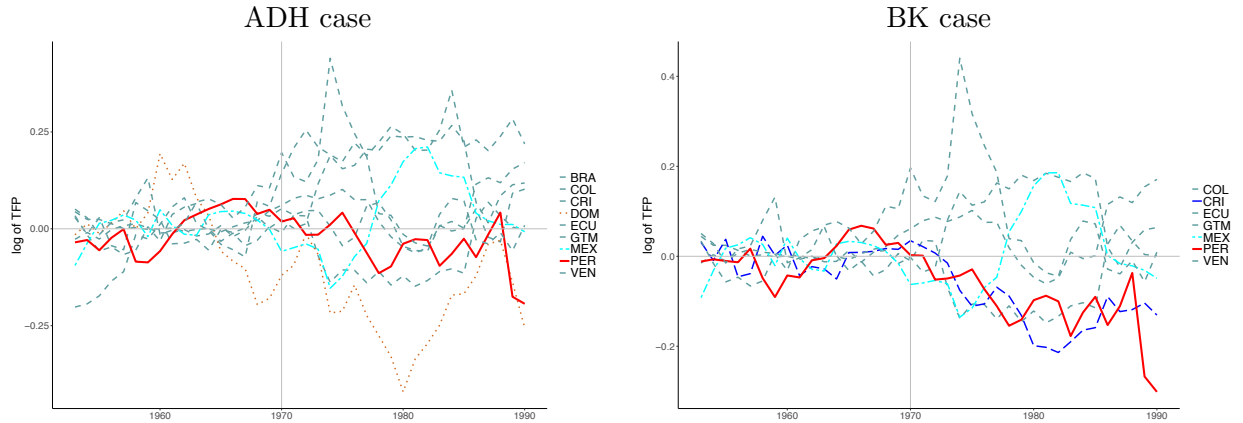
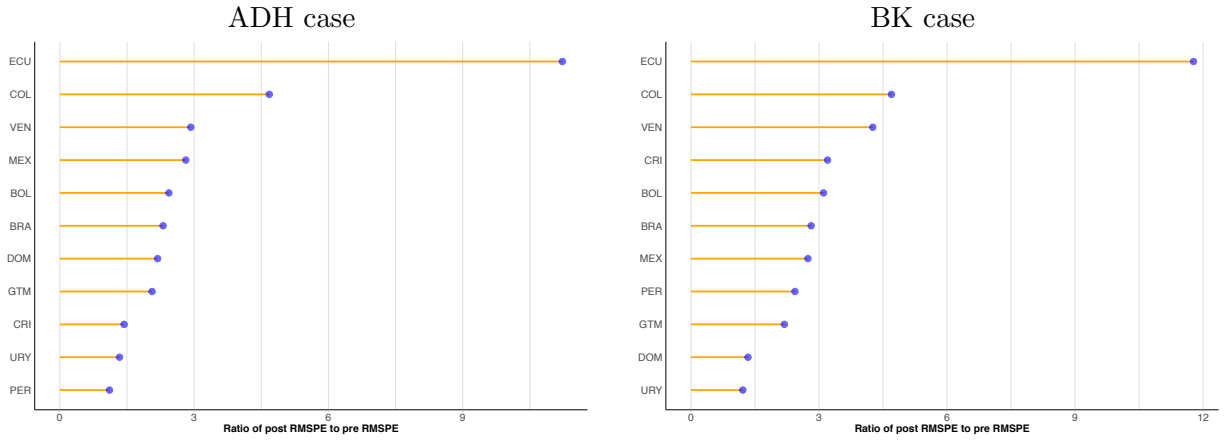


Figure 8 reports the ratios between the post and the pre-treatment RMSPE for Peru and all the donor countries. The figure reveals that the negative effect of the treatment in Peru is rather weak. The post-treatment RMSPE is just a bit more than the pre-treatment RMSPE. In other words, just by looking at the small set of LAC country predictor variables, we are not able to have a good prediction for the pre-treatment period.

The robustness exercise of section 6 shows more significance to the negative effect of Velasco's reforms on total factor productivity.

**Figure 8.** *TFP: Root mean squared prediction error (RMSPE) ratios*



### 5.3 Effects on capital stock per capita

Velasco’s regime attempted to put the state “at the center of capital accumulation in a market economy” (Fitzgerald 1983). Foreign borrowing and redirecting resources from the domestic financial sector served to finance an increase in public investment in oil and mining. Capital accumulation in the private sector may have been affected by the usual crowding out, by uncertainty about property rights, and by policy uncertainty. In turn, public investment after the first few years of military rule may have been affected by recurrent fiscal difficulties and the deleterious effects of stop-and-go policies.<sup>26</sup>

**Figure 9.** *Effect on private and public investment (LAC control group)*

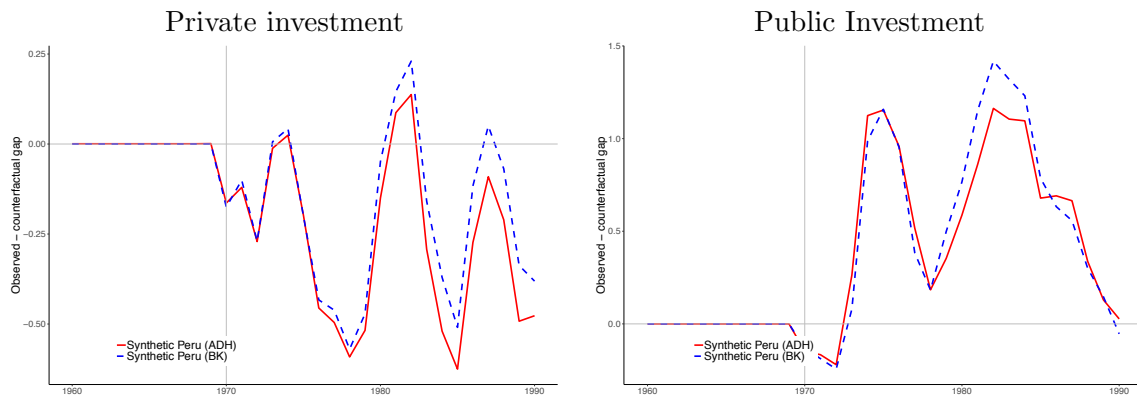


Figure 9 shows the effect of the radical reforms on private and general government invest-

<sup>26</sup>Gonzales de Olarte and Samamé (1991).

ment. Private investment tends to have a negative gap while public investment has a positive gap. A crowding out effect of private investment is clear from the figure. The loss in private investment tends to be about 50% while the increase in public investment reaches up to 100%. Official figures from the central bank of Peru show that the ratio of private to public gross investment went from 3 in the 60's to about 1.5 in 1976. So, overall, this channel tended to reduce capital stock.

Figure 10 illustrates the observed behavior of the capital stock per capita against that of the LAC counterfactual. Under both methods, the synthetic capital stock grows vigorously up until 1980 and then stops growing. In fact, capital stock stagnated in basically all Latin American economies during the 1980s due to adverse external factors such as higher world interest rates and the related debt default problems that arose in the region. In Peru, in contrast, capital stock per capita starts falling just after 1969. The loss in capital stock per capita measured at 1980, 1985 and 1990 according to this counterfactual was near 20%.

**Significance of capital stock estimates:** Figure 11 shows the placebo trajectories of country capital stock gaps before and after the treatment for the LAC control group. Again, countries with higher gap variance before treatment are omitted from both figures.

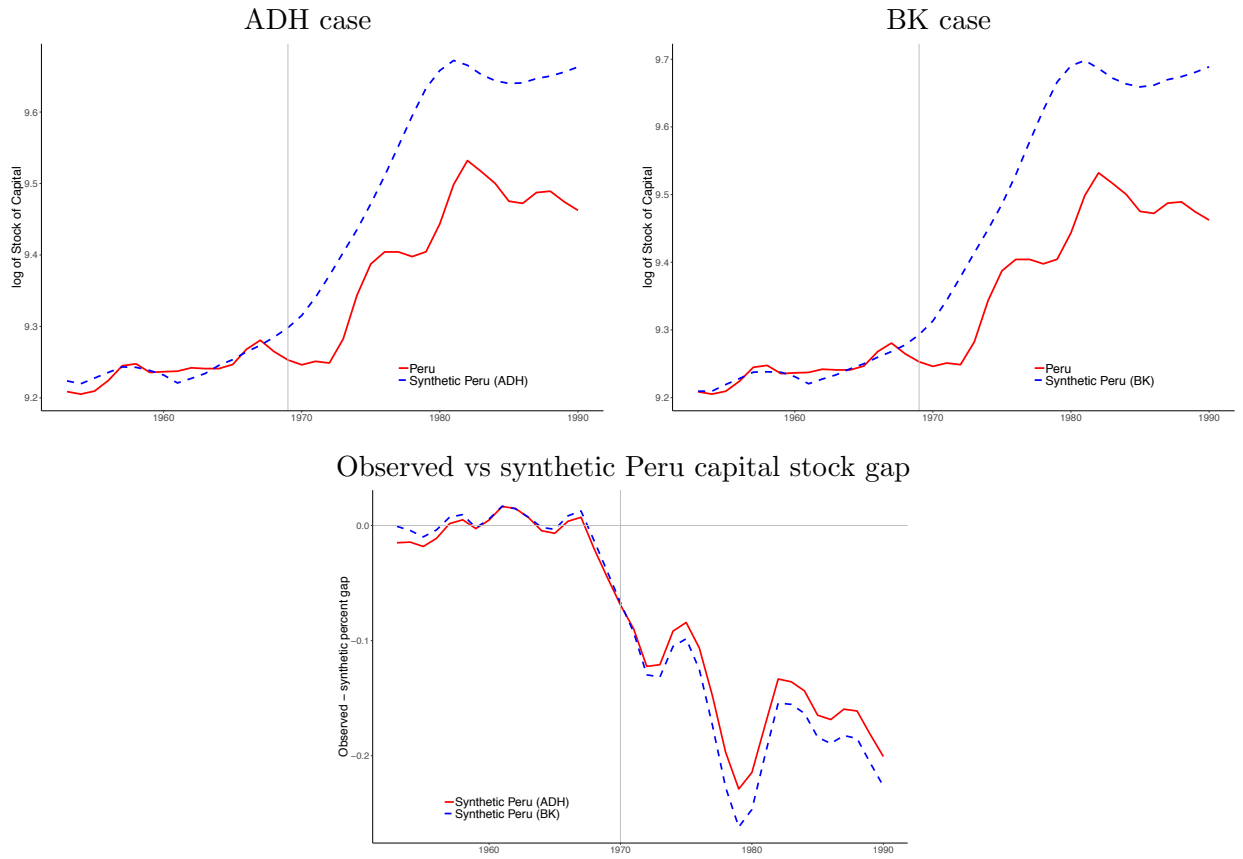
Figure 12 reports the ratios between the post and the pre-treatment RMSPE for Peru and all the donor countries. The figure reveals some evidence of negative effect of the Velasco treatment in Peru on the capital stock. The post-treatment RMSPE is between 10 and 20 times the pre-treatment RMSPE. The associated p-value for the ADH and BK case are 0.42 and 0.25 respectively.

Overall, the benchmarks results under the LAC control group show a strong GDP effect, a very weak effect on TFP and a mild effect on capital stock.

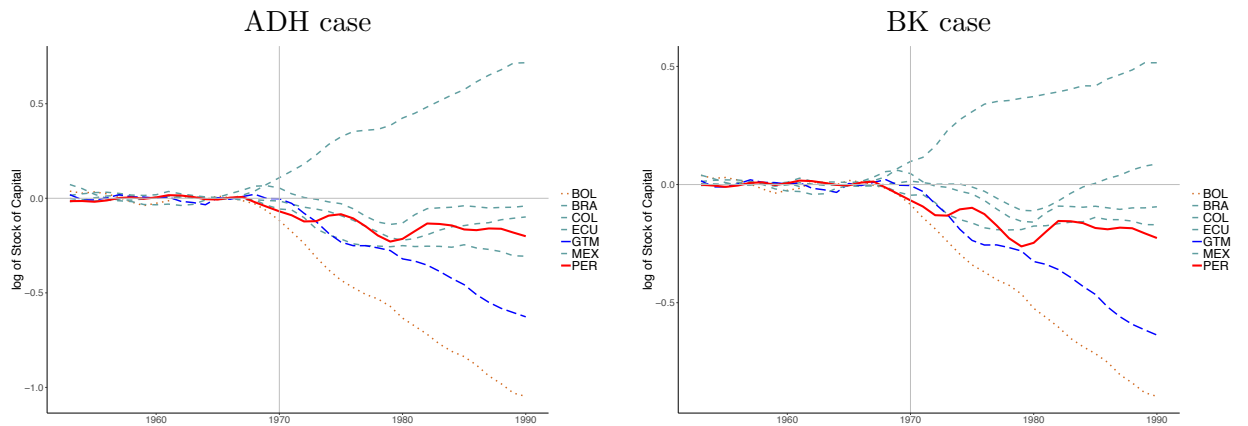
## 6 Robustness

We use a broader set of world countries to seek for the appropriate donor countries. Figure A-1 in the appendix illustrates the effects on per capita GDP, total factor productivity and per capita capital stock. In all three cases, the effect is negative. In turn, figure A-2 shows the

**Figure 10.** *TFP performance in Peru 1953–1990 (LAC control group)*



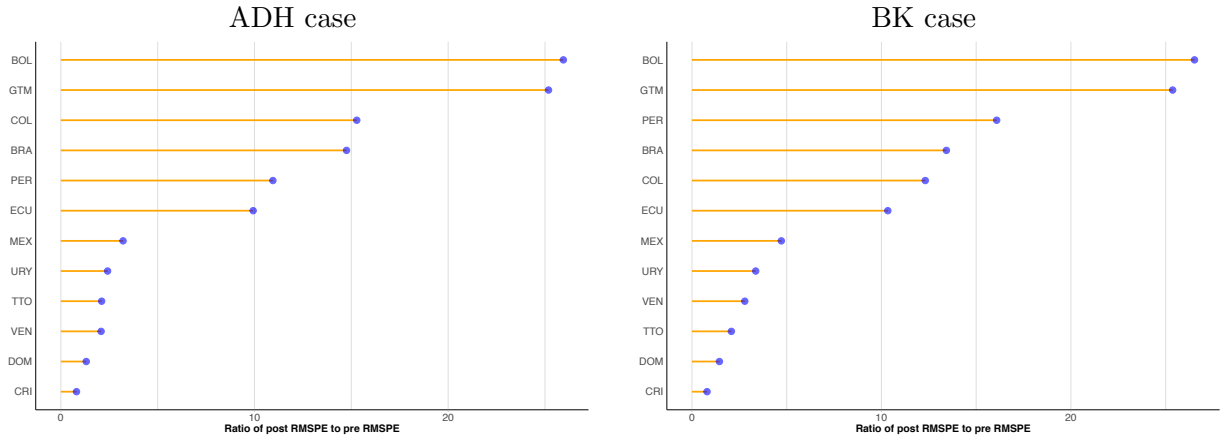
**Figure 11.** *TFP gaps against synthetic counterfactuals: placebo treatments (LAC)*



placebo runs for each country in the broader control group. One again, the negative effects in Peru are among the strongest. Last, figure A-3 depicts the ratios of post RMSPE to pre



**Figure 12.** *Capital stock: Root mean squared prediction error (RMSPE) ratios*



RMSPE. In all cases, the ratio corresponding to Peru stands out in the top group.

**Table 4.** *Summary of effects of reforms with the world control group*

year	GDP gap		TFP gap		K gap	
	ADH	BK	ADH	BK	ADH	BK
1975	-0.04	-0.04	-0.01	-0.005	-0.1	-0.1
1980	-0.3	-0.3	-0.04	-0.05	-0.3	-0.3
1985	-0.4	-0.4	-0.1	-0.2	-0.3	-0.3
1990	-0.6	-0.7	-0.3	-0.3	-0.4	-0.3
p-value (1990)	0.17	0.13	0.23	0.44	0.13	0.3

Table 4 shows the summary of the effects by each five-year period after treatment. The effects are similar to those obtained with the benchmark LAC control group. For each variable and weight estimation method, we also report the p-values as proposed in [Abadie et al. \(2015\)](#), which are relatively close to zero and thus, provide some evidence of the significance of the overall effects.

## 7 Concluding remarks

The Peruvian military junta of 1968–1975 embarked in an ambitious attempt to refashion the economy of the country away from traditional laissez-faire policies by increasing the size of

the public sector through an extensive program of nationalization and collectivization, and by command-and-control policies over the private sector. Some of military junta reforms, and in particular the importance of state-owned enterprises in the economy, were persistent.

The military junta's reforms were influenced by import substitution industrialization ideas popularized by CEPAL, by military nationalism, by the so called "dependency school," and by the general interventionist spirit of development economics at the time. All these pointed in the direction of state intervention in the economy to remove barriers to development and to correct and orient economic agents. The authoritarian nature of military rule allowed the implied policies to be taken to extremes.

The aftermath of the military junta was marked by a fall in GDP per capita until the market-oriented reforms of the 1990s. The external environment was unfavorable during the period, with terms of trade declining from the 1970s to the early 1990s, begging the question as to what extent the protracted recession was caused by policy and to what extent by the environment. To answer this question, we construct synthetic controls using a sample of Latin American countries and by a world sample.

Empirical exercises using synthetic controls provide evidence that the change in economic regime experienced by the country in the early 1970s had negative effects on GDP per capita, productivity and capital stock well beyond those of similar countries. That is, the recession was considerably worsened by the change in economic regime. The fall in productivity is consistent with increased misallocation due to extensive and arbitrary intervention in the economy, while the fall in capital accumulation is consistent with the observation of crowding out and from policy uncertainty and uncertainty over property rights.

Looking back, it is hard to miss the fundamental mistrust in market allocations by the military government and their advisors, compounded by wishful thinking, as an important reason behind the economic failure of the reforms. Similar mistrust in market allocations combined with wishful thinking would be a pattern repeated by the Garcia administration in 1985–1990. In line with the long-term reviews of the Peruvian economy by [Sheahan \(1999\)](#) and [Hunt \(2011\)](#), we think of the period from the 1960s to the 1980s as a stage in the (unfinished) process of the Peruvian society to find a path to growth and a better distribution.

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## Appendix

### Variables

Log of real GDP per capita, log of capital stock per capita and log of TFP are calculated using data from the *Penn World Table* version 9.0 [PWT] at constant 2011 national prices (in millions of USD); data for population is also obtained from the PWT. Openness is defined as exports plus imports as a share of output-side real GDP at constant 2011 national prices (in millions of USD). The corresponding series for exports and imports at the PWT are *cs<sub>h</sub>-x* and *cs<sub>h</sub>-m*; note that *cs<sub>h</sub>-m* has a negative sign. Terms of trade is taken from *DataMarket.com*. Labor force participation is obtained from the PWT as the ratio of numbers of persons engaged in labor (*emp*) divided by total population. The share of gross capital formation at constant PPP and the human capital index are obtained from the PWT. For private and public investment we take the variables *igov-rppp* that stands for the general government investment (gross fixed capital formation) and variable *ipriv-rppp* that stands for private investment (gross fixed capital formation). Both latter variables are expressed in billions of constant 2011 international dollars and are obtained from the Investment and Capital Stock Dataset (1960-2017) at the IMF.

### Robustness exercise

The world control group is composed of every country in the PWT with data available for 1960–1990; see table A-1. The Latin American and Caribbean control group is the subset from the region in table A-1.

**Table A-1.** *World control group*

Developed			Developing		
Europe	Other	Latin America and the Caribbean	Asia	Africa	
1 Austria	19 Australia	24 Bolivia	36 China	46 D.R. of the Congo	
2 Belgium	20 Canada	25 Brazil	37 India	47 Egypt	
3 Denmark	21 Japan	26 Colombia	38 Pakistan	48 Ethiopia	
4 Finland	22 New Zealand	27 Costa Rica	39 Philippines	49 Kenya	
5 France	23 United States	28 Dominican Republic	40 Sri Lanka	50 Morocco	
6 Germany		29 Ecuador	41 Thailand	51 Nigeria	
7 Greece		30 Guatemala	42 Turkey	52 South Africa	
8 Iceland		31 Jamaica	43 Republic of Korea	53 Uganda	
9 Ireland		32 Mexico	44 Taiwan		
10 Italy		33 Trinidad and Tobago	45 Israel		
11 Luxembourg		34 Uruguay			
12 Netherlands		35 Venezuela			
13 Norway					
14 Portugal					
15 Spain					
16 Sweden					
17 Switzerland					
18 United Kingdom					



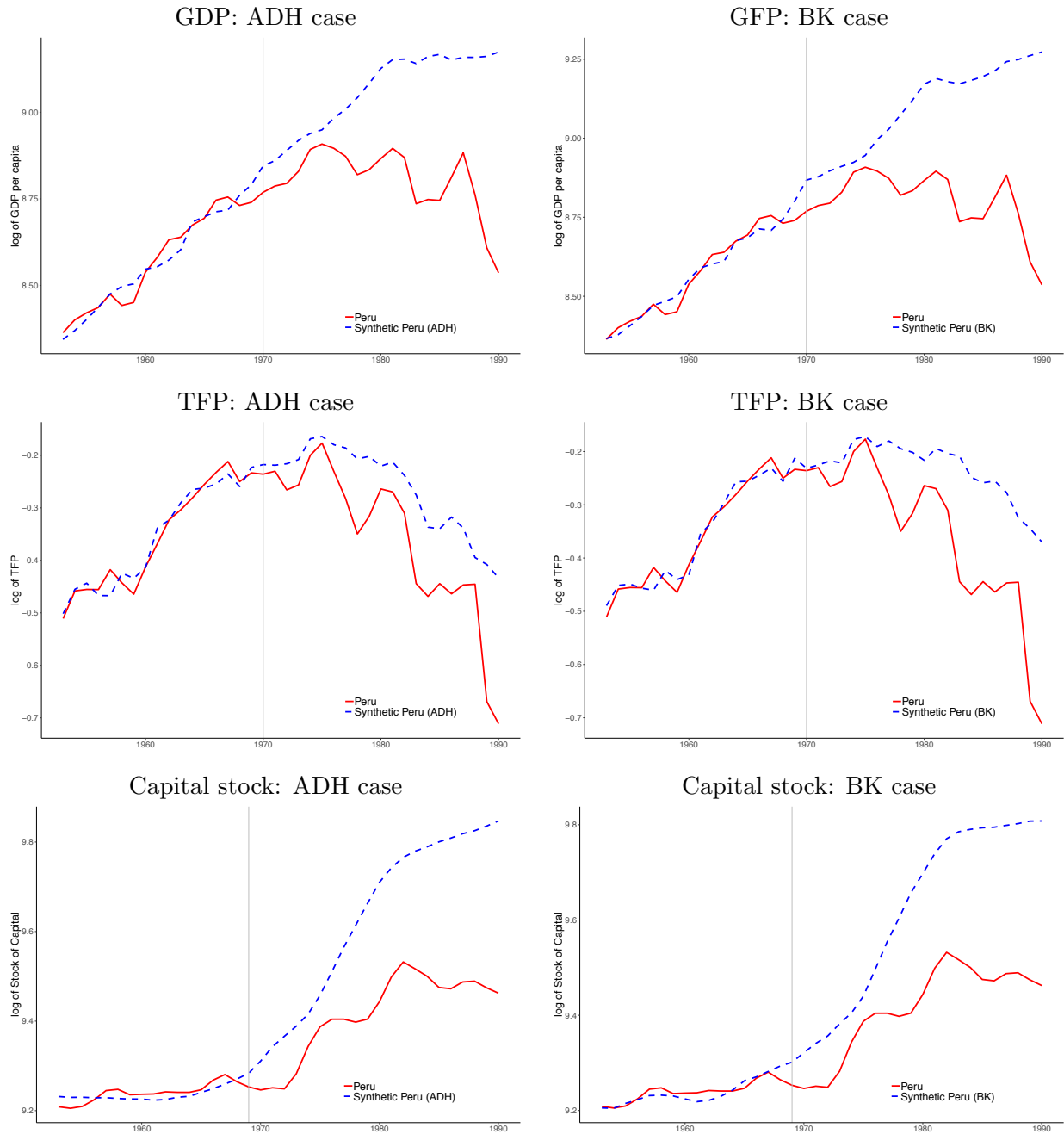
**Table A-2.** *Estimated synthetic control weights (world control group)*

country	GDP		TFP		Capital	
	ADH	BK	ADH	BK	ADH	BK
Bolivia	0.1	0	17.5	11.9	1.4	21.3
Brasil	0.1	0	11.5	2.1	0.7	0
Canada	0.2	9.7	4.9	18.8	0.6	0
Switzerland	0.1	0	0.02	0	0.2	0
D. R. Congo	10.9	4.8	NA	NA	NA	NA
Colombia	0.1	0	0.1	0	1.1	0
Costa Rica	0.3	0	26.4	16.5	17.5	0
Ecuador	0.04	0	0.1	0	11.4	0
Egypt	21.8	25.7	6.4	8.6	10.4	26.3
España	0.1	0	8.7	0	0.5	0
Guatemala	0.5	0	1.1	0	2.5	21.8
Japan	0.2	13.6	0.0	0	0.2	0
Kenya	0.1	0	0.7	0	12.4	0
Sri Lanka	0.04	0	0	0	5.3	0
Luxemburgo	2.0	0	0	0	0.4	0
Morocco	0.03	0	20.2	24.3	14.8	0
Mexico	35.0	0	0.1	0	0.6	0
Trinidad and T.	9.6	17.7	NA	NA	8.6	0
Uruguay	0.2	28.5	1.1	0	0.5	0
Venezuela	6.9	0	0	0	0.4	12.3

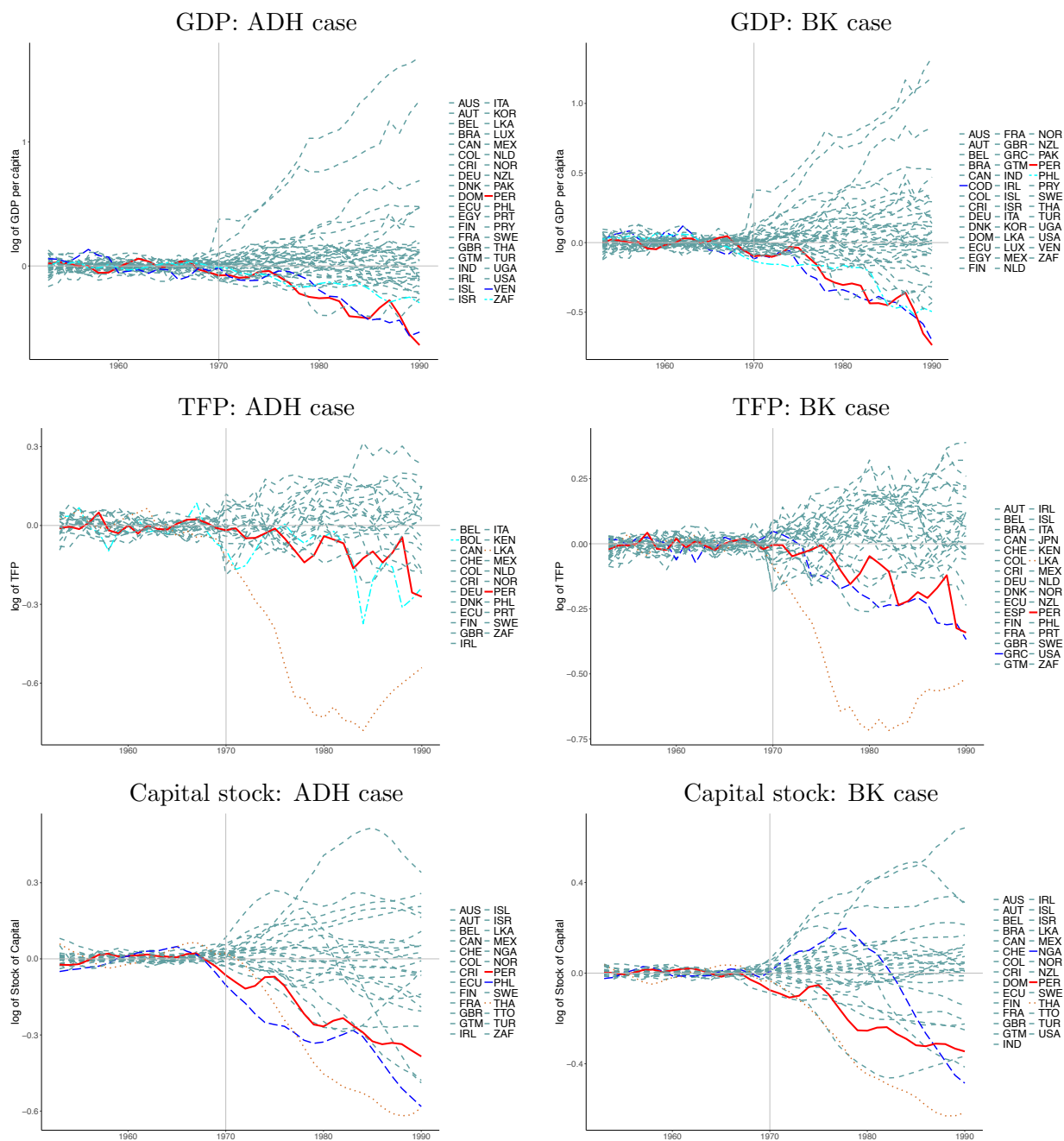
NOTE 1: NA means that data is not available to estimate the weight.

NOTE 2: Table for world control only reports countries whose sum of weights > 3.

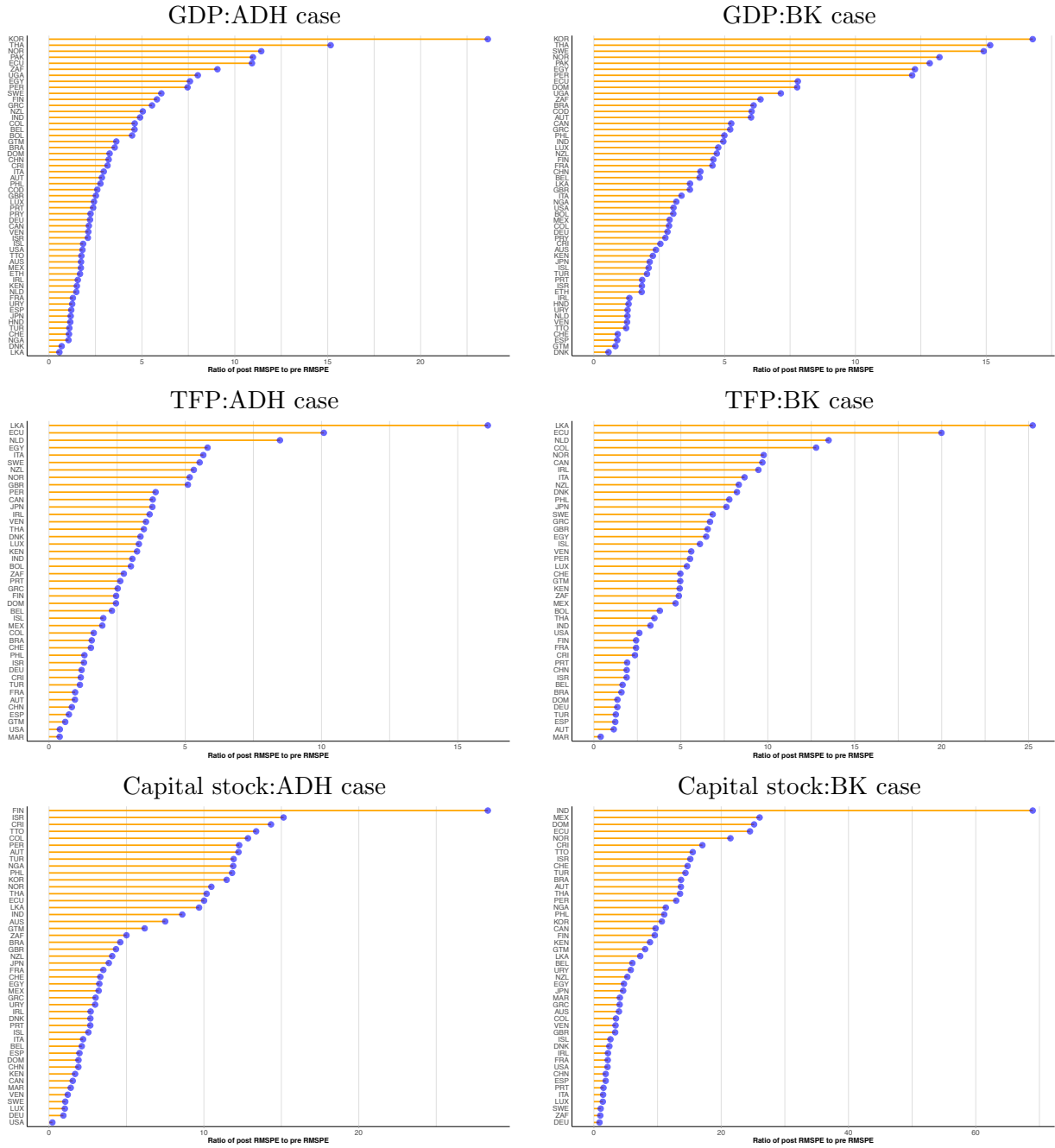
**Figure A-1.** *GDP performance in Peru 1953–1990 (world control group)*



**Figure A-2.** *GDP gaps against synthetic counterfactuals: placebo treatments (LAC)*



**Figure A-3.** *TFP gaps against synthetic counterfactuals: placebo treatments (world)*



## Exploration of treatment periods

### GDP per capita

The exact year treatment occurred is debatable. General Velasco was in power between October 1968 and August 1975. As explained in section 2, radical economic and social reforms started in 1969 and through 1974.

We run the synthetic control estimations treating each year since 1966 up to 1980 as a possible beginning-of-treatment year. In each case, we compute the mean squared errors of the pre-treatment gaps, which ideally should be close to zero for a good weights estimation to build the synthetic control. We also compute post-treatment mean losses for the remaining period until 1990. Post treatment mean losses can be computed all the way up to 1990 or just for the following ten years after treatment. For each instance of post-treatment loss comparisons we work with two cases according to the median or the mean values.

The results are shown in table B-1 to B-4. Column labeled mean post treatment effect shows that the bigger losses (marked read in each case) appear when we consider a starting year between 1967 and 1973 under the BK efficient computation. Under the ADH computation the starting years can be between 1968 and 1977. On the other hand, the best prediction fit for the pre-treatment period occurs, in all the cases, when we consider 1970, 1971, or 1972 as starting years.

### Total factor productivity

In this case, tables B-5 and B-6 show the MSE of pre-treatment and post-treatment losses respectively under the BK and ADH approaches. Again, a visual inspection favors a treatment year in the range 1969–1972. Figure B-1 shows BK losses are U-shaped centered in 1972.

**Table B-1.** *Mean squared errors (MSE) and mean post treatment GDP losses*

	treatment year	MSE pre- treatment (BK)	MSE pre- treatment (ADH)	Mean post-treatment effect (BK)	Mean post-treatment effect (ADH)
1	1966	0.13	0.15	-3.87	-22.81
2	1967	0.12	0.14	-26.15	-21.97
3	1968	0.11	0.13	-16.80	-22.90
4	1969	0.10	0.13	-19.57	-23.00
5	1970	0.09	0.14	-20.21	-23.10
6	1971	0.09	0.16	-20.35	-18.75
7	1972	0.07	0.17	-21.33	-20.30
8	1973	0.11	0.13	-20.16	-16.18
9	1974	0.13	0.19	-15.11	-19.99
10	1975	0.11	0.15	-15.87	-16.61
11	1976	0.10	0.14	-17.57	-17.72
12	1977	0.11	0.16	-18.07	-22.49
13	1978	0.12	0.20	-18.01	-21.69
14	1979	0.20	0.34	-15.94	-20.42
15	1980	0.27	0.49	-13.55	-18.04

Note: Average losses up to 1990. Predictor criteria: median.

**Table B-2.** *Mean squared errors (MSE) and mean post-treatment GDP losses*

	treatment year	MSE pre- treatment (BK)	MSE pre- treatment (ADH)	Mean post-treatment effect (BK)	Mean post-treatment effect (ADH)
1	1966	0.13	0.15	-15.91	-21.09
2	1967	0.12	0.14	-15.33	-22.16
3	1968	0.11	0.12	-16.95	-22.93
4	1969	0.10	0.13	-18.62	-22.01
5	1970	0.09	0.13	-20.26	-21.81
6	1971	0.09	0.14	-20.73	-21.09
7	1972	0.08	0.15	-22.19	-21.70
8	1973	0.12	0.16	-16.33	-17.82
9	1974	0.12	0.14	-14.63	-18.08
10	1975	0.11	0.13	-16.49	-19.98
11	1976	0.10	0.13	-17.85	-16.92
12	1977	0.11	0.16	-18.16	-22.10
13	1978	0.12	0.20	-17.98	-21.17
14	1979	0.20	0.34	-15.94	-19.89
15	1980	0.27	0.46	-13.55	-18.70

Note: Average losses up to 1990. Predictor criteria: mean.

**Table B-3.** *Mean squared errors (MSE) and mean post-treatment GDP losses*

	treatment year	MSE pre- treatment (BK)	MSE pre- treatment (ADH)	Mean post-treatment effect (BK)	Mean post-treatment effect (ADH)
1	1966	0.13	0.15	-7.86	-9.53
2	1967	0.12	0.14	-10.87	-10.43
3	1968	0.11	0.13	-7.22	-13.36
4	1969	0.10	0.13	-10.74	-14.49
5	1970	0.09	0.14	-12.74	-15.99
6	1971	0.09	0.16	-14.09	-13.68
7	1972	0.07	0.17	-15.96	-15.51
8	1973	0.11	0.13	-16.31	-12.84
9	1974	0.13	0.19	-12.90	-17.29
10	1975	0.11	0.15	-14.39	-14.85
11	1976	0.10	0.14	-15.73	-15.63
12	1977	0.11	0.16	-15.14	-19.62
13	1978	0.12	0.20	-14.88	-18.77
14	1979	0.20	0.34	-13.95	-18.52
15	1980	0.27	0.49	-13.55	-18.04

Note: Average 10 year losses after treatment. Predictor criteria: median.

**Table B-4.** *Mean squared errors (MSE) and mean post treatment GDP losses*

	treatment year	MSE pre- treatment (BK)	MSE pre- treatment (ADH)	Mean post-treatment effect (BK)	Mean post-treatment effect (ADH)
1	1966	0.13	0.15	-2.92	-8.67
2	1967	0.12	0.14	-4.32	-10.56
3	1968	0.11	0.12	-7.19	-12.94
4	1969	0.10	0.13	-10.07	-13.70
5	1970	0.09	0.13	-12.79	-14.83
6	1971	0.09	0.14	-14.41	-15.20
7	1972	0.08	0.15	-16.67	-16.10
8	1973	0.12	0.16	-13.10	-14.29
9	1974	0.12	0.14	-12.33	-15.36
10	1975	0.11	0.13	-14.94	-18.03
11	1976	0.10	0.13	-15.98	-14.91
12	1977	0.11	0.16	-15.23	-19.18
13	1978	0.12	0.20	-14.85	-18.30
14	1979	0.20	0.34	-13.95	-18.00
15	1980	0.27	0.46	-13.55	-18.70

Note: Average 10 year losses after treatment. Predictor criteria: mean.

**Table B-5.** *Mean squared errors (MSE) and mean post-treatment TFP losses*

	treatment year	MSE pre- treatment (BK)	MSE pre- treatment (ADH)	Mean post-treatment effect (BK)	Mean post-treatment effect (ADH)
1	1966	0.15	0.44	-8.54	5.14
2	1967	0.18	0.48	-10.29	5.39
3	1968	0.20	0.46	-11.91	-0.89
4	1969	0.21	0.54	-13.92	-7.46
5	1970	0.21	0.25	-14.09	-15.89
6	1971	0.24	0.81	-15.87	-7.07
7	1972	0.22	0.75	-16.91	-7.24
8	1973	0.23	0.57	-16.22	-8.10
9	1974	0.23	0.62	-15.26	-6.01
10	1975	0.22	0.54	-14.27	-8.25
11	1976	0.21	0.55	-11.75	-6.23
12	1977	0.22	0.47	-10.95	-6.43
13	1978	0.23	0.44	-7.43	-5.72
14	1979	0.25	0.45	-1.96	-4.77
15	1980	0.24	0.47	0.70	1.01

Note: Average losses up to 1990. Predictor criteria: median.

**Table B-6.** *Mean squared errors (MSE) and mean post-treatment TFP losses*

	treatment year	MSE pre- treatment (BK)	MSE pre- treatment (ADH)	Mean post-treatment effect (BK)	Mean post-treatment effect (ADH)
1	1966	0.14	0.37	-7.05	-0.67
2	1967	0.17	0.45	-9.20	5.88
3	1968	0.19	0.55	-10.80	-2.99
4	1969	0.18	0.53	-11.68	-5.04
5	1970	0.16	0.53	-10.74	-4.67
6	1971	0.15	0.49	-11.68	-4.59
7	1972	0.15	0.48	-13.42	-4.95
8	1973	0.16	0.45	-13.11	-4.76
9	1974	0.17	0.44	-12.58	-4.33
10	1975	0.18	0.44	-12.40	-4.48
11	1976	0.18	0.33	-10.18	-7.60
12	1977	0.19	0.33	-9.37	-3.15
13	1978	0.21	0.29	-8.25	-8.12
14	1979	0.22	0.28	-0.54	-8.31
15	1980	0.20	0.38	2.95	1.68

Note: Average losses up to 1990. Predictor criteria: mean.



**Figure B-1.** *Mean post-treatment TFP losses by possible treatment year*

