DOES FISCAL CONSOLIDATION IMPROVE PUBLIC INVESTMENT EFFICIENCY ?

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Abstract: Our paper investigates the effect of fiscal consolidations on public investment efficiency. Drawing upon a "treatment effects" local projection Jordà and Taylor (2016) methodology and stochastic frontier analysis (SFA) à la Kumbhakar et al. (2015), we provide evidence of significant efficiency gains during fiscal consolidations periods on a sample of 53 developed and emerging countries over 1980-2011 period. The positive gain goes up to 5 years after the onset of fiscal programs with a cumulative improvement of about 4% percentage points at the end foresight horizon. Robust to a wide range of alternative specifications, huge public investment efficiency gains arise during economic slack, in emerging countries, with high perceived sovereign default risk as well as with the support of IMF programs. Moreover, the real depreciation policy improves the quality of public investment during fiscal consolidations periods. Our findings support the idea that fiscal consolidations, even reducing the level of public investment, may ensure the long run economy development through better public management.

Keywords: fiscal consolidation; public investment efficiency; local projection, average treatment effects.

1 Introduction

The recent global financial 2007-09 turmoil has led, almost a decade after, to significant concern about the sustainability of public finances, with historically increase in debt ratios. (IMF, 2019) Indeed, the recessionary effect related to this systemic crisis led governments to implement fiscal expansionary policy in order to attempt to boost growth and private consumption. Logically, this fiscal stimulus policy has increased debt and fiscal deficits.

Since 2010 however, and more accurately after the Greek crisis episode, policymakers understood the need to design credible strategies to clear their public finances and give good signal to financial markets. Thereby, fiscal consolidations programs were quickly designed and austerity packages have been implemented.

This situation has revived the interest of academics to revisit the impacts and main characteristics of fiscal adjustments, with a particular attention on their successful ability to reduce debt and their expansionary (or recessionary) effects on growth. Although there is not a consensus in the literature, most of the papers are aligned with the fact that composition of consolidations packages matters for the growth pace.¹

In fact, Alesina et al. (2015, 2018); Yang et al. (2015), amongst others, support that spending based fiscal consolidations are associated with less output losses than tax based ones.

In addition, successful fiscal stabilizations appear to rely mainly on spending cuts rather than tax increases (Afonso and Jalles, 2012; Alesina and Ardagna, 1998; Heylen et al., 2013).

Focusing on public expenditure, many contributions go deeper into the composition of fiscal contractions packages to identify which component government should be cut first. Although current spending cuts, especially wage and transfers, have higher expansionary effects and strongly reduce deficit/debt (Alesina and Ardagna, 1998; Alesina and Perotti, 1995), governments mostly implement fiscal contractions through public investment cuts for political considerations (Balassone and Franco, 1999; Bamba et al., 2019; De Haan et al., 1996; Roubini and Sachs, 1989).

At the first glance, decline in the public investment may lead to strong adverse impact on the economy. Indeed, several theoretical and empirical papers highlight the positive link between public infrastructure and economy development (Canning and Pedroni (1999); Demetriades and Mamuneas (2000); Esfahani and Ramirez-Giraldo (2003)).²

The cut in public investment may hurt economic growth (Abiad et al. (2016)), overall productivity (Aschauer (1989)), and welfare (Heijdra and Meijdam (2002)), to the point where, given the current global mild economic conditions, IMF (2014, 2015) advocate for large public investment in infrastructure to sustain the global recovery after the crisis (echoing the 2014 "Juncker Plan" of the European Commission). As such, fiscal consolidations aimed at short-run stabilization may hurt the economy in the long-run through their detrimental effect on public investment, calling for a reflection upon how they could be re-designed to allow avoiding such undesirable consequences.

However, another part of the story is worthy of attention. In fact, it seems that the great part of positive effects of public capital on economy growth stems from its quality rather than its quantity. The starting point of this reflexion comes from the seminal paper of Pritchett (2000). The author questioned the large positive effects of public investment on growth, that has been found in the empirical studies. He outlines that the use of investment rate or Cumulated Depreciated Investment

¹Ramey (2019) surveys the recent development on fiscal multipliers estimates. While government spending multipliers are not above the unity, tax rate change multipliers range from -2 to -3. However, the magnitude of these estimates strongly depend on estimation methods, fiscal and country characteristics.

 $^{^{2}}$ Romp and Haan (2007) for the extended survey.

Effort (CUDIE) leads to overestimate the impact, because this indicator does not take the efficiency of public capital into account. Following Pritchett (2000), several contributions support this idea and provide theoretical and empirical evidence highlighting efficiency as a key determinant of social and economic impacts of public capital (IMF (2015); Gupta et al. (2014); Furceri and Li (2017)).³

In this paper, we attempt to shed light on the role of fiscal contractions in the constitution of productive public capital stock using 53 developed and emerging countries over 1980-2011 period. We investigate the effects of fiscal retrenchment on the efficiency of public investment. We contribute to the existent literature in several points.

First, we put in the limelight the link between fiscal consolidations and public investment efficiency at the macro level.⁴

Second, we expand the debate of expansionary or recessionary effects of fiscal consolidations by highlighting the efficiency channel. As recommended by the IMF (2019), governments should design growth-friendly fiscal stabilizations programs to reduce debt vulnerabilities and build buffers in case of a major recession. A positive impact of fiscal consolidations on the public investment efficiency may lead to an improvement of the productivity of public capital. An increase in efficiency can be understood as an optimal management and redistribution of public spending in strategic and growth-friendly sectors of the economy. Fiscal adjustment could then be growth friendly if it manages to improve public investment efficiency.

Third, we build a public investment efficiency index following the novel two step approach of Kumbhakar et al. (2015). This estimator provides more consistent and accurate score of efficiency while disentangling the efficiency score into the long and short run component.

Fourth, we use the Jordà and Taylor (2016) AIPW estimation method that combines an impact evaluation assessment and the local projection approach. The first advantage of this strategy is that we control for the allocation bias issue due to the no random assignment of fiscal adjustments episodes. The second advantage is the "double-robust" estimation, meaning that this estimator requires only that one model (between the treatment and outcome) has to be well specified. The third advantage relies on the local projection ability to compute time-varying, non linear and state dependent estimates using few restrictions with respect to other models.

Our baseline findings suggest that countries that experienced fiscal consolidations episodes significantly improve their public investment efficiency over 5 years after the beginning of the shock. The magnitude of the average treatment effects ranges from 0.98 (for the year of adjustment) to 3.96 percentage points (5 years after the shock). These results are robust to various endogenous definitions of fiscal consolidations, to extension of treatment and outcome model, to alternative estimators for efficiency as well as alternative assumptions on propensity score. Moreover, we undertake an interesting exercise of sensitivity with respect to the fiscal conditions (perception of sovereign risk), the state dependence of economy (business cycle and development stage), the presence of IMF supported programs and the implementation of accommodative monetary policy (real depreciation and low policy interest rate). Fiscal consolidations boost the productivity of public

³They find that a higher investment efficiency induces larger impact of public investment on output.

⁴There exists a literature on organizational slack concept and the advantages or disadvantages to have one. Slack refers to the presence of excess resources relatively to the normal efficient operation of an organization(e.g. Welbourne et al. (1999); George (2005); Sgourev and van Lent (2017)). In the government local level, the New Public Management (NPM) paradigm led policymakers to focus more on organizational efficiency and reduce excess capacity, that characterize inefficiency (Hood (1991); Pollitt et al. (2007); Diefenbach (2009); Overmans (2018)). Our study departs from the previous literature by focusing on the macro level of public spending management during fiscal stress.

capital more in the emerging countries, during the downward phase of the cycle, and with a high perceived sovereign default risk. In addition, we still gain in efficiency, through fiscal consolidations, under IMF supported programs and when government increases the competitiveness through real effective exchange rate depreciation.

The paper is organized as follows. Section 2 outline theoretical aspects, Section 3 presents the measurement strategy of fiscal consolidations and efficiency, Section 4 displays some stylized facts, Section 5 exposes our identification strategy, Section 6 reports the baseline results as well as robustness checks, Section 7 exhibits sensitivity tests and Section 8 concludes.

2 Theoretical considerations

2.1 Conception of efficiency in the macroeconomic context

The concept of efficiency is not new in microeconomics, as it is the conventional way to classify firms in terms of performance.

Referring to Farrell (1957), we understand economic (overall) efficiency through two main components: technical efficiency and allocative efficiency. The former is a ability to avoid waste in the production process. More clearly, technical efficiency highlights the level of firm production relatively to the production possibility frontier. The latter refers to an optimal mix of inputs given their respective costs and the production technology. In other words, allocative efficiency reflects the ability to choose, amongst the technical efficient packages, the less cost one. As defined, efficiency can be interpreted as an input conserving orientation (input orientation) or an output augmenting orientation (output orientation).

While input-oriented measures gauge the potential reduction of inputs without altering the level of output, output-oriented efficiency measures estimate how much output can be increased with the same quantities of inputs. The estimation of efficiency can also take the scale of economies into account. We have then constant return to scale (CRS) and variable return to scale (VRS).⁵

Developed first in the management firm literature, efficiency concept gains momentum in the public sector debate pushed by the increasing feeling of public administration accountability and the following New Public Management (NPM) paradigm in the 80s. Several contributions arose in the local (Afonso and Fernandes (2008); Vanden Eeckaut et al. (1993); Worthington (2000)) and regional country level (Zhong et al. (2011)).

Increasingly, researchers try to assess public sector efficiency at the national level with cross sections comparisons between countries. Several papers provide international comparisons of public spending management in various economic sectors including education (Afonso and Aubyn (2006); Witte and López-Torres (2017)) and health (Grigoli and Kapsoli (2013); Schwellnus (2009)).

Government acts as a decision making unit (DMU) by producing public goods and services (outputs) using government spending (inputs). As such, the efficiency of government is a ability to produce the highest level of public goods using public expenditure while avoiding waste.

To measure the performance of public sector, several methods have been implemented with various preference following the sector.

As far as public investment is concerned, the literature on the measurement of efficiency is relatively new and growing.

Dabla-Norris et al. (2012) develop a public investment management index (PIMI) based on four

⁵For more discussion, see Coelli et al. (2005).

critical stages of the process of public investment decision namely the project appraisal, selection, implementation and evaluation.

Gupta et al. (2014), drawing upon the PIMI index, compute an efficiency-adjusted public capital stock to reflect the quality of public investment.

Moreover, IMF (2015) proposes the Public Investment Management Assessment (PIMA) that reinforces the PIMI by taking into account the macroeconomic framework of public investment decision such as fiscal rules, government component coordination, PPP monitoring as well as management of state-owned firms.

Regarding the efficiency frontier analysis method, Albino-War et al. (2014) use the DEA and PFDH method to compute public investment efficiency scores for MENA and CCA Oil-Exporting Countries. They find that there is need to improve public investment management for these countries. The IMF (2015) uses also a non-parametric frontier analysis for over 100 advanced, emerging and low income developing countries. The comparison between the value of public capital (input) and measures of infrastructure coverage and quality (output) across countries reveals average inefficiencies in public investment processes of around 30 percent.

2.2 Transmission channels

Several transmission channels can support a potential impact of fiscal consolidations on public investment efficiency.

The first channel relies on the desire of governments to ensure the long run growth of the economy. Indeed, spending-based fiscal adjustments rely mainly on investments cuts instead of current spending reductions. The decrease in public investment may impact the development of private sector (both consumption and investment) as well as the long run output growth. With the limited fiscal space, the only way to preserve the growth path and fully reach fiscal consolidations aim is to increase the productivity of public investment and in turn public capital. Improvement of productivity requires better management of scare resources and fully employment of economy capacity. This then leads to increase in efficiency.

The second channel refers to fiscal conditions around adjustments and the willingness of governments to convince creditors and markets of the credibility of deficit sustainability strategy. Indeed, fiscal consolidations arise most of the time with specific fiscal conditions such as high debt and deficit, low growth, etc. These conditions decrease the confidence and notation of the financial markets about the country, as well as increase the pessimism of creditors and perceived sovereign default risk. In contrast, successful and growth-friendly fiscal consolidations require credibility from governments to financial markets through providing evidence of the financial solvency of country. As demonstrated by Edwards (1985), investment behavior, more precisely the productive part of investment, give a positive signal to markets actors through the reduction of sovereign bonds spreads. To be productive, investment should have a high quality both in terms of implementation and management.

In order words, the improvement of quality of public capital reduces the pessimism of creditors and contribute to lessen the perception of the sovereign risk. At the end, governments will increase public investment efficiency during fiscal consolidation programs in order to mitigate the pessimism of creditors and increase the likelihood of success of this program.

The third channel hinges upon the presence of international organizations programs such IMF supported programs during fiscal consolidations periods. As highlighted by the IEO (2003), IMF programs induce a large part of fiscal adjustment targets. These programs include some condi-

tionalities and technical assistance (as well as training). More precisely, revenue increase and/or spending management have part of the conditionality package (Crivelli and Gupta (2016); Gupta et al. (2018)). These conditionalities then give incentives to governments to engage structural reforms to strengthen the government efficiency.

Through training and technical assistance, IMF can encourage key reforms by raise awareness of the newest developments in the academic and policy discussion as well as of the best practices internationally.

All in All, fiscal consolidations, in presence of conditionalities from international institutions, may lead to improve public investment efficiency.

3 Identification of fiscal consolidations and efficiency score

3.1 Fiscal consolidations

The main concern when computing the fiscal consolidations episodes is to manage to proper identify the discretionary part in the policymakers decisions. While the first strand of the literature identify fiscal discretionary policy by removing statistically the part of fiscal policy that are related to business cycle, the second strand advocates for the narrative approach that consists to review the budget and legislature documents in order to extract the discretionary part of fiscal policy. Although the narrative approach is increasingly used in the literature (Devries et al. (2011); Guajardo et al. (2014), amongst others), this method is not exempt for serious and fundamental criticisms.

First, Guajardo et al. (2014) admit that fiscal impulse measurement remains biased whether the countries delay their fiscal consolidations till the economic conditions are favorable or reinforce it whether the growth path does not allow to achieve the targeted deficit reduction. Moreover, narrative-based fiscal shocks ignore anticipation effects.

Second, and more problematic, Jordà and Taylor (2016) shed light on the predictability of fiscal consolidations episodes by omitted fiscal variables, even after using the narrative approach as instrument. Following Alesina and Ardagna (1998, 2013) and Bamba et al. (2019), we use the cyclical-adjusted primary balance (capb) that belongs to the first category, to deal with our identification concern.⁶ This strategy consists of extracting the discretionary part of fiscal variables, excluding interest payments. Following Alesina and Ardagna (1998), we build the CAPB in two steps. First, we regress revenues R_t and spending G_t (in ratio of GDP) on a linear time trend (TREND) and the unemployment rate U_t ,for each country, to obtain the cyclically-adjusted revenues and spending (in ratio of GDP)

$$R_t = \alpha_0 + \beta_0 TREND + \gamma_0 U_t + \epsilon_t, \tag{1}$$

$$G_t = \alpha_1 + \beta_1 TREND + \gamma_1 U_t + u_t.$$
⁽²⁾

Using the estimated parameters, we compute what would have been revenues and spending in time t if the unemployment rate has remained constant between t and t - 1

$$R_t^*(U_{t-1}) = \hat{\alpha_0} + \hat{\beta_0} TREND + \hat{\gamma_0} U_{t-1}, \tag{3}$$

 $^{^{6}}$ We also in the second stage use the Jordà and Taylor (2016) approach to deal with the endogeneity and allocation bias concerns.

$$G_t^*(U_{t-1}) = \hat{\alpha_1} + \hat{\beta_1} TREND + \hat{\gamma_1} U_{t-1}.$$
(4)

Second, we construct the discretionary change in the fiscal balance as the difference between the cyclically-adjusted fiscal variables in year t, and their respective values in year t - 1

$$CAPB_t = [R_t^* - R_{t-1}] - [G_t^* - G_{t-1}].$$
(5)

Once we estimate the CAPB, we use an ad-hoc threshold and multi-year definition of fiscal adjustment episode following Alesina and Ardagna (2013):

Definition 1. A fiscal consolidation is either:

(1) the value of the fiscal retrenchment over a 2-year period if the ratio CAPB/GDP improves each year, and the cumulative improvement is of at least 2 percentage points, or

(2) the value of the fiscal retrenchment over a 3-year or more period if the ratio CAPB/GDP improves each year, and the cumulative improvement is of at least 3 percentage points.

This definition has several merits. First, it uses the novel approach that includes both the size and the persistence in the assessment of fiscal consolidations, whereas the size refers to the amplitude (intensity) of the CAPB/GDP change, and the persistence captures the length of the adjustment. Considering both features can overcome the famous "stop-and-go" problem in the fiscal consolidations literature. Second, it ensures the comparability of our analysis with the recent literature on fiscal consolidations that widely draws upon this definition (see e.g.Alesina and Ardagna(2010; 2013); Leigh et al., 2010; Guajardo et al., 2014; Yang et al., 2015).

3.2 Efficiency score

In the same vein of the recent literature in the quality of public investment (Albino-War et al. (2014); IMF (2015); Barhoumi et al. (2018)), we estimate our efficiency score using the efficiency frontier analysis.⁷

However, our approach differs to them insofar as we opt for the parametric method, namely the Stochastic Frontier Analysis (SFA), rather the non-parametric one.⁸ Several reasons motivate our strategy. First, The non-parametric techniques, especially the DEA and FDH (that are widely used), rely on linear optimization programs to build a convex curve that designs the efficiency frontier. As deterministic method, they ignore the random variation in the data, measurement error and any stochastic influence. In other words, this approach considers all variations between units as inefficiency (Kumbhakar and Lovell (2000)). This latter assumption is not fully true, especially in the relationship between between public outcomes and government spending. The level of public spending is not the only factor that determines the level of delivered outcomes in most of public services (education, health, investment, etc.). In the specific case of public investment, some unanticipated and noise shocks such as fall in oil prices, political crises, etc. may influence the way that

⁷It is noteworthy that we are more interested in the technical efficiency than allocative efficiency. First, our aim is to gauge the capacity of policymakers to put "the right coin to the right place with the right way". We are convinced that the technical efficiency fits this objective. Second, the estimate of allocative efficiency requires information on price structure of inputs. Evaluate the prices public sector input seems to be a very complicated task due to the feature of input and inconsistence of price information across countries.

⁸The efficiency frontier approach relies on the computation of the production frontier curve that represents the highest output level reachable using a given set of inputs. This curve materializes the technical efficiency frontier. All DMU on the frontier is technically full efficients and the distance between a unit and the curve is a measure of inefficiency. The efficiency frontier can be estimated through parametric or non-parametric methods.

governments will provide public infrastructure independently of their "true" inefficiency. As such, for the same amount of public investment, country A, which suffers from the unexpected shocks, will have systematically a low public infrastructure output than country B. It will inappropriate to interpret this "bad luck" as inefficiency. Fortunately, SFA allows us to disentangle the inefficiency arising from differences in socioeconomic contexts or "bad luck" from the right efficiency related to bad public sector management. Second, deterministic approach is very sensitive to the presence of outliers, sample size and in the case of heterogeneous units (Elisabetta et al. (2006)). We cover a wide range of developed and emerging countries over substantial large period. The level of public investment as well as its determinants may vary significantly across countries. SFA allow a regression-based approach to control these specificities.

3.2.1 Estimation process

We then estimate our public investment efficiency score following the novel Kumbhakar et al. (2015) methodology. We consider the following model :

$$y_{it} = \alpha_0 + \beta x_{it} + \alpha_i + v_{it} - u_{it}^+ - \eta_i^+ \tag{6}$$

where y_{it} represents the log of the output variable and x_{it} denotes the vector of the input variables (log). While *i* and *t* design the country and the time, the superscript (+) refers to the non-negative value of the corresponding component.

 $\alpha_i, v_{it}, u_{it}^+$, and η_i^+ represent each one a specific component of the error term ϵ_{it} . α_i captures the country-specific effects (country heterogeneity), v_{it} materializes the pure noise term (iid). While u_{it}^+ denotes the transient (short-run) technical inefficiency term, η_i^+ represents the persistent (long-run) inefficiency component. α_0 is a constant.

The use of the Kumbhakar et al. (2015) estimator is suitable in our case for several reasons. First, it controls for the unobserved heterogeneity between decisions making units and separate them to the inefficiency, contrary to most of the popular panel models (Battese and Coelli (1992); Kumbhakar (1991); Lee and Schmidt (1993)). Especially in the panel cross-country analysis, heterogeneous characteristics of countries regarding their economic development, their political situations, etc. may influence the public infrastructure provision without reflecting a bad or good public management.

Second, and most relevant, Kumbhakar et al. (2015) approach provides an interesting and more flexible decomposition of the overall inefficiency (U_{it}) into the short-term - time-varying (u_{it}^+) and long-term - time-invariant- (η_i^+) technical inefficiency term. Even when the previous models separate heterogeneity unit effects (fixed or random) from inefficiency (Greene (2005); Kumbhakar and Wang (2005)); none of them makes a slight distinction between a short-run and a long-run the inefficiency term.

The distinction between transient and persistent inefficiency is very relevant for several reasons. Although the improvement of public investment management (efficiency) is considering as time invariant due the fact that structural reforms implementation are long lasting (Dabla-Norris et al. (2012); Gupta et al. (2014)), there is a substantial part of this management that is likely to evolve over time.

In a microeconomic units context for instance, if we assume that a hospital has an inefficiency due to a excess capacity (more physicians and nurse that we need). The management can decide to reallocate the personnel into different activities in order that part of the physicians' and nurses' daily working hours are employed in day hospital activities rather than being partially under-utilized in a full-time job allocation to acute discharges. This simply reallocation process may increase the labor productivity of hospital and dealt with a short run part of inefficiency (Colombi et al. (2011)). In the same way, policymakers are able to reallocate the investment intentions amongst the different sectors of economy. This reallocation process is not time consuming and can improve in the shortrun a part of efficiency. For the same amount, governments will increase the productivity of global investment by more investing in high growth friendly sectors such as transport and infrastructure sectors. In addition, there are evidence that the institutional context can influence the return on investment and its growth dividends (Esfahani and Ramirez-Giraldo (2003)). However, several institutional indicators, including the Country Policy and Institutional Assessment (CPIA) index, provide evidence of a time-varying improvement of management framework across countries. This may then impact the efficiency of public investment in the short term.

The estimator requires two stage estimations. For this purpose, we rewrite equation (6) as follows:

$$y_{it} = \alpha_0^* + \beta x_{it} + \theta_i + \gamma_{it} \tag{7}$$

with

$$\alpha_0^* = \alpha_0 - E(\eta_i) - E(u_{it}) \tag{8}$$

$$\theta_i = \alpha_i - \eta_i + E(\eta_i) \tag{9}$$

$$\gamma_{it} = v_{it} - u_{it} + E(u_{it}) \tag{10}$$

First, we estimate equation (7) with a standard random effects estimator. We get consistent estimate of β as well as predicted values of θ_i and γ_{it} , denoted $\hat{\theta}_i$ and $\hat{\gamma}_{it}$.

Second, we estimate equation (9) (equation (10)) following a standard stochastic frontier method in order to get the transient (persistent) technical inefficiency, \hat{u}_{it} ($\hat{\eta}_i$).¹⁰

Finally, we compute the time-varying technical efficiency, $RTE = exp(-\hat{u}_{it})$, as well as the persistent technical efficiency, $PTE = exp(-\hat{\eta}_i)$ following (Jondrow et al. (1982)) process.

3.2.2 Output - Input

As mentioned above, the estimation of frontier analysis requires to specify at least one input and one output. In the public sector context, an output can be understood as measurable variable that reflects the performance or the achievement of government in a specific sector. For example in public education sector, the output refers to student's performance such as graduation rates, and student mathematical, reading and scientific literature indicators.¹¹ Public investment is used to provide infrastructure in several economic sectors such as transport, energy, telecommunication, etc. In doing so, we need to find a multi-dimensional index output that can encompass and evaluate

⁹We assume that $\theta_i = \hat{\theta}_i$ and $\gamma_{it} = \hat{\gamma}_{it}$ as it is common in the two-stage estimations.

¹⁰We assume that $v_{it} \rightarrow N(0, \sigma_v^2)$; $u_{it} \rightarrow N^+(0, \sigma^2)$; $\eta_i \rightarrow N^+(0, \sigma_\eta^2)$; and $\alpha_i \rightarrow N(0, \sigma_\alpha^2)$. We predict the technical inefficiency components using the Jondrow et al. (1982) estimators.

¹¹Several papers use the PISA indicators in OCED studies while educational attainment ratio is used in development and emerging countries studies (Clements (2002); Gupta and Verhoeven (2001)).

the performance of public spending in these different aspects. Albino-War et al. (2014) use the infrastructure part of the Global Competitiveness Indicator (GCI), developed by the World Economic Forum (WEF), as output to gauge the efficiency of public investment. However, this index does not fully reflect the performance of public investment as it is not possible to disentangle the public infrastructure from the private infrastructure. IMF (2015) slightly departs from the Albino-War et al. (2014) output by adding another physical composite indicator of infrastructure. This index includes some pure infrastructure indicators (electricity production, access to an improved water source and length of road network) and social services indicators (number of secondary teachers and number of hospital beds). However, the aggregation technique of the sub-components of this index relies on a simple arithmetic mean.¹² Although the assignment of equal weights to distinct dimensions of infrastructure is convenient, it may arise a conceptual issue.

Several papers relax this assumption and propose different aggregation methods for infrastructure based on statistical models (Calderón and Servén (2004, 2014); Francois and Manchin (2013)).

Following Donaubauer et al. (2016a,b); Kaufmann et al. (2011), we compute a global infrastructure index using the Unobserved Component Method (UCM). This approach interprets each sub component of infrastructure index as an imperfect measure of the underlying and unobserved notion of infrastructure. This interpretation turns the aggregation concern into a signal extraction problem. To solve this problem, the UCM approach models each sub-component as a linear function of the common unobserved component of infrastructure with a disturbance term that designs perception errors and sampling variation.¹³ As explained by Donaubauer et al. (2016b), there are several advantages to use UCM approach. First, compared to Principal Components Analysis (PCA), this method is robust to the unbalanced panel structure and the presence of outliers. Second, in the case of low correlation between the quantity and quality index, as it may be the case, the PCA is inappropriate to draw sufficient common factors between sub-components of infrastructure. Third, the unobserved indicator of infrastructure is expected to be more informative and precise about the infrastructure quality and quantity than any single index. We use 6 sub-index of infrastructure classified into 3 main groups:

- Transport: we use as quantitative indicator the length of road network, normalized by the density of population. For the quality of road, we use also the ratio of paved roads to total road network. - Telecommunications: we select the fixed telephone subscriptions and the faults per 100 fixed telephone lines per year.

-Energy: we use the electric power consumption per capita, as quantity, and the electric power transmission and distribution losses in percentage of output as the quality of energy.

After computing the output of public infrastructure, we present our selected inputs for the frontier estimation.

The first input is the government capital stock in percentage of GDP. This variable stems from the IMF database and is based on the perpetual inventory method.

The second input is the stock of public-private partnership in percentage of GDP. This variable captures the increasing number of public private partnership project in may countries.

The third output is the GDP per capita that control for the quality of infrastructure that is lead

 $^{1^2} y_i = \sum_{j=1}^4 \left(\frac{x_{ij} - \bar{x}_j}{\sigma_{x_j}}\right)$ where represents the sub-index j for the country i; $\bar{x}_j \sigma_{x_j}$ denotes the mean and the standard error of sub-index j respectively.

 $^{^{13}}$ See Donaubauer et al. (2016b) and Kaufmann et al. (2011) for the comprehensive and extended explanation of the process.

by the development stage. We introduce all input variables with a one lag period to mitigate the endogeneity.

4 Data and preliminaries

4.1 Data

We use an unbalanced panel over the 1980-2011 period. The selection of our 53 developed and emerging countries relies essentially on the availability of data to compute the CAPB. We use the Mauro et al. (2015) database that provides, to our knowledge, the widest coverage of fiscal aggregates. We do not include developing countries in our sample due to the need of high quality data on unemployment to build the CAPB.

Our treatment variable is the fiscal consolidation variable dummy that takes 1 during the consolidation episodes and 0 otherwise. The construction process of this variable has been detailed above.

Our outcome variable is the time-varying technical efficiency of public investment. We focus on the transient part of the efficiency as we are interested in the short-run impact of fiscal consolidation instances on the more flexible part of public investment management.

Two groups of covariates are considered for our analysis. The first group is related to the treatment model and is used to predict the likelihood of experiencing a fiscal consolidation, namely: (i) the cyclical part of the log of real GDP, (ii) the revenue to GDP ratio, (iii) the expenditure to GDP ratio, (iv) the GDP growth rate, (v) debt to GDP ratio, (vi) the real interest rate; (vii) the balance current account; (viii) the total investment; (ix) the national savings; (x) the trade openness, and (xi) the foreign direct investment (fdi). Apart from real interest rate, all variables are in percentage of GDP. The predictors are one year lagged. The second group of control variables is used in the outcome model to predict the change in the efficiency at each horizon h. This group includes : (i) the one and two years lagged change of the public efficiency before the beginning of fiscal consolidations, (ii) a time trend, (iii) the quality of government, and (iv) the investment profile.

4.2 Descriptive statistics

We identified 123 fiscal consolidation episodes during our considered period of 32 years. Figure 1 depicts the distribution of these episodes in percentage of the total number of fiscal consolidations in our sample, based on their size and persistence. Among them, 65 fiscal consolidations (52.85%) last 2 years, 19 (15.45%) last 3 years, and so on (see the Appendix for the list of fiscal consolidations); and 50 fiscal consolidations (40.65%) improve the fiscal balance between 2-4 percentage points of GDP, 38 (30.89%) between 4-6 percentage points of GDP, and so forth.

Prior to begin the econometric analysis, we compare the cumulative change of efficiency with and without consolidations episodes. Figure (2) displays the means comparisons after 1, 2 and 3 year of the onset of the consolidations instances. Stylized facts presented in figure (2) highlight a high level of efficiency in the fiscal consolidations periods relatively to the non-fiscal consolidation periods. The difference is more important (0.88% points improvement in consolidation time vs 0.39% points in normal time) 3 years after the shock.



Figure 1 – Distribution of the fiscal consolidation episodes by persistence and size

(a): the percentage of fiscal consolidations by length. (b): the percentage of fiscal consolidations by size.

5 Methodology

Our estimation strategy relies on the combination of local projections method and augmented inverse propensity score following Jordà and Taylor (2016) and Banerjee and Zampolli (2019). This identification methodology is a novel and powerful approach in the macroeconomic context to deal with random allocation bias and other sources of endogeneity.

To proper identify the causal impact of fiscal consolidation, we need to evaluate the efficiency of those that experienced with fiscal adjustments and those that did not.

In the randomization assignment, an estimate of the average treatment effect would be the better way to reach our objective. Although we took caution that our fiscal consolidation episodes reflect some exogenous shocks of fiscal policy, the decision to adjust or not may be strongly related to some fiscal variables such as the level of the debt or deficit.¹⁴ This includes some underlying differences between countries that adjust and not relatively to the observable variables, leading to a selection or allocation bias. In such context, the identified causal effects may include other aspects beyond the fiscal consolidation impact.

To deal with these issues, our strategy requires three steps. First, we estimate the policy propensity score for each observation regarding the consolidation decision. This score reflects the likelihood that a fiscal consolidation episode arises based on their determinants. We estimate a saturated

 $^{^{14}}$ Jordà and Taylor (2016) provide evidence of the predictability of CAPB based fiscal consolidations episodes even after using narrative based fiscal episodes as instrumental variable.



Figure 2 – Comparison of average public efficiency between fiscal consolidations and normal times

probit model designed as follows:

$$\hat{p}_{i,t} = Pr(D=1|X_{it}) = \Phi(X,\Gamma) \tag{11}$$

Where \hat{p}_{it} is the probability of experiencing a fiscal consolidation and X_{it} is a vector of policy factors. While Γ represents the set of estimated coefficients, Λ is the probit distribution function. The second step consists to re-randomize our sample and fits the outcome model. We use the inverse of the propensity score to re-balance the sample. Indeed, countries engaged in fiscal consolidations episodes, in our sample, includes too many observations with high propensity scores compare to a sample obtained by a standard randomization process.¹⁵ Using the inverse of propensity score to weigh observations, we mimic the quasi randomization assignment i.e. higher weight is attributed to observations with small propensity score (those underrepresented amongst the treated) in the treatment group and inversely in the control group. Propensity score is acknowledged as an useful tool to eliminate all systematic differences between outcomes due to observables since the seminal work of Rosenbaum and Rubin (1983).

With a more balancing sample, we use the following Local Projection method of Jordà (2005) to derive the potential outcomes:

$$\Delta eff_{i,t+h} = \alpha_i^h + \Lambda^h D_{i,t} + \theta_0^h \Delta eff_{i,t-1} + \theta_1^h \Delta eff_{i,t-2} + \gamma_0^h TREND + \epsilon_{i,t+h}$$
(12)

¹⁵Reversely, our control group contains very small number of observations with high propensity score than if we have a randomized sample.

with $h \in [0,5]$. $\Delta eff_{i,t+h} = (eff_{i,t+h} - eff_{i,t-1})/eff_{i,t-1} \times 100$ represents the cumulative change of efficiency score, in percentage, between the period t-1 and t+h. $D_{i,t}$ is our policy dummy variable that takes 1 in the presence of fiscal consolidations and 0 otherwise. $\Delta eff_{i,t-1}$ and $\Delta eff_{i,t-2}$ outline the change of efficiency score for t-1 and t-2. We introduce *TREND* to account for the time improvement of efficiency. While α_i denotes the country fixed effects, $\epsilon_{i,t+h}$ is the idiosyncratic term.

The use of local projections has several merits. First, it allows the estimation of direct and indirect effects of fiscal consolidations on efficiency. Second, this strategy is more robust to misspecification than other autoregressive strategies because it estimates direct impulse response from individual regression at each h horizon. Third, it is a very flexible estimation method with highly non linear and state dependent specification to account for realism in the econometric analysis. Moreover, local projection is widespread used in the fiscal multipliers, financial crises and fiscal consolidations literature, see e.g. (Auerbach and Gorodnichenko (2012); Banerjee and Zampolli (2019); Diniz (2018); Jordà (2005); Jordà and Taylor (2016); Pontines (2018)).

Finally, the third step consists to compute a specific average treatment effect using the AIPW estimator developed by Lunceford and Davidian (2004).

$$\hat{\Lambda}^{h}_{AIPW} = \frac{1}{n} \sum_{i} \sum_{t} \left\{ \left[\frac{D_{i,t}(eff_{i,t+h} - eff_{i,t-1})}{p_{i,t}} - \frac{(1 - D_{i,t})(eff_{i,t+h} - eff_{i,t-1})}{1 - p_{i,t}} \right] - \frac{D_{i,t} - p_{i,t}^{2}}{p_{i,t}^{2}(1 - p_{i,t})} \left[(1 - p_{i,t})m_{1}^{h}(X_{it}, \hat{\eta}_{1}^{h}) + p_{i,t}m_{0}^{h}(X_{it}, \hat{\eta}_{0}^{h}) \right] \right\}$$

$$(13)$$

where $m_j^h(.,.)$ defines the conditional mean of $eff_{i,t+h} - eff_{i,t-1}$ for the treatment group (j = 1)and the control group (j = 0) and $\hat{\eta}_i^h$ refers to the specific parameters.

This estimator fits into the double robust class of estimators and it is the most efficient i.e. with the smallest asymptotic variance. This estimator brings together the power of Regression Adjustment and Inverse Propensity score Weighting method with a stabilization term. According to Glynn and Quinn (2009), the stabilization term is expected to be null if we use the correct specification of the entire data generating distribution, while different to zero whether the policy propensity score is close to zero or one. ¹⁶

In addition, the AIPW estimator achieves better results than comparable estimators when the treatment or outcome model is misspecified and presents relatively equal or lower mean square error whether both models are well specified. Moreover, the AIPW provides unbiased estimates as long as at least one of the treatment or the outcome model is correctly specified (Lunceford and Davidian, 2004; Wooldridge, 2007).

6 Results

We summarize in this section our estimates coming from the previous specifications. As mentioned above, our estimation procedure includes several stages. We first begin with the first-stage (eq 11) results of predicting the policy propensity score model in Table 1, based on saturated probit specifications. The findings confirm that fiscal consolidations are not randomly assigned but are

¹⁶It is not necessary to truncate the propensity score weights with this estimator (Imbens, 2004).

endogenous to several factors. From the most parsimonious equation with lag of the dependent variable, we increasingly add the output gap , government revenue, public spending, growth rate of GDP and debt to GDP ratio. Based on the column (6), fiscal consolidation appears to be a long lasting process (reflected by the significant and positive impact of the lag dependent variable), likely occurs during huge fiscal imbalances (large public spending and low government revenue) as well as when the economy is growing below potential. Moreover, the AUC ¹⁷ statistic of 0.90 (column (6))confirms the power of our predictive model. This means that our model offers better prediction of fiscal adjustment decisions than a random predictor that give the same probability (0.5) to a country in each of the two groups. In addition, table (2) and figure (12) provide strong evidence of good balance diagnostics. Indeed, table (2) shows that the use of propensity score to weigh observations has considerably clear a great part of the difference of covariates between treated and control group. Further, figure (12) confirms a good overlap between treatment and control observations. Addressing allocation bias issue, we can now estimate the average treatment effect.

6.1 Average Treatment effects of fiscal consolidations

After mimic a quasi-randomization assignment through the Inverse propensity weightings, we estimate the second stage outcome model (eq12) using the Local Projection (LP). The average treatment effect of fiscal consolidations is computed following the AIPW estimator (equation13).

figure(3) depicts graphically the cumulative response of public investment efficiency to fiscal consolidation over our 5 year forecast horizon.

While the dark gray and light gray areas are respectively 90% and 95% confidence intervals, the solid blue line illustrates the point estimates.

Based on coefficients in table(3), public investment efficiency positively and significantly reacts to fiscal contractions episodes over time, with higher cumulative impact of around 4 percentage points up to 5 years after the onset of shock. Put differently, implement a fiscal consolidation program leads to short run efficiency gains relative to not engage in the adjustment process.

Mostly relying on spending cuts than tax hikes (Heylen et al., 2013; Schaltegger and Feld, 2009; Von Hagen et al., 2002), consolidations significantly decrease public spending relative to government consumption (Bamba et al., 2019; De Haan et al., 1996; Roubini and Sachs, 1989). With small room for investment and the need to support long run growth and sustainable development, governments take a close look at of fiscal policy management and meticulously select high potential productive sectors to investment.

6.2 Alternative definitions of fiscal consolidations

Our baseline results rely on the Alesina and Ardagna (2013) of fiscal adjustments episodes. We use a range of alternative definitions to check whether results are sensitive to the way we identify fiscal consolidations instances.

First, we increase the initial threshold of CAPB to reinforce the discretionary aspect of the policy. Under "Threshold 1", a fiscal consolidation corresponds to either 2 years of subsequent improve in the CAPB with cumulative change of at least 2.5 percentage points (pp) of GDP or 3 years with at least 3.5 percentage points. This hint at countries have an uniform reactions to discretionary

¹⁷AUC means Area Under the Curve. It provides the level of false positive and true positive for each probability. It is commonly used to estimate the classification property. See Jordà and Taylor (2016).

Figure 3 – Cumulative response of efficiency to fiscal consolidation over 6 years



shocks in fiscal policy. "Threshold 2" ("Threshold 3") use 2 years & 3 pp (4 pp) or 3 years & 4 pp (5 pp) as criterion.

Second, we account for the country-specific heterogeneity in fiscal responses to shock by using the novel approach of Wiese et al (2018) based on the bai perron structural filter. This approach relies on the identification of structural break in the Data Generating Process (DGP) of CAPB to define fiscal consolidation episodes.¹⁸

Third, we extend the CAPB computation framework following Fatas and Mihov (2003) approach. Indeed, Alesina and Perotti (1995) use only unemployment and trend as covariates to adjust fiscal variables. Instead, Fatas and Mihov (2003) regress primary deficit on GDP, interest rate and inflation. While GDP captures a more comprehensible aspect of the state of economy (especially in emerging countries), interest rates and inflation may affect the budget, through decision to invest in public infrastructure, delay in tax collection or indexation of some spending components.

Fourth, we use the CAPB database computed by Kose et al. (2017). Authors use output gap elasticity of expenditures and revenues to extract the discretionary part of the fiscal policy.

As shown by Figure(4), the positive and significant efficiency gains during fiscal consolidations episodes is robust to various definitions of fiscal adjustments.





6.3 Extended treatment and outcome model

We now extend our treatment and outcome model using additional control variables. Indeed, our causal interpretation of the efficiency-fiscal consolidation nexus mainly relies on the "selection on observables" assumption. This means that we have selected sufficient and plausible determinants of fiscal consolidation decisions in order to accurately predict the probability and use them to re-randomize the assignment. As recommended by Lunceford and Davidian (2004) and following Diniz

 $^{^{18}}$ for further detail see Wiese et al. (2018) and Wiese (2014).

Figure 5 – Cumulative response of efficiency to fiscal consolidation: additional controls, efficiency alternative and other propensity score assumptions



(2018); Jordà and Taylor (2016); Kuvshinov and Zimmermann (2019), we double check whether this assumption holds by including in the equation(11) additional potential factors of fiscal consolidations namely: (i) the real interest rate; (ii) the balance current account; (iii) the total investment; (iv) the national savings; (v) the trade openness; and (vi) the foreign direct investment, apart from real interest rate, all variables are in percentage of GDP.

Moreover, we include additional covariates in the outcome model to account for the institutional aspect. It is well known that public finance management is closely related to sound and strong institutions. We refer to the quality of governance $(gov_i crg)$ and the investment profile $(invp_i crg)$ as relevant for investment efficiency. Figure 5 panel (a) reveals that our results remains qualitatively the same.

6.4 Alternative efficiency estimators: True Fixed Effects (TFE) Greene 2005

We now change our efficiency estimators in order to account for the flexibility of specification. Our benchmark specification, using Kumbhakar et al. (2015) process, rely on the two stage procedure and separate the error term in four component. Greene (2005) is a one step specification model which disentangle specific units characteristics from inefficiency. Figure (5) panel (b) confirms the qualitative robustness of our baseline results.

6.5 Alternative assumptions

The baseline specification use the full distribution of propensity score to mimic the sample randomization assignment. This distribution can include some outliers observations with weights near zero or above 10. To mitigate the influence of potential outliers, Imbens (2004) and Cole and Hernán (2008) suggest to truncate the maximum weights to 10. Figure 5 displays results after our truncation maximum weights process to 10 (panel (c)) and 5 (panel (d)). The significant and positive impacts of fiscal consolidations on public investment efficiency still at work.

7 Sensitivity

7.1 Perception of the default risk

We now investigate the sensitivity of fiscal consolidations impact to others fiscal conditions, especially the perception of default risk. Indeed, the expansionary effect and successful of fiscal consolidations are strongly related to the market perception regarding the sustainability of deficit and debt (Guajardo et al., 2014). As such, higher market pessimism should lead to sharp and credible fiscal consolidations in order to convince the creditors and reduce risk premium. As explained above, efficiency gains seems to be a credible channel of fiscal consolidations to positively impact output growth. Hence, we expect that in some "bad" fiscal conditions, proxy by a pessimism of creditors, fiscal consolidations could lead to a significant improvement of public investment efficiency relatively to "good" fiscal conditions. Drawing upon the Institutional Investor Rating (IIR)¹⁹ index, we split our sample into a high perception of the sovereign default risk (index value below the median of the distribution) and the low perception of sovereign risk (index value above the median of the distribution).

Figure 6 – Cumulative impact of fiscal consolidation on public investment efficiency: High vs Low perceived sovereign risk



Figure (6) presents significant and positive efficiency gains for countries that experiencing fiscal

¹⁹The Institutional Investor Ratings (IIR) index relies on assessments of sovereign risk by private sector analysts which range from 0 to 100 (with 0 assigned to the higher perceived sovereign default probability).

consolidations with high sovereign default risk, up to four years after the onset of the program. When there is a small perception of the sovereign default risk, fiscal consolidations do not significantly impact the evolution of technical public investment efficiency. To wrap up, the presence of tight fiscal conditions lead governments to engage drastic fiscal consolidations in order to improve their credibility on financial markets.

7.2 Business cycle

We account now for the state dependency of business cycle. Using the Hodrick and Prescott filter, we characterize the economy in a boom or slump cycle. While the boom period usually depicts an expansion period where the economy is above its potential output, slump denotes a recession phase in which activity is at its lower level. Figure (7) reveals that countries that experienced fiscal consolidations in this latter period get significant gain in efficiency with respect to other countries in recession. However, fiscal consolidations do not lead to significant improvement in efficiency during expansion periods. The scarcity of resource in low output growth period constrains governments to boost activity through better allocation in the high productivity investment and as such increase efficiency of their public investment. This result is quiet interesting because it unveils the benefit of counter-cyclical fiscal policy on public finance management.

Figure 7 – Cumulative impact of fiscal consolidation on public investment efficiency: Boom vs Slump



7.3 Development stage

We are interesting now on the role of structural difference between countries capturing by the level of development. Indeed, there likely exists some underlying difference in the public finance management between developed and emerging or developing countries due to the presence of strong institutions to surround the use of public finance. Such differences may at work to fiscal consolidations and lead to heterogeneous impacts. Figure (8) supports our intuition: Amongst emerging countries, fiscal consolidations significantly raises the public investment management over the entire period with the cumulative impact at the end of 6.05 percentage points. Regarding OECD countries, fiscal consolidations do not appear to make any difference in terms of quality of management.





7.4 IMF programs

Bringing together almost all countries in the world , one of the main activities of the IMF is to provide technical and financial supports to its member states. Governments usually call for IMF intervention when they face financial distress and unsustainable budget deficit. IMF programs are then design to get countries out of such bad situations with sometimes important fiscal actions.²⁰ As such, we investigate the sensitivity of our baseline results to the support of IMF during fiscal contractions. Figure (9) clearly demonstrates the significant improvement of efficiency due to fiscal consolidations under IMF programs. Structural conditionality associated with technical assistant appears to be useful for public finance management.

 $^{^{20}}$ According to the (IEO, 2003) annual report, the average target of fiscal retrenchment was 1.7% of GDP over the 1993-2001 period within 133 IMF programs.

Figure 9 – Cumulative impact of fiscal consolidation on public investment efficiency: IMF vs No IMF Programs



7.5 Monetary Policy: Real Effective Exchange and Short term policy interest rate

To improve the likelihood of successful or their expansionary effects, fiscal consolidations are sometimes surrounded by accompanying policies. Indeed, IMF (2019) highlights that growth-friendly or less costly fiscal consolidations require accommodative monetary policy through lower interest rate and depreciation of real exchange rates. While decrease in interest rates soften the shock on global investment and consumption, the real exchange rate depreciation will foster output growth through increase in net exports. We investigate how these two policies impact our baseline findings. Although Figure (10) denotes efficiency gains of fiscal consolidations associated with real depreciation policy, Figure (11) shows no significant increase in public investment efficiency due to fiscal consolidations with low interest rate. The depreciation of the real effective exchange rate both offset the decrease of global demand from governments by increasing the net exportations. This gain in competitiveness puts pressure on domestic economy, on government as well, and increases the relationship with foreign markets including skills and technology exchange. To support the overall development and more precisely that of private sector, governments should enhance infrastructure and energy through gain in efficiency and performance.





Figure 11 – Cumulative impact of fiscal consolidation on public investment efficiency: High vs Low Policy Interest Rate



8 Conclusion

We investigate in this paper the impact of fiscal consolidations on the transient technical public investment efficiency. Drawing upon a "treatment effects" local projection (Jordà and Taylor, 2016) methodology, we provide evidence of short run significant efficiency gains during fiscal consolidations periods on a sample of 53 developed and emerging countries over 1980-2011 period.

The positive gain goes up to 5 years after the onset of fiscal programs with a cumulative improvement of about 4% percentage points at the end foresight horizon. Robust to a wide range of alternative specifications, our baseline findings appears to be sensitive to the perceived sovereign default risk, economy slack, development stage, the presence of IMF programs as well as the policy mix.

Indeed, technical public investment efficiency gain is higher mostly in the emerging countries, when the economy is in slump as well as well when the perception of the sovereign risk is high. Moreover, fiscal consolidations accompanied by real depreciation highly improve the management of public capital. These findings highlight the fact that fiscal consolidations may ensure sustainable long run economy growth path if they improve the quality of government management, especially in the public investment sector.

References

- Abiad, A., Furceri, D., and Topalova, P. The macroeconomic effects of public investment: Evidence from advanced economies. *Journal of Macroeconomics*, 50:224–240, 2016.
- Afonso, A. and Jalles, J. Measuring the success of fiscal consolidations. Applied Financial Economics, 22:1053–1061, 2012.
- Afonso, A. and Aubyn, M. S. Cross-country efficiency of secondary education provision: A semiparametric analysis with non-discretionary inputs. *Economic modelling*, 23(3):476–491, 2006.
- Afonso, A. and Fernandes, S. Assessing and explaining the relative efficiency of local government. *The Journal of Socio-Economics*, 37(5):1946–1979, 2008.
- Albino-War, M. A., Cerovic, S., Grigoli, F., Flores, J. C., Kapsoli, J., Qu, H., Said, Y., Shukurov, B., Sommer, M., and Yoon, S. Making the Most of Public Investment in MENA and CCA Oil-Exporting Countries. Technical report, International Monetary Fund, 2014.
- Alesina, A. and Ardagna, S. Tales of fiscal adjustment. *Economic Policy*, 13:488–545, 1998.
- Alesina, A. and Ardagna, S. Large changes in fiscal policy: Taxes versus Spending. Tax Policy and the Economy, 24:35–68, 2010.
- Alesina, A. and Ardagna, S. The design of fiscal adjustments. *Tax Policy and the Economy*, 27: 19–68, 2013.
- Alesina, A. and Perotti, R. Fiscal expansions and adjustments in OECD countries. *Economic Policy*, 10:205–248, 1995.
- Alesina, A., Favero, C., and Giavazzi, F. The output effect of fiscal consolidation plans. Journal of International Economics, 96:S19–S42, 2015.
- Alesina, A., Azzalini, G., Favero, C., Giavazzi, F., and Miano, A. Is it the "how" or the "when" that matters in fiscal adjustments?. *IMF Economic Review*, 66:144–188, 2018.
- Aschauer, D. Is public expenditure productive?. Journal of Monetary Economics, 23:177– 200, 1989.
- Auerbach, A. J. and Gorodnichenko, Y. Fiscal multipliers in recession and expansion. In Fiscal policy after the financial crisis, pages 63–98. University of Chicago Press, 2012.
- Balassone, F. and Franco, D. Public investment in the Stability Pact framework. *Concorrenza fiscale in un'economia internazionale integrata, Milano: Franco Angeli*, 1999.
- Bamba, M., Combes, J.-L., and Minea, A. The effects of fiscal consolidations on the composition of government spending. *Applied Economics*, pages 1–16, 2019.
- Banerjee, R. and Zampolli, F. What drives the short-run costs of fiscal consolidation? evidence from oecd countries. *Economic Modelling*, 82:420–436, 2019.

- Barhoumi, K., Vu, H., Towfighian, S. N., and Maino, M. R. Public Investment Efficiency in Sub-Saharan African Countries. International Monetary Fund, 2018.
- Battese, G. E. and Coelli, T. J. Frontier production functions, technical efficiency and panel data: with application to paddy farmers in india. *Journal of productivity analysis*, 3(1-2): 153–169, 1992.
- Calderón, C. and Servén, L. The effects of infrastructure development on growth and income distribution. The World Bank, 2004.
- Calderón, C. and Servén, L. Infrastructure, growth, and inequality: an overview. The World Bank, 2014.
- Canning, D. and Pedroni, P. Infrastructure and long run economic growth. *Center for* Analytical Economics working paper, 99(09), 1999.
- Clements, B. How efficient is education spending in europe. *European Review of Economics* and Finance, 1(1):3–26, 2002.
- Coelli, T. J., Rao, D. S. P., O'Donnell, C. J., and Battese, G. E. An introduction to efficiency and productivity analysis. Springer Science & Business Media, 2005.
- Cole, S. R. and Hernán, M. A. Constructing inverse probability weights for marginal structural models. American journal of epidemiology, 168(6):656–664, 2008.
- Colombi, R., Martini, G., and Vittadini, G. A stochastic frontier model with short-run and long-run inefficiency random effects. 2011.
- Crivelli, E. and Gupta, S. Does conditionality in IMF-supported programs promote revenue reform? *International Tax and Public Finance*, 23(3):550–579, 2016.
- Dabla-Norris, E., Brumby, J., Kyobe, A., Mills, Z., and Papageorgiou, C. Investing in public investment: an index of public investment efficiency. *Journal of Economic Growth*, 17(3): 235–266, 2012.
- De Haan, J., Sturm, J., and Sikken, B. Government capital formation: Explaining the decline. *Review of World Economics*, 132:55–74, 1996.
- Demetriades, P. O. and Mamuneas, T. P. Intertemporal Output and Employment Effects of Public Infrastructure Capital: Evidence from 12 OECD Economies. *The Economic Journal*, 110(465):687–712, 2000.
- Devries, P., Guajardo, J., Leigh, D., and Pescatori, A. A new action-based dataset of fiscal consolidation. 2011.
- Diefenbach, T. New Public Management in Public Sector Organizations: The Dark Sides of Managerialistic 'Enlightenment'. *Public Administration*, 87(4):892–909, 2009.
- Diniz, A. Effects of fiscal consolidations in latin america. *IMF Economic Review*, 66(4): 694–731, 2018.

- Donaubauer, J., Meyer, B., and Nunnenkamp, P. Aid, infrastructure, and fdi: Assessing the transmission channel with a new index of infrastructure. World Development, 78:230–245, 2016a.
- Donaubauer, J., Meyer, B. E., and Nunnenkamp, P. A new global index of infrastructure: Construction, rankings and applications. *The World Economy*, 39(2):236–259, 2016b.
- Edwards, S. The pricing of bonds and bank loans in international markets: an empirical analysis of developing countries' foreign borrowing. National Bureau of Economic Research Cambridge, Mass., USA, 1985.
- Elisabetta, F., Karmann, A., and Koetter, M. The cost efficiency of german banks: a comparison of sfa and dea. Technical report, Discussion Paper Series 2: Banking and Financial Studies, 2006.
- Esfahani, H. and Ramirez-Giraldo, M. Institutions, infrastructure, and economic growth. Journal of Development Economics, 70(2):443–477, 2003.
- Farrell, M. J. The measurement of productive efficiency. Journal of the Royal Statistical Society: Series A (General), 120(3):253–281, 1957.
- Fatas, A. and Mihov, I. On constraining fiscal policy discretion in EMU. Oxford Review of Economic Policy, 19:112–131, 2003.
- Francois, J. and Manchin, M. Institutions, infrastructure, and trade. World development, 46:165–175, 2013.
- Furceri, D. and Li, B. G. The Macroeconomic and (Distributional) Effects of Public Investment in Developing Economies. *IMF Working Paper No.* 17/217, 2017.
- George, G. Slack Resources and the Performance of Privately Held Firms. Academy of Management Journal, 48:661–676, 2005.
- Glynn, A. and Quinn, K. Estimation of causal effects with generalized additive models. *Vienna, Austria: R Foundation for Statistical Computing*, 2009.
- Greene, W. Reconsidering heterogeneity in panel data estimators of the stochastic frontier model. *Journal of econometrics*, 126(2):269–303, 2005.
- Grigoli, F. and Kapsoli, J. Waste not, want not : The efficiency of health expenditure in emerging and developing economies. *IMF Working Paper No.* 13/187, 2013.
- Guajardo, J., Leigh, D., and Pescatori, A. Expansionary austerity? International evidence. Journal of the European Economic Association, 12:949–968, 2014.
- Gupta, M. S., Schena, M., and Yousefi, M. R. Expenditure Conditionality in IMF-supported Programs. *IMF Working Paper No.* 18/255, 2018.
- Gupta, S. and Verhoeven, M. The efficiency of government expenditure: experiences from africa. *Journal of policy modeling*, 23(4):433–467, 2001.

- Gupta, S., Kangur, A., Papageorgiou, C., and Wane, A. Efficiency-Adjusted Public Capital and Growth. World Development, 57:164–178, May 2014.
- Heijdra, B. and Meijdam, L. Public investment and intergenerational distribution. Journal of Economic Dynamics and Control, 26:707–735, 2002.
- Heylen, F., Hoebeeck, A., and Buyse, T. Government efficiency, institutions, and the effects of fiscal consolidation on public debt. *European Journal of Political Economy*, 31:40–59, 2013.
- Hood, C. A Public Management for All Seasons? *Public Administration*, 69(1):3–19, 1991.
- IEO. Fiscal adjustment in IMF-supported programs. Evaluation Report (Washington: International Monetary Fund), 2003.
- Imbens, G. W. Nonparametric estimation of average treatment effects under exogeneity: A review. *Review of Economics and statistics*, 86(1):4–29, 2004.
- IMF. Is it time for an infrastructure push? The Macroeconomic Effects of Public Investment. IMF World Economic Outlook, ch.3. Washington, DC, USA, 2014.
- IMF. Making public investment more efficient. IMF Policy Paper, 2015.
- IMF. Fiscal Monitor: Curbing Corruption. IMF Fiscal Monitor, ch.2. Washington, DC, USA, 2019.
- Jondrow, J., Lovell, C. K., Materov, I. S., and Schmidt, P. On the estimation of technical inefficiency in the stochastic frontier production function model. *Journal of econometrics*, 19(2-3):233–238, 1982.
- Jordà, Ó. Estimation and inference of impulse responses by local projections. *American* economic review, 95(1):161–182, 2005.
- Jordà, and Taylor, A. M. The Time for Austerity: Estimating the Average Treatment Effect of Fiscal Policy. *The Economic Journal*, 126(590):219–255, February 2016.
- Kaufmann, D., Kraay, A., and Zoido-Lobatón, P. Aggregating governance indicators, volume 2195. world Bank publications, 1999.
- Kaufmann, D., Kraay, A., and Mastruzzi, M. The worldwide governance indicators: methodology and analytical issues. *Hague Journal on the Rule of Law*, 3(2):220–246, 2011.
- Kose, M. A., Kurlat, S., Ohnsorge, F., and Sugawara, N. A cross-country database of fiscal space. The World Bank, 2017.
- Kumbhakar, S. and Lovell, C. K. Stochastic production frontier. Cambridge University Press. Kumbhakar, SC, & Sarkar, S. (2003). Deregulation, ownership and productivity growth in the banking industry: Evidence from India. Journal of Money Credit and Banking, 35(3): 403424, 2000.

- Kumbhakar, S. C. Estimation of technical inefficiency in panel data models with firm-and time-specific effects. *Economics Letters*, 36(1):43–48, 1991.
- Kumbhakar, S. C. and Wang, H.-J. Estimation of growth convergence using a stochastic production frontier approach. *Economics Letters*, 88(3):300–305, 2005.
- Kumbhakar, S. C., Wang, H.-J., and Horncastle, A. P. A Practitioner's Guide to Stochastic Frontier Analysis Using Stata. Cambridge University Press, February 2015.
- Kuvshinov, D. and Zimmermann, K. Sovereigns going bust: estimating the cost of default. European Economic Review, 119:1–21, 2019.
- Lee, Y. H. and Schmidt, P. A production frontier model with flexible temporal variation in technical efficiency. The measurement of productive efficiency: Techniques and applications, pages 237–255, 1993.
- Leigh, D., Devries, P., Freedman, C., Guajardo, J., Laxton, D., and Pescatori, A. Will it hurt? Macroeconomic effects of fiscal consolidation. *IMF World Economic Outlook*, 93: 124, 2010.
- Lunceford, J. K. and Davidian, M. Stratification and weighting via the propensity score in estimation of causal treatment effects: a comparative study. *Statistics in medicine*, 23(19): 2937–2960, 2004.
- Mauro, P., Romeu, R., Binder, A., and Zaman, A. A modern history of fiscal prudence and profligacy. *Journal of Monetary Economics*, 76:55–70, 2015.
- Overmans, T. Innovative austerity management. Journal of Public Budgeting, Accounting & Financial Management, 2018.
- Pollitt, C., Van Thiel, S., and Homburg, V. New Public Management in Europe. Palgrave Macmillan, Basingstoke., 2007.
- Pontines, V. Self-selection and treatment effects: Revisiting the effectiveness of foreign exchange intervention. *Journal of Macroeconomics*, 57:299–316, 2018.
- Pritchett, L. The Tyranny of Concepts: CUDIE (Cumulated, Depreciated, Investment Effort) Is Not Capital. *Journal of Economic Growth*, 5(4):361–384, 2000.
- Ramey, V. A. Ten years after the financial crisis: What have we learned from the renaissance in fiscal research? *Journal of Economic Perspectives*, 33(2):89–114, 2019.
- Romp, W. and Haan, J. d. Public Capital and Economic Growth: A Critical Survey. *Perspektiven der Wirtschaftspolitik*, 8(Supplement):6–52, 2007.
- Rosenbaum, P. R. and Rubin, D. B. The central role of the propensity score in observational studies for causal effects. *Biometrika*, 70(1):41–55, 1983.
- Roubini, N. and Sachs, J. Political and economic determinants of budget deficits in the industrial democracies. *European Economic Review*, 33:903–933, 1989.

- Schaltegger, C. and Feld, L. Are fiscal adjustments less successful in decentralized governments?. European Journal of Political Economy, 25:115–123, 2009.
- Schwellnus, C. Achieving Higher Performance: Enhancing Spending Efficiency in Health and Education in Mexico. 2009.
- Sgourev, S. V. and van Lent, W. When too many are not enough: Human resource slack and performance at the Dutch East India Company (1700–1795). *Human Relations*, 70 (11):1293–1315, 2017.
- Vanden Eeckaut, P., Tulkens, H., and Jamar, M.-A. Cost efficiency in Belgian municipalities. CORE Discussion Papers RP 1033, Université catholique de Louvain, Center for Operations Research and Econometrics (CORE), 1993.
- Von Hagen, J., Hallett, A. H., and Strauch, R. Budgetary consolidation in europe: quality, economic conditions, and persistence. *Journal of the Japanese and International Economies*, 16:512–535, 2002.
- Welbourne, T. M., Neck, H. M., and Meyer, G. D. Human resource slack and venture growth: an exploratory analysis of growing employees at a faster rate than sales. *Frontiers of entrepreneurship research*, 19:480–490, 1999.
- Wiese, R. What triggers reforms in oecd countries? improved reform measurement and evidence from the healthcare sector. *European Journal of Political Economy*, 34:332–352, 2014.
- Wiese, R., Jong-A-Pin, R., and de Haan, J. Can successful fiscal adjustments only be achieved by spending cuts? *European Journal of Political Economy*, 54:145–166, 2018.
- Witte, K. D. and López-Torres, L. Efficiency in education: a review of literature and a way forward. *Journal of the Operational Research Society*, 68(4):339–363, April 2017.
- Wooldridge, J. M. Inverse probability weighted estimation for general missing data problems. Journal of econometrics, 141(2):1281–1301, 2007.
- Worthington, A. C. Cost efficiency in Australian local government: a comparative analysis of mathematical programming and econometrical approaches. *Financial Accountability & Management*, 16(3):201–223, 2000.
- Yang, W., Fidrmuc, J., and Ghosh, S. Macroeconomic effects of fiscal adjustment: A tale of two approaches. *Journal of International Money and Finance*, 57:31–60, 2015.
- Zhong, W., Yuan, W., Li, S. X., and Huang, Z. The performance evaluation of regional R&D investments in China: An application of DEA based on the first official China economic census data. Omega, 39(4):447–455, 2011.

A Appendix

Unobserved Component Model (UCM)

The Unobserved Component Model is a well known approach used in economics, especially in the signal extraction problem. This method consists to extract the common unobserved part of the signal from an each individual source of information.

The first application of this tool, as statistical aggregate method, stems from (Kaufmann et al., 1999, 2011) with the computation of the World Governance Indicators (WGI) of the World Bank. As explained in Kaufmann et al. (2011), each individual source of data measures imperfectly the notion of governance but contains a part of the message. In order words, we have a signal extraction problem and need to find how extract the informative signal relative to the underlying component of governance common to each of the data source and how to be close as much as possible to the real measure of governance in a country using various data source. Kaufmann et al. (2011) combine hundreds of individual underlying variables from dozens of different data sources to get six aggregate governance indicators. Regarding the infrastructure index, we face a similar problem since "infrastructure" covers a very wide range of dimensions including telecommunications, transport, energy, etc. coming from different sources with various measurement approaches.

Calderón and Servén (2004) use the UCM approach, with two other aggregate methods, to assess the impact of infrastructure on income inequality. They combine four dimensions of infrastructure, such as Telecommunications, Energy, Roads, and Railways, both covering quality and quantity of aspect of infrastructure.

Donaubauer et al. (2016b) compute a composite index of infrastructure with UCM approach by taking into account other dimension such financial infrastructure.

Figure 12 – Distribution of propensity score for treatment and control groups



Notes: The policy propensity score is computed the probit specification which includes country fixed effects (satured probit). The long dashed red line represents the predicted probabilities of experiencing fiscal consolidations for treatment group while the solid blue line displays those probabilities for control group.

Prob	oit model of	f treatment	at time t (fis	scal consolida	ation event)	
	(1)	(2)	(3)	(4)	(5)	(6)
$CONS_{it-1}$	0.383***	0.365***	0.367***	0.397***	0.397***	0.397***
	(0.012)	(0.013)	(0.012)	(0.012)	(0.012)	(0.012)
GDP HPit - 1		-1.711***	-1.705***	-0.813***	-0.806**	-0.776**
		(0.326)	(0.323)	(0.300)	(0.325)	(0.336)
REV_{it-1}			-0.009***	-0.039***	-0.039***	-0.039***
00 1			(0.002)	(0.003)	(0.003)	(0.004)
EXP_{it-1}				0.037***	0.036***	0.036***
				(0.003)	(0.003)	(0.003)
$GROWTH_{it-1}$					-0.000	-0.000
					(0.003)	(0.003)
$DEBT_{it-1}$						0.000
						(0.000)
Observations	1258	1258	1258	1258	1258	1258
Model AUC	0.839	0.851	0.856	0.899	0.899	0.902
s.e.	0.0126	0.0124	0.0119	0.00924	0.00924	0.00912

Table 1 – Fiscal Treatment Regression, satured Probit Estimators (average marginal effects)

Standard errors in parentheses and clustered by country. $CONS_{it-1}$ refers to the treatment (fiscal consolidations), GDP_HPit-1 is the cyclical component of logarithm of the output. REV_{it-1} and EXP_{it-1} represents respectively the revenues and primary expenditure of government. While $GROWTH_{it-1}$ designs the rate of the output growth, $DEBT_{it-1}$ denotes the level of debt. All variables are included in the lagged value

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

Table 2 – Covariates balance checks between treatment and control groups

			Before Matching				After Matching	
Variables	Treated	Control	Standardized Bias (%)	Variance Ratio	Treated	Control	Standardized Bias (%)	Variance Ratio
Const-1	.70442	.1174	148.5	1.48	.62687	.62687	0.0	1.00
lgdp_hp	00938	.00319	-38.7	1.39	01355	00905	-13.9	1.32
lgdp_growth	2.7019	3.3765	-19.1	1.40	3.8696	3.8904	0.6	2.06
lexpd_gdp	32.863	30.114	21.1	1.14	29.807	32.321	-19.3	1.08
lreven_gdp	33.117	31.692	10.7	1.10	30.991	33.473	-18.6	1.13
ld	56.664	54.684	6.3	0.89	50.448	50.518	0.2	1.85
lrintr	6.568	6.6634	0.8	1.24	9.2974	9.1661	1.0	2.15
IBCA_NGDPD	88178	-1.0006	2.2	1.02	.08403	.73354	-11.9	0.65
INID_NGDP	22.468	23.802	-24.3	1.35	21.538	21.167	6.8	1.81
INGSD_NGDP	21.21	22.157	-13.7	1.15	21.301	21.802	-7.2	1.10
ltrade_gdp	59.281	64.251	-16.8	0.59	64.57	58.667	19.9	0.91
lfdi_gdp	52942	907	12.8	0.60	-1.2098	83503	-12.7	0.69

Following Rubin (2001), a standardized bias below 25% suggest there is a not significant difference between treated and control group for this specific variable. Besides, Rubin (2001) use the ratio of between treated and control group variances as an indicator of balance property. A good balance ratio should be close to 1.0 and a bad balance ratio is less than 0.5 or higher than 2.0

	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5
ATE_IPWRA	0.98^{***}	2.37^{***}	2.54^{**}	2.91^{*}	4.53^{**}	3.96^{**}
	(0.32)	(0.72)	(1.04)	(1.45)	(1.82)	(1.92)
Observations	282	282	282	282	282	282

Table 3 – AIPW baseline

Standard errors in parentheses

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

Table 4 – AIPW robustness: treatment model extend

	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5
ATE_IPWRA	1.12^{***}	3.04^{***}	4.70^{***}	5.77^{**}	5.32^{**}	7.57^{**}
	(0.35)	(0.89)	(1.67)	(2.26)	(2.50)	(3.23)
Observations	223	223	223	223	223	223

Standard errors in parentheses

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

Table 5 – AIPW baseline

	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5
ATE_IPWRA	1.79^{***}	4.33^{***}	4.88^{**}	5.73^{**}	8.60**	7.48^{*}
	(0.61)	(1.36)	(1.94)	(2.71)	(3.46)	(3.73)
Observations	282	282	282	282	282	282

Standard errors in parentheses

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

Table 6 – ATE Risk pr	emium p	cofile
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	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5
ATE u wts high_risk	1.16^{***}	3.98^{***}	4.04^{***}	4.89^{**}	6.91^{**}	1.86
	(0.42)	(1.28)	(1.41)	(1.91)	(2.80)	(3.32)
ATE u wts low_risk	0.27	2.24**	0.07	-0.00	3.80	-3.31
	(0.46)	(1.05)	(1.52)	(2.27)	(2.51)	(3.67)
Pvalue_eq	0.15	0.30	0.06	0.11	0.43	0.32
Observations	282	282	282	282	282	282

Standard errors in parentheses

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

	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5
ATE u wts boom	0.31	0.43	1.45	2.15	1.69	-0.17
	(0.51)	(1.10)	(1.35)	(1.71)	(2.52)	(3.34)
ATE u wts slump	1.11^{*}	2.55^{**}	4.14**	5.22^{**}	6.20**	6.75**
	(0.56)	(1.05)	(1.60)	(2.00)	(2.44)	(2.89)
Pvalue_eq	0.34	0.20	0.23	0.27	0.25	0.20
Observations	282	282	282	282	282	282

Table 7 – ATE: Business Cycle

Standard errors in parentheses

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

	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5
ATE_IPWRA_dev	-0.43	0.07	1.03	1.20	-0.29	-3.00
	(0.66)	(1.10)	(1.01)	(1.03)	(1.51)	(2.13)
ATE_IPWRA_ndev	1.10***	2.19**	3.50^{**}	4.68**	5.84***	6.05***
	(0.33)	(0.84)	(1.35)	(1.76)	(2.09)	(2.10)
Pvalue_eq	0.05	0.14	0.15	0.10	0.02	0.00
Observations	282	282	282	282	282	282

Table 8 – ATE: Development Stage

Standard errors in parentheses

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

	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5
ATE u wts imfp	1.25^{**}	4.66^{***}	3.58^{*}	6.47^{***}	8.79***	10.73***
	(0.58)	(0.95)	(1.92)	(2.19)	(2.65)	(2.76)
ATE u wts nimfp	0.78^{*}	-0.93	2.29	3.08	2.97	-1.95
	(0.42)	(1.33)	(1.43)	(2.06)	(2.76)	(4.01)
Pvalue_eq	0.51	0.00	0.57	0.25	0.11	0.01
Observations	282	282	282	282	282	282

Table 9 – ATE: IMF program

Standard errors in parentheses

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

	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5
ATE u wts High REER	0.48	2.19	0.40	2.35	-3.24	-0.55
	(0.64)	(1.45)	(1.96)	(3.30)	(4.33)	(4.54)
ATE u wts Low REER	2.52^{***}	5.35^{***}	7.43***	8.70***	9.27**	10.68^{**}
	(0.79)	(1.66)	(2.26)	(2.86)	(3.62)	(4.84)
Pvalue_eq	0.05	0.16	0.03	0.19	0.04	0.13
Observations	228	228	228	228	228	228

Table 10 – ATE: REER

Standard errors in parentheses

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

Table 11 – ATE Policy Interest Rate

	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5
ATE u wts High Policy Interest Rate	2.81	4.60	7.67	8.91	11.42	9.75
	(1.57)	(3.16)	(5.17)	(6.32)	(7.31)	(9.32)
ATE u wts Low Policy Interest Rate	0.22	5.25	8.86	11.93	17.11	18.95
	(2.02)	(3.97)	(5.76)	(9.20)	(12.45)	(13.42)
Pvalue_eq	0.23	0.88	0.85	0.76	0.67	0.45
Observations	61	61	61	61	61	61

Standard errors in parentheses

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