FISCAL RULES AND PUBLIC INVESTMENT: THE CASE OF PERU

Research proposal for "Fiscal Rules and the Behavior of Public Investment in Latin America and the Caribbean: Towards Growth-Friendly Fiscal Policy?", IDB.

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INTRODUCTION

Can fiscal rules or, more generally, fiscal adjustments, negatively affect economic growth?

According to Végh et al. (2018), the favorable effects of fiscal adjustments on longterm economic growth are "crystal clear". A lower fiscal deficit and a lower public debt reduce inflation and the burden of public debt, increase the availability of resources for the private sector, allow greater and cheaper access to international credit, and reduce the probability of public debt crisis. All these factors contribute to economic growth.

Nonetheless, when the weight of either fiscal adjustments or rules, falls on public investment, the beneficial effects described above can severely weaken. Izquierdo et al. (2018), for instance, argues that fiscal rules are an important determinant of the composition of public spending in Latin America and the Caribbean (LAC) and that these rules have made capital expenditure lose ground to current expenditure. Cavallo and Powell (2012) find, for a sample of 75 countries,

comprising 17 from LAC countries, including Peru¹, that in countries with rigid fiscal rules², fiscal consolidation is achieved through the reduction of public investment. In a scenario of fiscal consolidation of at least 1.5 percent of GDP, these countries cut capital expenditures by approximately 10 percent from the onset, up to one year thereof. However, for LAC countries whose fiscal rules include at least one of the flexible features, a fiscal consolidation of at least 1.5 percent of GDP is associated with a decline of only 1 percent in capital expenditure.

Rigid fiscal rules can undermine economic growth. The area basically two reasons. First, as Végh et al. (2018) puts it, fiscal multipliers of public investment are greater than multipliers of the other components of spending or taxes. Second, as put forward by Izquierdo et al. (2018), the stock of public capital (roads, ports, railways and other durable public goods) is badly impaired.

In the Peruvian case, the linkage between fiscal rules and public investment has some characteristics that may differ from the general case reviewed above.

First, Peru has been one of the first LAC countries adopting a fiscal rule (December 1999). This. we have enough information to verify its effectiveness and its effects.

In addition, given the undue influence of commodity prices on government revenues, there is a steep dependence of Peruvian fiscal accounts to the behavior of commodity prices. As an indication, the correlation between the tax revenue growth and commodity price growth during the period 1990-2018 amount to 0.7.

¹ Cavallo and Powell (2012) argue that fiscal rules of Peru have two characteristics of flexibility. On the one hand, they have specific escape clauses. On the other hand, the current expenditure rule excludes expenditure in infrastructure maintenance.

² Flexible fiscal rule is a dummy equal to 1 if the rule is i) an investment- friendly rule, or country has ii) cyclically-adjusted budget balance rule, or iii) rules with well-defined escape clauses. Otherwise, if it is rigid, the dummy is 0.

Next, in this century, Peru is the LAC country that most reduced its public debt as a percentage of GDP³. As a result, Peruvian current country risk indicators are among the best in the region.

Last, in the medium and long term, given the fiscal space produced by having a low public debt, fiscal rules do not seem to have had such an unfavorable effect on public investment, as seemed to have occurred in other countries.

These features have two major implications for the development of our proposal.

First, we can choose 2000 as the year of implementation of the fiscal rules in Peru. Given that the Peruvian experience is one of the oldest in LAC, we can take advantage of data spanning at least 18 years to perform a set of statistical tests and resort to structural macroeconomic models.

Second, commodity prices and public debt as a percentage of GDP can be two relevant predictors of public investment.

³ According to the WEO database (2019), within LAC, Peru is one of the countries that most reduced its gross debt, 17.6 percent of GDP. Only below Guyana (73.8%), Nicaragua (58.1%), Saint Kitts and Nevis (31.8), Honduras (25.5%) and Haiti (22.2%).

1. FISCAL RULES AND PUBLIC INVESTMENT IN PERU: 1990-2018

Peru had its first fiscal law in December 1999, the Fiscal Prudence and Transparency Law (FPTL), Law 27245⁴. This Law has undergone several modifications, which are detailed in Tables 1 and 2. Since that date, Peru has passed 3 fiscal laws (Law 27958⁵, 2003; Law 30099, 2013; and LD 1276, 2016), 8 amendments of articles of the fiscal deficit rule, as well as 13 changes concerning the expenditure rule. In addition, during the study period, the maximum fiscal deficit allowed in the modifications was 3.5 percent of GDP, while the maximum real growth of current expenditure was 10 percent.

Table 1 shows the series of changes in the Peruvian fiscal deficit ceiling and highlights the four most important laws.

		· · · · · · · · · · · · · · · · · · ·
Year	Record	Ceiling
1999	Law 27245	$FD \leq 2$ percent of GDP.
2001	Law 27245	$FD \leq 1,5$ percent of GDP.
2001	Law 27577	The application of the rule is suspended.
2002	Law 27577	The application of the rule is suspended.
2003	Law 27958	$FD \leq 2$ percent of GDP.
2004	Law 27958	$FD \leq 1,5$ percent of GDP.
2009	Law 29368	The application of the rule is suspended ⁶ .
2010	Law 29368	The application of the rule is suspended.
2013	Law 29952	Budget balance must not be negative.

Table 1:	Changes	to the	Fiscal	Deficit	(FD)) ceilina
					· - /	

⁴ This Law stipulated that the limit to the nominal fiscal deficit will not have to exceed 1 percent of GDP. This ceiling has not been changed. It should be noted that this Law also created a Fiscal Stabilization Fund (FSF).

⁵ The FPTL also indicates that the growth rate of government spending in real terms could not be greater than 2 percent. This was modified by the Fiscal Responsibility and Transparency Law (FRTL) or Law 27958, which extended the spending growth limit to 3 percent in real terms. The latter also created fiscal rules for local and regional governments.

⁶ The implementation of the Fiscal Stimulus Plan triggered the suspension of the fiscal deficit rule. Moreover, a ceiling of 2 percent of GDP is established.

2014	Law 30099	Budget balance must not be negative.		
2015	Law 30099	$SFD \leq 1$ percent of GDP.		
	Law 30099	SFD \leq 1 percent of potential GDP.		
2016	UD 002-2015	SFD \leq 2 percent of potential GDP.		
	UD 003-2015	SFD \leq 3 percent of potential GDP.		
	Law 30420	SFD \leq 1,5 percent of potential GDP.		
2017	Law 30499	SFD \leq 2,2 percent of potential GDP.		
2017	LD 1276	$FD \leq 2,5$ percent of GDP.		
	Law 30637	$FD \leq 3$ percent of GDP.		
	Law 30420	SFD \leq 1 percent of potential GDP.		
2010	Law 30499	SFD \leq 2 percent of potential GDP.		
2018	LD 1276	$FD \leq 2,3$ percent of GDP.		
	Law 30637	$FD \leq 3,5$ percent of GDP.		
	Law 30499	SFD \leq 1,8 percent of potential GDP.		
2019	LD 1276	$FD \leq 2$ percent of GDP.		
	Law 30637	$FD \leq 2,9$ percent of GDP.		
	Law 30499	SFD \leq 1,5 percent of potential GDP.		
2020	LD 1276	$FD \leq 1,5$ percent of GDP.		
	Law 30637	$FD \leq 2,1$ percent of GDP.		
2021	Law 30499	$SFD \leq 1$ percent of potential GDP.		
	LD 1276	$FD \leq 1$ percent of GDP.		
	Law 30637	$FD \leq 1$ percent of GDP.		

Source: Technical Secretariat of Fiscal Council. (2016). *Reglas Fiscales en el Perú*. Annex 1 of discussion note 002.

Similarly, table 2 identifies the various amendments of the expenditure rule and highlights the four most important laws.

Year	Record	Ceiling
		Increase of Non-Financial Spending (NFS) of
1999	Law 27245	GG may not exceed the annual average
		inflation rate plus 2 percentage points (p.p.).

Table 2: Changes to the expenditure ceiling

2004	Law 27958	Real increase of NFS of GG may not exceed percent, determined on the basis of the GE deflator.			
2005	Law 28562	The application of the rule is suspended.			
2006	Law 28750	The application of the rule is suspended.			
		Real increase of consumption expenditure ⁷ of			
2007	Low 20025	Central Government (CG) may not exceed 3			
2007	Law 29035	percent, determined on the basis of BCRP			
		target (2 percent).			
2008	Low 20144	Real increase of consumption expenditure ⁸ of			
2000	Law 29144	CG may not exceed 4 percent.			
2000	1 20268	Real increase of consumption expenditure of			
2009	Law 29300	CG may not exceed 10 percent.			
2010	Law 20269	Real increase of consumption expenditure of			
2010	Law 29500	CG may not exceed 8 percent.			
2011	Law 29812	The average annual CPI of Lima Metropolitana			
2011		was used instead of the BCRP target.			
		Expenditure of maintenance of infrastructure,			
		goods and services of social programs framed			
2012	Law 29854	under the Budget for Results scheme, and			
		equipment for Public Order and Security were			
		excluded from the calculation.			
		NFS rule was replaced by the NFPS budget			
	1	balance rule.			
2013	Law 29952	Real increase of NFS of the CG is subject to the			
	Law 50099	ex-ante guidance of the SFD and the MMM			
		forecasts ⁹ .			
		NFS of NG \leq 118 064 millions.			
2015	SD 084-2014-EF	Personnel and pensions of NFS of NG \leq			
		56 332 millions.			

⁷ Remuneration and goods and services.

⁸ The definition was extended to remuneration, goods and services and pensions.

⁹ It became effective since 2015.

		NFS of NG \leq 123 108 millions.					
	SD 242-2015-EF	Personnel and pensions of NFS of NG \leq					
	SD 242-2015-FF	60 044 millions.					
		Real increase of NFS of GG should not be					
2016	LD 1276	greater than the upper limit of the range +/-					
		p.p. of the real average 20-year GDP growth					
		rate.					
	LD 1276	Current expenditure ¹⁰ cannot be greater than					
		the lower limit of the NFS rule.					
		The set of arrangements ¹¹ must be consistent					
2017	Law 30499	with the fulfillment of a $FD \leq 2,5$ percent of					
		GDP ¹² .					
		The NFS rule of the GG does not apply.					
	Law 30637	The current expenditure of GG (without					
2018		maintenance) should not exceed the result of					
2010		the 20-year average of the real annual GDP					
	Law 30637	growth subtracted minus 1 p.p ¹³ . In the 2018-					
		2021 MMF, the ceiling is 4 percent in real terms.					
2019	Law 30637	The NFS rule of the GG does not apply.					
	Law 30637	For the NFS of GG, LD 1276 will apply.					
		The current expenditure of GG (without					
2020		maintenance) should not exceed the result of					
		the average of 20 years of the real annual					
		growth of the GDP subtracted less 1.5 p.p^{14} .					
2021	Law 30637	For the NFS of GG, LD 1276 will apply.					

Source: Technical Secretariat of Fiscal Council. (2016). *Reglas Fiscales en el Perú*. Annex 1 of discussion note 002.

¹⁰ Excluding maintenance expenditure.

¹¹ It refers to the budget, indebtedness and financial balance laws, as well as supplementary credits and the SPNF budget execution.

¹² Implicitly, expenditure rules of NG are voided.

¹³ This calculation will be applied during 2018-2019.

¹⁴ This calculation will be applied during 2020-2021.

In a sense, although it is true that it is difficult to perform an assessment of the degree of compliance of fiscal rules, simple statistic measures show that, without any temporary extension, the fiscal deficit and expenditure rules were fulfilled around 33 and 44 percent of the time, respectively. If these temporary extensions are contemplated, the rules were fulfilled 66 and 50 percent, of the time respectively. It should be noted that both rules were not fulfilled in 22 percent and were exempted in 12 percent of times.

Also, it is worth mentioning that all law or article changes have respected the general principle of maintaining a decreasing trajectory of the fiscal deficit and the public debt, and a moderate growth of current expenditure. Regarding public debt, it is only with Legislative Decree 1276, called the Fiscal Responsibility and Transparency Framework of the Non-Financial Public Sector (MRTF) of 2016, that a ceiling of 30 percent of GDP was set forth. This limit has not been changed and has been complied with.

The rules have contributed to the fiscal situation of the Peruvian economy. Currently, Peru has one of the strongest fiscal positions in LAC. Public debt¹⁵ as a percentage of GDP is 26.8 percent, the lowest after Chile. It has not always been the case. At the end of the eighties Peru's public finances were the worst in the region. Public debt reached 89 percent of GDP and the fiscal deficit¹⁶ was around 10 percent of GDP.

The significant fall in public debt is associated with the sustained decline in fiscal deficit. As a percentage of GDP, the average fiscal deficit has been reduced from 8.1 by the end of 1980s¹⁷, 3 percent in the 1990s and only 0.5 percent throughout this century.

¹⁵ Database of Reinhart and Rogoff (2011) with Central Government coverage.

¹⁶ BCRP data with General Government coverage.

¹⁷ Period 1988-1990.

As a consequence of this outstanding fiscal behavior of recent years, our risk premium, measured by the yield differential of the Emerging Market Bond Index (EMBIG) of Peru, is today one of the lowest in the region, and has dropped significantly since 1998, the year in which this indicator begins to be registered. Likewise, the Peruvian credit rating has improved considerably in the last two decades, reaching investment degree in long-term government debt during the years 2008 and 2009¹⁸. Since then, Peruvian credit rating has improved to the point that it maintains by 2019 a rating of A3, BBB+ and BBB+ by Moody's, Fitch and Standard & Poor's, respectively.

The fiscal rules Peru operates since 1999, have contributed to the results described above. In particular, the more lasting (permanent) rule, the ceiling of fiscal deficit as a percentage of GDP, has helped reduce fiscal deficit gradually and thus, has cut down public debt.

It is true that the pro-cyclical nature of the permanent rule may undermine public investment. Given the rigid nature of current spending, the rule that reduces the fiscal deficit can affect the most endogenous component of public expenditure, namely, investment.

Nevertheless, falling public investment is not observed in the Peruvian data. Just as an indication, between 2000 (in December 1999 the first fiscal Law was adopted) and 2018, General Government capital expenditures have risen from 3.8 to 4.9 percent of GDP.

Why did not fiscal rules in Peru disrupt public investment? This research proposal offers some possible explanations, albeit preliminary.

First, fiscal consolidation has been accompanied by an increase in government revenues. Tax revenues of the General Government (GG), as a percentage of GDP,

¹⁸ Fitch Ratings, Standard and Poor's (S&P) and Moody's granted Peru the investment grade category on 2 April 2008, 14 July 2008 and 11 December 2009, respectively.

rose from 14 percent reached in 1999, to 14.9 percent in the first decade of this century and to 15.5 percent in the last 9 years.

Second, fiscal consolidation contributed to a notable reduction of interest payments of Peruvian public debt. As a percentage of GDP, the interest of CG public debt fell from 2.2 percent of GDP in 1999, to 1.8 percent in the first decade of this century and to only 1.1 percent in the last 8 years. These results are associated with the direct effect of the lower volume of public debt, as well as its indirect effect, through the impact of lower public debt on the risk premium and the interest rate.

Third, in the period of analysis, current expenditure has been under control. The current expenditure of the GG as a percentage of GDP fell from 15 percent in 1999 to only 14.5 percent in the first decade of the 21st century, and has risen only slightly, to 14.8 percent, in the last 8 years.

In summary, fiscal rules in Peru, despite their various modifications and their intrinsic pro-cyclical nature (essentially due to their effects on public debt as a percentage of GDP), do not seem to have negatively influenced public investment.

2. ACTORS AND INSTITUTIONS

What are the institutions and actors of fiscal policy in Peru?

Fiscal policy in Peru is protected by the corresponding legislation. In general, this legislation comes from initiatives of the Executive Power, led by the Ministry of Economy and Finance (MEF), which had to be approved by Congress. That was the case of the four fiscal laws and modifications to individual articles of the different laws.

The task of ensuring compliance with the legislation lies essentially with the MEF.

First, the MEF, in August of each year, with the approval of the Council of Ministers, publishes the Multiannual Macroeconomic Framework (MMF), a document that contains the macroeconomic and fiscal projections for the next four years, considering compliance of the current fiscal rules.

Second, based on the MMF projections, the MEF drafts the Projects of Budget Law of Public Sector, of Financial Equilibrium of Public Sector Budget and of Public Sector Indebtedness, for the corresponding fiscal years. The first Law sets the level and composition of public expenditure, and it is made by the General Directorate of Public Budget (GDPB). The second Law records the balance between public spending, tax collection and indebtedness, and it is also elaborated by the GDPB. The third Law shows the design of public indebtedness, and it is prepared by the General Directorate of Public Debt. These Projects are sent by the Executive Power to Congress before 30 August of each year and must be approved before 30 November of each year.

Third, the MEF periodically issues fiscal rule compliance reports. Since 1 January 2017, MEF publishes a quarterly Report of Fiscal Expenditure Rules, as well as its Monitoring Report of Public Finances and Fiscal Rules of Regional and Local

Governments. Also, due to article 10 of Legislative Decree 1275, MEF presents an Annual Report on Compliance with Fiscal Rules, which shows the evolution of public finances and the evaluation of the annual compliance of the fiscal rules of the Regional and Local Governments. Additionally, MEF elaborates the document of Declaration of Compliance of Fiscal Responsibility of the NFPS, whose frequency is also annual.

On the other hand, an additional component of fiscal policy is the Fiscal Stabilization Fund (FSF). This fund is sustained by a fraction of income from privatizations and concessions, which were sizeable when the fund was created but not anymore. Currently, the fund is sustained by Public Treasury surpluses which are a source of ordinary resources¹⁹. The FSF is an intangible fund that can only be used, in current or capital expenditures, in exceptional situations, natural disasters or significant external shocks, or exogenous shocks that affect both economic activity and government revenues. The FSF reached a peak of 4.5 percent of GDP in 2013 and currently, as of July 2019, only accounts for 2.5 percent of GDP.

A recent fiscal policy actor in Peru is the Fiscal Council (FC). Created in 2013 by Law 30099, it started operating in January 2016. The FC is an independent institution attached to the MEF with the aim of contributing to the independent technical analysis of the macro-fiscal policy by issuing a non-binding opinion on the modification and compliance with fiscal rules, the MMM fiscal projections and the short and medium term evolution of public finances.

Last, the Peruvian fiscal policy has also the concurrence of the National Superintendence of Tax Administration (NSTA), an agency attached to the MEF,

¹⁹ In good times, because of the economy grows or the price of exports rises, government revenues increase, surpluses are generated and the FSF grows.

and whose purpose is to manage, apply, control, sanction and collect government tariffs and taxes.

3. METHODOLOGY

The research proposal combines two strategies. On the one hand, the narrative analysis, which is a descriptive and reflexive approach. On the other, the quantitative analysis through the application of the Synthetic Control Method, the building of a DSGE model, and a debt sustainability analysis.

3.1. NARRATIVE ANALYSIS

As we can see in tables 1 and 2, in section 1, we have identified all the modifications over the fiscal deficit rule and the non-financial current expenditures rule during the period 1999 to 2018. The modifications in fiscal laws will be essential for our narrative analysis.

The main objective of this section is to keep track of the motivations lying behind fiscal rules changes and to get lessons from the Peruvian experience during their implementation. The narrative analysis will be complemented with some interviews show in table 3.

Modification	Charge	Interviewee		
Low 20000 (2012)	Former Minister of	Alonso Segura Vasi		
Law 50099 (2015)	Economy and Finance			
	Former Manager of			
Law 30099 (2013)	Fiscal Policy Department			
Legislative Decree	- MEF	César Liendo Vidal		
1276 (2016)	Vice Minister of			
	Economy			
Legislative Decree Former Minister of		Alfredo Thorne Vetter		
1276 (2016) Economy and Finance				
Law 27245 (1999) Consultant		locé Valdorrama		
Law 27958 (2003)				

Table 3: List of interviewees

Law 30099 (2013)		
Legislative Decree		
1276 (2016)		
Law 30637 (2018)	Vice Minister of Treasury	Betty Sotelo Bazán
Law 30637 (2018)	Vice Minister of	Michal Canta Tarraras
	Economy	

The access to the interviewees listed on table 3, in general terms, is very good. Our leading researcher, Waldo Mendoza, has worked or interacted closely with the above interviewees because of his experience in the Ministry of Economy and Finance (MEF) and in his actual position as President of the Fiscal Council of Peru.

3.2. QUANTITATIVE ANALYSIS

The quantitative section of this research proposal aims to study the effect of fiscal rules implementation and analyze the performance of alternative designs over public investment and fiscal sustainability.

Because of the complexity of the task, we will use a set of complementary tools to helps us:

- a) estimate the macroeconomic effects of fiscal rules implementation over public investment,
- b) quantify the performance of alternative fiscal rules over public finances, and
- c) study the implications of current and alternative fiscal rules over public debt sustainability.

In the following subsections, we describe the main features of each tool to be used and link them to the aims concerning this research proposal. We follow the classification of methodologies from IMF (2018).

3.2.1. Counterfactual analysis

We will address the estimation of the macroeconomic effect of fiscal rules implementation over public investment through the application of the Synthetic Control Method (SCM). In that sense, we will be able to answer the question: *What has been the impact of fiscal rules implementation since 2000 over public investment in the Peruvian economy?*

According to Abadie et al (2010), the SCM quantifies the effects of events or policy interventions that take place at an aggregate level and affect aggregate entities, such as countries or subnational governments. For that purpose, the method allows for the creation of a "synthetic" or artificial entity through the weighted average of data from countries that have similar characteristics as the country under study.

In the context of our research proposal, the SCM will be applied for building a retrospective scenario of the Peruvian economy without fiscal rules. Later, the effect of the fiscal rules implementation over public investment is obtained as the difference between the observed time series and its synthetic control.

The number of applications of the SCM for studying macroeconomic issues has grown over the last decade because of the increased availability of databases and the development of econometric packages. In this proposal, we take two recent papers as references. In Asatryan et al (2018), the authors studied the effect of constitutional-level balanced budget rules over fiscal outcomes for a group of countries. The authors found the introduction of these rules is associated with a reduction in the likelihood of experiencing a debt crisis and with a decrease of 11 percentage points in the ratio of public debt to GDP. Also, Martinelli and Vega (2019) estimated the long-term consequences of the militar interventionism in Peru. The authors pointed out the economic reforms of the early 1970s in Peru had sizable loses in per-capita GDP along two decades (around a 50 percent fall in GDP per capita in 1990). The fall of GDP was linked both to a decline in capital accumulation and to a decrease in productivity.

Despite of its flexibility and rising use, the SCM has some disadvantages. For instance, the IMF (2015) highlights the presence of two potential sources of bias when this method is applied for studying the macroeconomic effects of fiscal policy reforms. According to that paper, results could be potentially biased upwards because of the difficulty to disentangle the impact of these reforms from other factors. Also, if the researcher includes countries (in the comparator group) which also underwent fiscal policy reforms, then results could be potentially biased downwards.

a) The Synthetic Control Method

Following the notation of Martinelli and Vega (2019), if J + 1 countries are observed, the first unit is the treated country exposed to the policies (fiscal rules implementation), while others remain isolated to the policy. The last group is know as "control group". Outcomes are observed for T periods and the policy starts in $T_0 + 1$ (with $1 \le T_0 < T$). The observed outcome vector for each country is $Y_j = (Y_{j,1}, ..., Y_{j,T_0}, ..., Y_{j,T})$ and may be 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:

$$Y_{j,t} = Y_{j,t}^N + \alpha_{j,t} D_{j,t}$$

where $D_{j,t}$ is an indicator variable that takes the value of 1 for the treated unit after T_0 and is zero otherwise. 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. According to Abadie et al (2010), $Y_{j,t}^N$ is expressed as follows:

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

where δ_t is a time-fixed effect, μ_j is a time-invariant unobserved predictor with time-varying coefficients λ_t , Z_j is a time-invariant vector of predictors with timevarying coefficient θ_t , and $\epsilon_{j,t}$ is a country-level unobserved shock. 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, $T_0 + 1$ y T, the SCM approximates the unobserved $Y_{1,t}^N$ by a synthetic control unit. This is a weighted average of potential controls that best approximates the relevant pre-intervention characteristics of the treated country.

Let the weighting matrix be $W = (w_2, ..., w_{J+1})'$ where the elements are the contribution of each control country to the synthetic control unit. Notice $w_j \ge 0$ and $w_2 + \cdots + w_{J+1} = 1$. The estimator of the counterfactual is a linear combination of the observed outcomes of the potential control regions, such that:

$$\hat{Y}_{1,t}^{N} = \sum_{j=2}^{J+1} w_j Y_{j,t}$$

In this sense, the estimated treatment effect for the treated country for each 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

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

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

The vector W_t^* 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 a $k \times J$ 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. Additionally, the elements from V matrix will be obtained from combinations such that the mean squared prediction error of the outcome variable is minimized over some set of pre-intervention periods.

b) Empirical strategy

Our variable of interest is public investment, naturally. The data will be obtained from the Investment and Capital Stock Dataset of the International Monetary Fund (IMF).

In the case of the Peruvian economy, the fiscal deficit rule, despite its modifications and exceptions, is the more long lasting rule. With this rule, the public investment is the most endogenous component of public expenditures, because of the rigidity of current expenditures. In that sense, public investment is greater when tax pressure, GDP or export prices are greater too, because of fiscal revenues increases; or when the numeric limit of the fiscal deficit rule is higher or more flexible²⁰. All of these variables expand the fiscal space for public investment. By the same token, public investment is lower when current expenditures or public debt interests payments are larger.

On the other hand, we may add the ratio of public debt to GDP as a predictor, following Ardanaz et al. (2019). This variable is a proxy of potential constraints on external financing which will also affect the public investment. Additionally, as we can see in section 1, given a fiscal deficit limit, a lower public debt will increase the fiscal space for public investment because of its direct and indirect effects on interests payments of public debt.

²⁰ We will not include the numerical limit of fiscal deficit rule as a predictor because of the synthetic unit will be based in countries without this kind of regulatory arrangement before the year 2000.

From this set of variables, we choose GDP, tax pressure (proxied with the ratio of fiscal revenues to GDP), public debt and export prices as predictors. Moreover, we will use terms of trade instead of export prices because of its availability in the database. Finally, we will add population as a predictor, following Ardanaz et al. (2019)²¹. The variables and their sources are shown in Table 4.

Outcome			Source				
Log	of	General	Government	Investment and Capital Stack Dataset			
Invest	ment			Investment and Capital Stock Dataset			
Predic	tors			Source			
Log of	f GDP			Investment and Capital Stock Dataset			
Log of Terms of Trade				DataMarket.com			
Log of Population				World Economic Outlook Database			
Fiscal	revenu	ies to GDP le	evel	World Economic Outlook Database			
				World Economic Outlook Database			
Public Debt to GDP level				and Historical Public Debt Database			
				(International Monetary Fund)			

Table 4: Variables

As we mentioned previously, the choice of predictor variables and the control group is of utmost importance to reduce potential biases in the results.

In case of control groups, we will work with three (see Table 5). The first one contains Latin America and the Caribbean countries. The second group is formed by emerging markets, using the classification of the *Emerging Market Bond Index* from JP Morgan. Additionally, we consider commodity exporters from the classification of the IMF *(World Commodity Exporters Database).*

Regarding the treatment year, we will set it in 2000. Since that year, fiscal rules operated in the Peruvian economy after the passing of the Prudence and Fiscal

²¹ We should have considered current spending among predictive variables. As we have seen, given our fiscal rules, this variable can affect negatively public investment. The reason is that we have not found enough statistical information on this variable.

Transparency Law (Law 27245, published in December 1999). Last, the weighting matrix W^* will be calculated with two complementary methods from Abadie et al. (2010), and Becker and Klößner (2018). All computational codes are available as R software packages supporting these methods.

In sum, we will estimate six versions of the SCM. The one with LAC control group, treatment year set in 2000 and with a weighting matrix calculated using Abadie et al. (2010) will be the base model. The other five models will be used for robustness checks.

With fiscal rules							
Latin America and the Caribbean	Emerging Markets		Commodity exporters				
Argentina (2000)	Argentina (2001)	Pakistan (2005)	Australia (1985) Gabo		Gabon (200	abon (2002)	
Brazil (2000)	Brazil (2000)	Poland (1999)	Botswana (2003)		Guinea Biss	au (2000)	
Chile (2001)	Chile (2001)	Czech Republic (2001)	Camerun (2002)		Indonesia (1967)		
Colombia (2000)	Colombia (2000)	Romania (2007)	Canada (1998)		Iran (2010)		
Costa Rica (2001)	Hungary (2004)	Russia (2007)	Chad (2002)		Mali (2000)		
Ecuador (2003)	India (2004)		Chile (2001)		Mexico (20	06)	
Jamaica (2010)	Indonesia (1967)		Colombia (2000)		Mongolia (2	2013)	
Mexico (2006)	Israel (1992)		Congo (2002)		Niger (2000))	
Panama (2002)	Malaysia (1959)		Ivory Coast (2000)		Nigeria (2007)		
Paraguay (2015)	Mexico (2006)		Ecuador (2003)		Norway (2001)		
Uruguay (2006)	Nigeria (2007)		Equatorial Guinea (2002)		Russia (2007)		
Without fiscal rules (control groups)						
Latin America and the Caribbean	Emerging Markets		Commodity exporte	prs			
Bolivia	Bangladesh	Turkey	Algeria	Saudi Arabi	а	Congo Democratic Republic	
El Salvador	China	Ukraine	Angola	Kazakhstan		Papua New Guinea	
Guatemala	Egypt	United Arab Emirates	Azerbaijan	Kuwait		Syria	
Haiti	Oman	Venezuela	Bahrain	Libya		Timor-Leste	
Honduras	Philippines	Vietnam	Bolivia	Oman		Trinidad and Tobago	
Nicaragua	Qatar		Brunei	Surinam		United Arab Emirates	
Dominican Republic	South Africa		Chad	Qatar		Venezuela	
Trinidad and Tobago	Taiwan		Guyana	South Africa	a	Yemen	
Venezuela	Thailand		Iraq	Sudan		Zambia	

Table 5: Classification of countries (without Peru)

Note: Number in parentheses is the implementation year of fiscal rules according to IMF (2017). Source: JP Morgan and IMF.

3.2.2. Model-based approach

The second goal of our quantitative analysis is to compare the impact of alternative fiscal rules over public finances. In this case, we will answer the question: *What would have happened with public investment if fiscal rules had been different?* In contrast to the SCM, we will estimate the effect of alternative fiscal rules over public investment using a model-based approach and compare them regarding the observed performance of this variable during the period 2012-2016.

As we mentioned above, the Peruvian economy has fiscal rules that drive either the fiscal deficit or the growth of non-financial current expenditures since 2000. Since 2013, an additional rule targets the ratio of public debt to GDP. While these rules have undergone modifications and exceptions, they are essential pillars of the Peruvian macroeconomic strength. However, a possible flaw of their design is that they induce a procyclical stance in the behavior of public investment.

During booms, fiscal revenues increase, and the non-financial current expenditures are constrained by their rule. In this case, there is room for more public investment. However, during busts, fiscal revenues decrease, the non-financial current expenditures remain constant because of the great rigidity of their main components and the fiscal deficit rule is the active constraint. Then, the public investment is the adjustment variable and it will must to reduce in order to fulfill the rule.²²

Because of this stylized fact, we choose a period of decelerating economic growth in the Peruvian economy (2012-2016) to analyze the performance of alternative designs of the fiscal deficit rule. During the period 2012-2016, export prices fell 6.7 percent on average, when in the previous five-year term, they grew by 11.4 percent. Moreover,

²² When the public debt rule (no more than 30 percent of GDP) was implemented, the ratio of public debt to GDP was 19.2 percent. In 2017, it grew until 24.9 percent, such that in practice this rule has not been an active constraint over the fiscal policy behavior during the sample years.

the non-commodities GDP growth was 4.4 percent during 2012-2016, while it was 7.9 percent in the previous five-year period. Therefore, during the decelerating economic growth period, capital expenditures reduced in 1.0 percentage point (from 5.7 to 4.7 as a percentage of GDP) while during the boom they increased in 1.7 percentage point (from 3.5 to 5.2 as a percentage of GDP).

We propose to analyze two alternative designs of the fiscal deficit rule. In theory, these new rules are acyclical. We consider a structural deficit rule which corrects the transitory effects of the business cycle and export prices cycle over fiscal accounts, mainly on the fiscal revenues side. Moreover, we will use the golden rule, which is applied to the current deficit, such that the public investment is exempt from any normative limit.

As the IMF (2018) mentioned, the structural deficit rule gives greater predictability for public expenditures because it isolates the cyclical effects of GDP and export prices. However, its calculation and real-time monitoring are difficult.

Additionally, the golden rule sets a quantitative limit over the fiscal deficit net of capital expenditures (current deficit), allowing public investment to be financed with public debt while current expenditures are financed by fiscal revenues. This way, the golden rule establishes a growth-friendly fiscal policy. However, this rule does not consider either the maintenance expenditures (accounted as current expenditures) nor some budgetary concepts which favor the accumulation of human capital. Moreover, it may generate fiscal unsustainability problems.

For dealing with the goals of this subsection, we will use a dynamic stochastic general equilibrium model (DSGE). The DSGE models allow understanding the transmission mechanism and the aggregate consequences of exogenous shocks using a theoretical consistent structure. The use of this tool for the analysis of fiscal topics in

small open economies is growing in recent years as we can see in García-Cicco and Kawamura (2015)²³, Melina et al. (2016)²⁴ and Suescún (2018)²⁵.

In our case, the DSGE model will serve as a tool for building counterfactual scenarios like in Groshenny (2013)²⁶. In that sense, we will get the shocks from the baseline model and will add them in new models which have alternative fiscal rules. Then, we will simulate the evolution of the variables of interests from the period 2012 to 2016. The base model follows Garcia-Cicco and Kawamura (2015) but with some modifications in the fiscal policy block for allowing the presence of public investment and public capital, and for matching the model with the features of the Peruvian economy.

In general terms, the model follows the RBC tradition, with Ricardians and non-Ricardians households, three productive sectors (tradable, non-tradable and commodity-exporting), producers of investment and capital goods, entrepreneurs who manage physical capital and a fiscal policymaker who executes productive and non-productive expenditures (public investment and current expenditures,

²³ The authors built an RBC model with three sectors (tradable, non-tradable and commodity sectors), calibrated using Chilean data. The model has a fiscal deficit rule which can be conventional or structural. With this model, they studied the impact of the implementation of fiscal rules over households welfare when the economy faces commodity prices shock.

²⁴ They described the DIGNAR model (Debt, Investment, Growth and Natural Resources). With this tool, they analyzed the macroeconomic effects of the increase in public investment in natural resources rich countries. The model added novelty elements like investment inefficiency or absorption capacity frictions and diverse arrangements for the fiscal policy.

²⁵ The author showed the FMM-MTFF model and studied the implementation of macro-fiscal frameworks in the medium run. This is an RBC model with three sectors (tradable, non-tradable and commodity sectors) and additional elements which assures a better match between the model and the data. It is calibrated for Colombian and Peruvian economy in annual frequency.

²⁶ The author executed a counterfactual analysis by turning-off monetary policy shocks over the United States economy during the period 2002-2006. Later, he generated simulated paths for inflation, unemployment and the interest rate during that period.

respectively). The public expenditures are financed with fiscal revenues (from final goods consumption taxes, income taxes and commodity production taxes) and public debt (internal and external).

The base model has seven exogenous processes: commodity prices, commodity production, public debt composition, tradable sector technology, non-tradable sector technology, international interest rate, and tradable goods price. Moreover, it will be calibrated in annual frequency, trying to match the simulated and the observed moments in the Peruvian economy during 2000-2018, which is the period of fiscal rules implementation.

In the next subsection, we describe the fiscal policy block of our DSGE model. The behavior of the other agents follows closely Garcia-Cicco and Kawamura (2015).

a) The fiscal policy block

We assume the policymaker collects taxes from three sources: final goods consumption (c_t), tradable and non-tradable income ($p_t^X y_t^X$ and $p_t^N y_t^N$), and commodity production ($p_t^{Co} y_t^{Co}$). The fiscal revenues (rev_t) are given by:

$$rev_t = \tau^{C}c_t + \tau^{R}(p_t^{X}y_t^{X} + p_t^{N}y_t^{N}) + \tau^{Co}p_t^{Co}y_t^{Co}$$

where τ^{C} , τ^{R} and τ^{Co} are tax rates to consumption, income and commodity production respectively. Additionally, the policymaker has access to external $(d_{t}^{g^{*}})$ and internal (d_{t}^{g}) debt markets and purchases non-tradable goods (current expenditures), g_{t}^{c} , and investment goods (public investment), i_{t}^{g} . In consequence, the financing needs, f_{t} , follow the next equation:

$$f_{t} = p_{t}^{n}g_{t}^{c} + p_{t}^{i}i_{t}^{g} + d_{t-1}^{g^{*}}(1 + r_{t-1}^{*}) + d_{t-1}^{g}(1 + r_{t-1}) - rev_{t}$$

As Suescún (2018), we assume a fraction ϕ_t^g of financing needs is obtained from domestic debt market. Therefore, a fraction $1 - \phi_t^g$ is obtained from foreign debt market:

$$d_t^g = \varphi_t^g f_t$$
$$d_t^{g^*} = (1 - \varphi_t^g) f_t$$

where φ^g_t follows an AR(1) process:

$$\varphi^g_t = \big(1-\rho_g\big)\varphi^g + \rho_\varphi\varphi^g_{t-1} + \varepsilon^\varphi_t$$

And $\epsilon_t^{\phi} \sim N(0, \sigma^{\phi})$ is a public debt composition shock. Moreover, the public capital (k_t^g) follows the next equation:

$$k_t^g = (1 - \delta^g)k_{t-1}^g + \left[1 - S_g\left(\frac{i_t^g}{i_{t-1}^g}\right)\right]i_t^g$$

where δ^g is the depreciation rate of public capital and $S_g(\cdot)$ is its adjustment cost. Notice that k_t^g affects tradable and non-tradable production through their respective Cobb-Douglas functions.

b) Fiscal rules

b.1) Current expenditures rule

We set the current expenditures rule as follows:

$$p_t^n g_t^c = \phi^{gc} \left(p \times g dp \right)$$

where $p \times gdp$ is the nominal long-run (steady state) GDP. Therefore, the current expenditures are a constant fraction of that concept²⁷.

b.2) Fiscal deficit rule

²⁷ The model does not have a balanced-growth path. In that sense, we cannot link the non-financial current expenditures with the long run GDP growth.

In this case, the fiscal deficit follows the next equation:

$$p_t^n g_t^c + p_t^i i_t^g + d_{t-1}^{g^*} (r_{t-1}^* + \eta_r) + d_t^g r_{t-1} - rev_t = \eta_{0,t}$$

where p_t^n is the price of non-tradable goods, p_t^i is the price of investment goods, r_t^* is the international interest rate, r_t is the domestic interest rate, $\eta_{0,t} = \varphi_0^{fr}(p_t \times gdp_t)$ is a fraction φ_0^{fr} of the nominal GDP, and η_r is an adjustment parameter which assures the public debt stationarity.

b.3) Structural fiscal deficit rule

The rule over structural fiscal deficit is given by

$$p_t^n g_t^c + p_t^i i_t^g + d_{t-1}^{g^*}(r_{t-1}^* + \eta_r) + d_t^g r_{t-1} - rev = \eta_1$$

where $\eta_1 = \phi_1^{fr}(p \times gdp)$, so the legal limit is set as a constant fraction, ϕ_1^{fr} , of the nominal long-run (steady state) GDP. Moreover, rev is the steady state fiscal revenues level.

b.4) The golden rule

The golden rule is set over the current deficit:

$$p_t^n g_t^c + d_{t-1}^{g^*}(r_{t-1}^* + \eta_r) + d_t^g r_{t-1} - rev_t = \eta_{2,t}$$

When this rule is introduced to the model, the current expenditures rule (b.1) is turned off. Moreover, $\eta_{2,t} = \phi_2^{fr} p_t \times gdp_t$. Additionally, the public investment follows a stochastic AR(1) process in logs:

$$\log(i_{t}^{g}) = (1 - \rho_{i})\log(i^{g}) + \rho_{i}\log(i_{t-1}^{g}) + \epsilon_{t}^{i,g}$$

where i^g is the public investment steady state level and $\varepsilon_t^{i,g} \sim N(0,\sigma^{ig}).$

3.2.3. Scenarios analysis using stochastic simulations

To what extent do current fiscal rules and alternative designs affect the sustainability of public finances? The last goal of our quantitative analysis is to assess the impact of the current fiscal rules and alternative designs over the future path of public debt.

We understand the concept of fiscal sustainability as Talvi and Végh (2000). According to this Talvi and Végh, public debt is sustainable if the government is solvent without much need to make significative adjustments in the planned trajectories of revenues and expenditures and, at the same time, if it is in a liquid position. This definition is complemented by Escolano (2010) and IMF (2013) definitions, which point out fiscal sustainability is guaranteed if the ratio of public debt to GDP is stabilized around a prudent level in the medium run.

We will apply a debt sustainability analysis (DSA) through a probabilistic approach, following Celasun et al. (2006)²⁸. This methodology requires the estimation of a Vector Autoregressive (VAR) model and equations or identities for fiscal accounts. With this system, we will simulate scenarios with the current fiscal deficit rule and the two alternatives (structural deficit and golden rule). In that sense, the results will show us different paths of public debt for the next six years (from 2019 to 2023) through *fancharts*. Later, we will calculate the likelihood of exceeding the current limit over public debt for each scenario (no more than 30 percent of GDP).

a) Simulation of macroeconomic variables

We will estimate a VAR model for macroeconomic variables which affect the public debt dynamics directly or its main determinants. From this model we will get the

²⁸ As IMF (2018) pointed out, a debt sustainability analysis cannot be executed through a DSGE model because this tool has, by definition, a public debt sustainability condition which assures its stationarity.

estimated parameters and the reduced-form residuals. Next, we will simulate forward each variable. The model is:

$$\begin{bmatrix} y_{1,t} \\ y_{2,t} \end{bmatrix} = \begin{bmatrix} c_1 \\ c_2 \end{bmatrix} + \begin{bmatrix} \mathbf{A}'_1 & \mathbf{A}'_2 \\ \mathbf{B}'_1 & \mathbf{B}'_2 \end{bmatrix} \times \begin{bmatrix} x_{1,t} \\ x_{2,t} \end{bmatrix} + \begin{bmatrix} \mathbf{D}'_1 \\ \mathbf{D}'_2 \end{bmatrix} \times x_{3,t} \begin{bmatrix} \epsilon_{1,t} \\ \epsilon_{2,t} \end{bmatrix}$$

where $y_{1,t}$ and $y_{2,t}$ are vectors of n_1 foreign variables and n_2 domestic variables, respectively; while $x_{1,t}$ and $x_{2,t}$ are vectors with p lags of those variables, so $x_{1,t} = [y_{1,t-1}, ..., y_{1,t-p}]'$ and $x_{2,t} = [y_{2,t-1}, ..., y_{2,t-p}]'$. Additionally, $y_{3,t}$ is a vector of n_3 exogenous domestic variables, such that the vector $x_{3,t} = [y_{3,t-1}, ..., y_{3,t-p}]'$ contains their p lags.

The vector of foreign variables comprises the annual growth of export prices (Δp_t^{Co}), the annual growth of world GDP (g_t^*) and the international interest rate (r_t^*); while the vector of domestic variables considers the annual growth of GDP (g_t), the annual depreciation of bilateral real exchange rate (Δq_t) and the domestic interest rate (r_t). The vector $y_{3,t}$ contains the annual growth of capital expenditure in real terms (Δi_t^g).

On the other hand, the parameters to estimate are the vector of intercepts c_1 and c_2 , as well as the matrices A_1 , A_2 , B_1 , B_2 , D_1 and D_2 . The errors are $\epsilon_{1,t}$ and $\epsilon_{2,t}$ with dimensions $n_1 \times 1$ and $n_2 \times 1$, respectively.

In order to capture the main features of a small open economy, we will suppose that $A'_2 = 0$ and $D'_1 = 0$, such that the domestic variables do not affect the dynamics of foreign variables. Moreover, we model the impact of public investment over domestic variables through D'_2 . This effect is usually overlooked in this kind of models.

The system will be estimated by full information maximum likelihood method, with p = 1, and with quarterly frequency information from the period 2003Q1 to 2018Q4. Later, we will simulate 500 paths for each variable of the system using the estimated coefficients and the errors draw through the Bootstrap method.

b) Simulation of fiscal variables

In contrast to Celasun et al. (2006), we do not need to estimate a fiscal reaction function on the primary deficit because we will assume the strict fulfillment of fiscal rules in all the forecast period. However, we need to model the behavior of the main fiscal accounts by econometric models or accounting identities. In the case of fiscal revenues, we propose the model:

$$\Delta fr_{t} = \alpha_{0} + \alpha_{1} \Delta fr_{t-1} + \alpha_{2} g_{t} + \alpha_{3} \Delta p_{t}^{Co} + \epsilon_{3,t}$$

where Δfr_t is the annual growth of General Government fiscal revenue. Notice we add a new source of uncertainty with $\epsilon_{3,t}$ (tax policy shock). The errors from this equation will be draw through Bootstrap.

On the other hand, the public debt interests in domestic (\bar{d}_t^{DC}) and foreign (\bar{d}_t^{FC}) currencies are defined by:

$$\overline{\mathrm{int}}_{t}^{\mathrm{DC}} = \frac{r_{t}\overline{d}_{t-1}^{\mathrm{DC}}}{1+g_{t}}$$
$$\overline{\mathrm{int}}_{t}^{\mathrm{FC}} = \frac{r_{t}^{*}(1+\Delta q_{t})\overline{d}_{t-1}^{\mathrm{FC}}}{1+g_{t}}$$

c) Fiscal rules

c.1) Non-financial current expenditures rule

We will assume the fulfillment of the upper limit over the non-financial current expenditures (g_t^c) in all the forecast period.²⁹

c.2) Fiscal deficit rule

We will assume the fulfillment of the fiscal deficit rule ($\overline{fd}_t = 1,0\%$). With the simulations of the other fiscal variables, the public investment will be obtained as a residual from the next equation³⁰:

$$\overline{i^{g}}_{t} = \overline{fr}_{t} - \overline{g^{c}}_{t} - \overline{int}_{t}^{DC} - \overline{int}_{t}^{FC} + \overline{fd}_{t}$$

Later, the primary deficit as a percentage of GDP (\overline{pd}_t) will be calculated by the next identity:

$$\overline{\mathrm{pd}}_{\mathrm{t}} = \overline{\mathrm{g}^{\mathrm{c}}}_{\mathrm{t}} + \overline{\mathrm{i}^{\mathrm{g}}}_{\mathrm{t}} - \overline{\mathrm{fr}}_{\mathrm{t}}$$

while the ratio of public debt to GDP (\overline{d}_t) will evolve according to its dynamic equation:

$$\overline{d}_t = \frac{1}{1 + g_t} \left[(1 + r_t) \overline{d}_{t-1}^{DC} + (1 + r_t^*)(1 + \Delta q_t) \overline{d}_{t-1}^{FC} \right] + \overline{pd}_t$$

c.3) Structural fiscal deficit rule

We will assume fiscal revenues are the only component affected by the cyclical adjustment from business cycle and export prices cycle. In that sense, public investment is defined by the next equation:

$$\overline{\iota^g}_t = \overline{fr}_t^* - \overline{g^c}_t - \overline{int}_t^{DC} - \overline{int}_t^{FC} + \overline{fd}_t$$

 30 Where $\ \overline{X}_t = \frac{X_t}{Nominal \ GDP_t} \$ and X is any fiscal variable.

²⁹ The non-financial current expenditure of the General Government may not grow above the upper limit of the range of plus and minus 1 percentage point of the average real GDP growth over 20 years. To calculate this average, the real GDP growth rates of the previous 15 years, the current year and the projections of the subsequent 4 years are used.

where \overline{fr}_t^* are the structural fiscal revenues as a percentage of GDP. This fiscal variable is calculated from:

$$\widetilde{\mathrm{fr}}_{\mathrm{t}} = \mathrm{fr}_{\mathrm{t}} - \alpha_2 \, \widetilde{\mathrm{g}}_{\mathrm{t}} - \alpha_3 \, \widetilde{\mathrm{p^{Co}}}_{\mathrm{t}}$$

where \tilde{fr}_t are the structural fiscal revenues in levels, α_2 and α_3 are the elasticities of fiscal revenues to GDP and export prices, respectively. Moreover, \tilde{g} is the business cycle and $p^{\widetilde{Co}}_t$ is the export prices cycle. The variables expressed as cycles are obtained by the Baxter and King filter. Later, $\bar{fr}_t^* = \frac{\tilde{fr}_t}{Nominal GDP_t^*}$ where Nominal GDP_t^{*} is the long-run nominal GDP.

Finally, we will combine the previous equations with the definition of the primary deficit, the dynamic equation of public debt and the current expenditures rule for getting the simulated paths for all the system.

c.4) The golden rule

The golden rule is over the current deficit, so the constraint affects the current expenditures directly. In this case, the rule (c.1) is not active. Current expenditures as a percentage of GDP are given by:

$$\overline{g^{c}}_{t} = \overline{fr}_{t} - \overline{int}_{t}^{DC} - \overline{int}_{t}^{FC} + \overline{cd}_{t}$$

where \overline{cd}_t is the current deficit as a percentage of GDP, while the growth of public expenditures (Δi_t^g) follows an AR(1) process:

$$\Delta i_t^g = i^g + \rho_i \Delta i_{t-1}^g + \epsilon_{4,t}$$

where i^g is the intercept and ρ_i is the persistence parameter of the process. Notice that we will add a new source of uncertainty, $\epsilon_{4,t}$, when the golden rule is active. This is interpreted as public investment shock. Later, i^g_t will be expressed as a percentage of GDP. As last step, we will combine the simulated paths for current and capital expenditures with the definitions of primary deficit and public debt.

4. ON THE POTENTIAL RELEVANCE OF POLICY IMPLICATIONS

The policy implications of this research will be derived from the several results that we will find and from the different methods that we will use.

First, by using synthetic control methods we aim to estimate the effect of fiscal rules implementation in year 2000 over public investment in the years that followed³¹. In theory, the design of fiscal rules has encouraged a procyclical stance in public investment, so that our results will be conditioned by the sign of the economic cycle. Hence, we expect that the introduction of fiscal rules has reduced public investment relative to a counterfactual without fiscal rules in the years before commodity price booms (2000-2003); while in the economic booming years (2004-2011), fiscal rules might have allowed greater capital expenditure. These results, however, can be mitigated by the impacts of rules on fiscal consolidation that relax, as we saw in section 2, the fiscal space for public investment.

Nevertheless, these results should be taken carefully. The estimation of the effects using synthetic control methods is more accurate in the years that followed the first implementation of fiscal rules. As we move away from the implementation year, confounding factors difficult to isolate kick in and made the results more difficult to analyze.

Second, unlike the synthetic control method, the exercise based on the DSGE model will allow us to analyze issues about the design of fiscal rules. In this case, because of our analysis focuses on a period of economic slowdown, we expect that the

³¹ In this case, the introduction of fiscal rules is understood as a "one-time" policy intervention.

alternative fiscal rules (of structural fiscal deficit and the golden rule), which are – by definition - acyclic, will allow greater public investment relative to the path observed between the years 2012-2016. Additionally, the use of the DSGE model will allow us to rank the performance of each rule proposed in our analysis through consumer welfare criteria or following a loss function of the fiscal policy maker.

Finally, the stochastic simulation exercise will provide information on the potential paths that the public debt would take in case the economy has different fiscal rules and is exposed to shocks of similar magnitude to those observed in previous years. Ex ante we expect that the implementation of acyclic fiscal rules generates an increase of the volatility of public debt, although its implications for fiscal sustainability will be different. We also expect that the structural deficit rule will allow a decreasing path of public debt in the future, even less than in the case of the observed fiscal deficit rule. Meanwhile, the golden rule, by setting public investment "free", would generate a path of public debt whose trajectory would be above the two alternative scenarios. Therefore, there would be a greater probability that the public debt exceeds the legal ceiling of 30 percent of GDP when the fiscal policy maker implements the gold rule.

These findings will allow us to make policy proposals that can support the permanence of the essentials of the fiscal rules that have governed Peruvian fiscal stance in the last 18 years or, eventually, their replacement, total or partial, by rules that are better in terms of economic growth, fiscal sustainability and welfare.

CENTRO DE INVESTIGACIONES SOCIOLÓGICAS, ECONÓMICAS, ANTROPOLÓGICAS Y POLÍTICAS (CISEPA) - SUMMARY OF INSTITUTIONAL EXPERIENCE 2010-2018

The Pontificia Universidad Católica del Perú (PUCP) —founded in 1917—, is the number one university of Peru, number 18 in South America, and the only Peruvian university among the top 500 in the world in the international rankings. This position is recognition of the quality of their teaching, research, publications, social responsibility, contribution to culture and undeniable academic and institutional leadership. Thus, the university aims to consolidate its excellence with international standards and committed to our country, which is recognized as the largest multidisciplinary center of scientific, humanistic and cultural innovation in Peru for its broad academic and institutional leadership, for being a defender of the values of democracy, rights and human development, and for promoting the responsible use of natural resources and the environment, all in consonance with the Christian principles that inspire it.

The leadership exercised by the university on the basis of the status achieved, which feeds on objective and qualitative factors such as the quality of professors, the prestige of the graduates, the quality of academic publications, technological developments, cultural events and all the activities carried out by the University as a living expression of its mission and that give it a reputation and legitimacy among its peers and society in general. The PUCP has been able to use its recognition and institutional leadership for creative purposes, to promote academic and scientific development and as an authoritative source of opinion on the great problems of our country. In this way, the PUCP has laid the foundations to become a research university, encouraging the academic work of professors and students through its

faculties, departments, and research centers and institutes from a multiinterdisciplinary approach.

The CISEPA belongs to the Faculty of Social Sciences, to the Departments of Social Sciences and Economics of the PUCP. Since 1966, it focuses on interdisciplinary applied research and seeks to contribute to the design and evaluation of public policies, in order to respond to the main economic, political and social problems of the country. It also builds capacity through the School of Researchers, allowing research results to be shared in order to influence public opinion and contribute to political and academic debate.

Objectives of CISEPA are to promote interdisciplinary and social research among the disciplines of Anthropology, Economics, Political Science and Sociology; give greater visibility and space to research in Social Sciences, especially in non-academic sectors such as business, public, and others; and, develop strategies, techniques and methodologies, tools and data for research in Social Science. The CISEPA organization is structured in three areas: Research and Advocacy Coordination, Project Management Coordination and Training Services Coordination.

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JUSTIFICATION OF THE CHOICE OF THE RESEARCH TEAM

The team of researchers is trained to make relevant and solid research on the theme of the call.

The project leader, Waldo Mendoza, has several publications in Public Finance and also has an outstanding experience in public management. In the research team, Marco Vega has developed academic articles using the synthetic control method. Similarly, Carlos Rojas has done research in the fiscal field in the Ministry of Economy and Finance as well as in the Fiscal Council, and handles easily the DSGE models. The research assistant Yuliño Anastacio, in addition to being the best student in Economics of PUCP, has just supported his undergraduate thesis in the fiscal field. In order to provide detailed information of experience of each one, we include curricula vitae of the researchers in the annex.

DIFUSSION STRATEGY AND POLICY IMPLICATIONS

We hope that our diffusion strategy will contribute to our research having effects on fiscal policy.

The diffusion will be done on three fronts.

First, in the front of those involved with fiscal policy. We pretend to present the results of the investigation to the Minister of Economy and Finance and its main officials, and to the board of the Fiscal Council.

Second, on the academic front, first, through the Department of Economics and the Centro de Investigaciones Sociológicas, Económicas, Políticas y Antropológicas (CISEPA) of the Pontificia Universidad Católica del Perú (PUCP). On the PUCP campus, an event circumscribed to some 30 leading researchers and policy makers will be organized. Second, through the Economic and Social Research Consortium (CIES), an association of 49 institutions dedicated to research and teaching. In this case, an open event will be organized where the research will be presented, with comments by an academic and a policy maker.

Third, in media front, the research coordinator will give interviews in the most important written and radio media and television. At the same time, opinion articles will be published in the two Peruvian newspapers that have a good section of Economy, El Comercio and Gestión.