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Response of Fiscal Policy to Foreign Aid: Estimation of Impulse Response Functions by Local Projections

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Response of Fiscal Policy to Foreign Aid:
Estimation of Impulse Response Functions by Local Projections

A thesis submitted in partial fulfillment
of the requirements for the degree of
Master of Arts in Economics

by

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Abstract

Does foreign foreign aid make the recipient governments spendthrift or fiscally prudent or neither? In other words, does aid resources discourage domestic revenue mobilization and stimulate government recurrent expenditure rather than funneling the resources in to long-term development projects? Empirical studies on fiscal response behavior of aid receiving governments have not offered a categorical answer yet. Results of previous studies mainly fall into the three categories: "yes", "no" and "neither." By revisiting this topic, the main contribution of current study could be the application of a newly developed time series technique - estimation of Impulse Response Functions by Local Projections - for the first time in the aid effectiveness literature. The findings presented in the form of impulse responses of fiscal policy variables to shocks to foreign aid, suggest that foreign aid depresses tax efforts, while has no significant impact on government recurrent expenditure. These results are stable to variations across the sampling composition, altering time period and data from alternate sources. Moreover, there is an indication of significant and positive association between foreign aid and public investment in the small sample of countries, however the responses do not remain significant in the larger sample with shorter time span.

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0.1 Introduction

Effectiveness of foreign aid has widely been debated for decades both in academia and donor community. On the donor side the structure and mechanism for the better funneling of aid resources has been evolving since 1960s. A significant and recent move made to this end was in 2005 when donor countries and multilateral organizations came together in Paris discussing better ways for achieving improved aid effectiveness. This conference concluded with so-called Paris Declaration on Aid Effectiveness serving as a guideline for all parties – recipient countries donor countries and multilateral organizations. According to this declaration, the donor countries and multilateral organizations agreed to adopt a better approach, which will lead to increased aid effectiveness. The new approach requires a better coordination among donors and partner countries and particularly it was highlighted that partner countries should exercise more ownership and leadership in the design and implementation of development projects (Paris Declaration on Aid Effectiveness and the Accra Agenda for Action, 2005).

In the academic circle, researchers have studied various dimensions of aid effectiveness. They examined the aid impact on economic growth, fiscal policy and one several other sectors of aid receiving economy. This strand of literature mainly empirical has been expanding with availability of more comprehensive dataset and development of econometric techniques. However, so far the results have not been conclusive. In order to get a better insight about why results are mixed, I will do a brief survey of general literature review on aid effectiveness. There are ample evidences that studies with availability of more update and comprehensive dataset and applying a different research methodology could not support the findings of preceding works. In a highly influential paper by Burnside and Dollar (1997), the authors argue that foreign aid improves economic growth in those recipient countries that have sound economic policies, while it has negligible impact in countries with poor policy environment. However, by using a more comprehensive database, Easterly et al. (2003) find that there is little evidence to support the finding that foreign aid improves economic growth in a good policy environment.

Absence of conclusive results in the aid effectiveness studies could be associated with several factors that some are listed here. Firstly, authors have applied various conventional econometric methods, and in most cases they got competing results. Carter (2013) who used a more advanced econometric model on three datasets – Gupta et al. (2004), Remmer (2004) and Crivelli et al. (2012) - suggests that there is not adequate evidence to support the hypotheses of negative relationship between foreign aid and tax revenues, while the mentioned authors argue that foreign aid depresses tax efforts in recipient countries. Secondly, the choice of econometric method and data transformation to construct the variables of interest could change the outcome. Tarp et al. (2015) applied a different empirical strategy using the data of Nowak-Lehmann, Dreher, Herzer, Klasen, and Martinez-Zarzoso (2012) without any log transformation and argue that foreign aid has positive effect on income. While the results reported in the original paper, suggest no effect. Thirdly, Mosley (1987) and White (1992) explain the macro-micro paradox of aid effectiveness, over-aggregation across country and continental level may not produce consistent results. Given the existence varying political economy factors in the aid recipient countries, the cross country studies might generate results that are barely applicable in the case of a single country.

Against this background, the present study will examine the dynamic of interaction between foreign aid and fiscal policy variables, by applying a newly developed time series technique. Estimation of impulse response functions (IRFs) by Local Projection was introduced by Jorda (2005) as an alternative to Vector Autoregressive (VAR) model. As the author points out this method has certain advantages over the conventional VAR, both in the cross-sectional and panel data settings. Further details on this empirical strategy will be discussed in the later sections. As far as the data collection and data transformation are concerned, I follow the recent empirical studies. Further details of methodology, data collection and data transformation will be explored in section 3.

To preclude potential ambiguity due to frequent use of some phrases and terminologies, I would like provide brief clarification. Government consumption, government expenditure, government spending and public consumption are used here as equivalents of government recurrent expenditure that exclude the investment component. Similarly, government

investment and public investment have been used interchangeably. Throughout this study the term “revenue” explicitly denotes to the tax revenue and the non-tax revenue is not included in the debate. Development Assistant Committee (DAC) defines the Official Development Assistance (ODA) as grants or loans transferred to the recipient countries. In the literature most of the researchers have used the grant component of ODA. Roodman (2006) calculated a different measure of ODA called Net Aid Transfer (NAT) which is equal to gross aid transfers plus interest forgiven minus ODA loans and interest received. A few researchers have used this measurement of ODA. In the present work, I have employed both ODA grants and NAT. In terms of wording, the term “foreign aid” has been used as equivalent of these two measures.

0.2 Aid and Fiscal Policy

The theoretical cum empirical seminal work by Heller (1975) is the genesis of the later research modeling the response of three significant macroeconomic factors – taxation, public expenditure and public investment – to foreign aid. The author has derived the models by maximizing a utility function which contains tax revenues, domestic borrowing, public investment, and government expenditure subject to the two budget constraints. Using optimization techniques the reduced form equations have been derived. This work has been extended by subsequent studies and researchers have applied the models with different specification on various datasets.

0.2.1 Tax Revenue

Government consumption are primarily financed by tax and non-tax revenues and borrowing. In the aid-receiving countries, foreign aid is as added as the third source of revenue. So if the consumption level is kept constant, deficiency in one revenue component, should be compensated by increase in others, Heller (1975). In fact, a broad tax base administered efficiently is a reliable source of revenue for the government, however altering the tax rate and composition has political and economic ramifications. The plexiform nature of public finance intertwined with politically motivated fiscal policy formulation makes it difficult to comprehend the dynamic of fiscal policy response to foreign aid. Prior delving in to the review of empirical literature, some crucial points that will illuminate the later discussions will be discussed here. Firstly, the basic economic theory tells us that economic growth is accompanied with higher income generation, regardless of who the main beneficiaries are. Therefore, one direct implication of economic growth would be increased taxable incomes and consequently rising tax revenues if a progressive tax system is in place. However, rising taxable income does not necessarily mean higher tax revenues. Secondly, it is important to know how efficient and transparent the tax administration of a country is. If the aid-receiving countries are suffering from poor institutional quality and have higher corruption index, then this untoward circumstance will have multi-dimensional deleterious effects on overall economy. Rampant corruption will lead to leakage in the revenue mobilization, especially in

tax levy and misappropriation of resources. Poor institutional quality will adversely affect the overall performance of government apparatus, particularly hinder the design and implementation of aid-sponsored development projects.

Against this background, empirical studies have examined the impact of foreign aid on tax revenues. Some researchers have taken into consideration institutional quality and transparency scores of aid receiving countries in their studies. Gupta et al. (2004) find that foreign aid undermines tax efforts and this effect is pronounced stronger in the countries with higher corruption index. A similar study by Crivelli et al. (2012) which is the extension of Gupta et al. (2004) confirm that there is a negative relationship between foreign aid and tax revenues. This inverse relationship is stronger in the countries with poor institutional qualities. However, the stability of these findings have been questioned by later studies. Clist and Morrissey (2011) extended the data of Gupta et al. (2004) and using the same model and variables, find totally the opposite results, stating that there is a positive association between the tax revenues and the grant component of foreign aid. Furthermore, with the availability of more comprehensive data on tax revenues compiled by ICTD¹, Morrissy et al. (2014) contradict the results supporting the existence of any relationship between foreign aid and tax efforts. They state that even if there is a sign of weak relationship that is not “robust to alternative specifications and estimators.” Paul Clist (2016) who has also used the ICTD Government Revenue Database data rejects the results of Crivelli et al. (2012) and argues that there exists a positive association between foreign aid and tax revenues. This study is interesting in the sense that unlike others, the author has used data from multiple sources and subjected the model to various specifications, but still results remain unchanged.

A few number of researchers have employed time series techniques which are deemed to produce more stable and less controversial results. Endogeneity is one of the main concerns that casts doubt on the credibility of results. Although some researchers are using the lagged values of foreign aid as instrumental variable to purge endogeneity, but that does not address this issue properly, Carter (2013). Using a more advanced panel time series technique, Carter (2013) argues that the Remmer (2004), Gupta et al. (2004) and Crivelli et al. (2012) results

¹International Center for Tax and Development

that claim negative relationship between foreign and tax revenue are not stable and points out “there is little evidence that aid displace domestic taxation.” The main argument of the author is that most of the previous studies are applying static models with highly restrictive assumptions such as long-term parameter homogeneity.

A few recent studies on this topic have taken in to account the aid conditionality and revenue targeting set by donors. Conditions attached to aid package might differ from one country or region to other. However, there are commonalities when it comes to conditions such as privatization and trade liberalization and these processes have remarkable impact on revenue generation. One specific condition is revenue targeting set by IMF, some studies argue that it has mollified that dampening effect of foreign aid on revenue mobilization. Crivelli et al. (2017) show that aid conditionality proxied by IMF-supported programs “partially offset” the negative impact of grant component of foreign aid on the tax performance, this impact is more pronounced in countries with high aid dependency ratio and poor governance quality.

Although in terms of model specification and variable selection this study follows the previous works, it differs in some ways. Firstly, it uses two comprehensive datasets – from IMF and ICTD. Secondly, this study explores the effect of aid conditionality on disaggregate tax revenues and they find that the effect is stronger on tax on goods and services. Finally, the conclusions from both sources of data have similarities, thus the overall results remain the same.

0.2.2 Government Recurrent Expenditure

One of the main concerns of donor community is how fiscally provident or prodigal the aid-receiving countries are when it comes to allocation of aid resources. Will they use foreign aid as a substitute or complement for tax revenues? Will they increase current expenses or invest in the development projects that will pay off in the long term. However, given the complex nature of political economy factors, Mosley (2015) argues that the dynamics of aid effectiveness, public expenditure and taxation and their linkage to economic growth cannot be confined to crowding out effects. Remmer (2004) states that “aid promotes not only increased spending, but also reduced revenue generation.”

With the availability of better data on fiscal policy variables, specially the IMF databases and development of econometric techniques, researchers have applied time series models to study the relationship between fiscal policy and foreign aid. Juselius et al. (2012) studying the long run association between foreign aid and macro variables – investment, private consumption and government consumption – in 36 Sub-Saharan African countries, suggest that foreign aid have positive long-run impact on macroeconomic variables and does support the hypothesis that aid is fungible. In this paper the authors have estimated a Co-integrated VAR model for each country separately. Another country specific study in the context of Ghana indicates improved fiscal performance associated with foreign aid. Such positive fiscal impact is characterized as decreased domestic borrowing and increased tax efforts and government consumption (current spending) Osei et al. (2005). However, Gang and Khan argue that foreign aid do not have significant impact on public consumptions.

0.2.3 Public Investment

Public investment is deemed to be a major driving force of economic growth and also it measures how of much of resources are allocated for development expenditure. Therefore, researchers have investigated that what amount of tax revenues and aid resources are allocated to public investment, and what is the impact of foreign aid on public investment. Theoretically, according to the two gape-model developed by Chenery and Strout (1966) capital inflow in the form of aid resources will compensate for the domestic saving shortages. So, the perceived outcome will be dwindling saving-investment gap and sustainable economic growth. Heller (1975) finds that aid increases investment and at the same time decreases taxation and borrowing, but the size of response differs based on the types of ODA component, “grant is pro-consumption and loan is pro-investment.” Gang and Khan (1991) employed the extended version model and their findings suggest that the two components of foreign aid, grants and loans are invested in the development projects, thus have no contribution to government recurrent consumption. Similarly, Khan and Hoshino (1992) support the hypothesis that foreign aid have positive effect on public investment. Taking into consideration the saving dimension of investment, Hansen and Tarp (2000) support the economic theory of two-gap

model stating that aid flow does increase aggregate savings and subsequently investments. However, there are some other empirical works that don not conform to this theory and they argue that foreign aid does not increase investment, Easterly (2003). Moreover, White (1994) argues that foreign aid have no impact on public investment, and criticize that positive results shown by Gang and Khan (1991) is merely a misinterpretation of the results.

0.3 Methodology and Data

0.3.1 Methodology

Researchers have applied various conventional econometric methods investigating the response of aid recipient governments fiscal policy response to foreign aid, and as noted in the preceding section, their findings are not conclusive. Regardless of being of being aid optimist or aid pessimist, the choice of empirical strategy, data transformation and sample composition might have been the determinant factors. Detailed review of the existing literature on response of fiscal policy to foreign provides us with the significant insights. However, in the empirical studies, it is more critical to know how those results have been generated, and what type of models the researchers have estimated. Therefore, in this part, before delving into the new empirical strategy, I go over some of the commonly used methodologies in the literature. This review of econometric method has two fold purposes. Firstly, in the selection of control variables and data transformation for the new model, I will be following the existing models. Secondly, juxtaposition of these models will facilitate a better comparison with the new empirical strategy.

Remmer (2004) has used an error correction model with following specifications:

$$\Delta Y_{it} = \beta_0 + \beta_1 Y_{i,t-1} + \Delta X_{it} \beta_2 + \beta_3 X_{i,t-1} + \epsilon_{it}$$

where ΔY_{it} is the change in government spending as proportion of GDP, X is a vector of control variables such as ODA, log of population, GDPPC, public debt, tax revenue and dependency ratio. β_2 and β_3 are the coefficients of interest that indicate short term and long term association respectively.

Gupta et al. (2004) and Crivelli et al. (2012) have applied the following models

$$Y_{it} = \beta_0 + \beta_1 G_{it} + \beta_2 L_{it} + \beta_3 G^2 + \beta_4 L_{it}^2 + \beta_5 X_{it} + \alpha_t + \epsilon_{it}$$

where Y is the log to tax-to-GDP ratio, G indicates ODA grant, L represents the loan component of ODA and X is a vector of control variables such as per capita GDP, agriculture share in value added, industry share in value added and trade openness. And α represents the time-specific effects. To address endogeneity, they have used the lagged value of foreign aid as instrument and also they applied GMM estimators.

Carter (2013) who provides a critical survey of empirical studies, has applied the following panel time series model using the data sets of the three above mentioned papers.

$$\Delta T_{it} = C + \beta(T_{i,t-1} - \theta_1 - \theta_2 A_{t-1}) + \gamma_1 \Delta T_{i,t-1} + \gamma_2 \Delta A_{i,t-1} + \eta$$

where ΔT_{it} is the change in the tax revenues and the coefficient of interest for the long term relationship between aid and tax is θ_2 which constrained to remain identical. β indicates the deviation from long term equilibrium and the short coefficient vary across the panels. The author levels three main criticisms to the existing literature. Firstly, the previous studies have not solved the issue of endogeneity. Secondly, most of the empirical strategies applied in the literature are estimated based on the restrictive assumptions such as homogenous coefficients across the panels. Thirdly these applied strategies can not model the future path of fiscal policy variables to innovations to foreign aid. Carter (2013), has estimated the above Error Correction Model using Pooled Mean Group Estimator (PMG). Pesaran et al. (1999) state that pooled mean group estimator (PMG) allows the variation of short-term coefficients and error variance across the groups, but the long-run coefficient is maintained to be homogenous. Estimation of this model with more general methods such as Pooled Mean Group estimator address the issue of parameter heterogeneity. The results based on the three mentioned data set suggest that the negative coefficients have lost significance. The author states that even these estimators allowing to capture the unobserved country specific heterogeneity, are not enough to address this issue properly.

To sum up the methodological aspect of previous literature, researcher have made disparate efforts to address the concerns casting doubts on the stability results. Crivelli et al. (2012) have done several model specifications to address endogeneity and Carter(2013) focused on the parameter heterogeneity. In the present study, I will try to model the future path of fiscal policy variables to innovations to foreign aid over a specified time horizon. The new model, is not static, it allows for adjustment dynamics. Since the lagged values of foreign are used, the concern associated with endogeneity is not posing a credible threat to the stability of results.

0.3.2 Impulse Response Functions by Local Projections

Jorda (2005) advocated this model as a better alternative to conventional VAR method computing the impulse response functions. Since then it has been employed for single cross section and panel data settings. To the best of our knowledge the current study is the first work of its type using the this method in the aid effectiveness literature. Generally, this method has several advantages over VAR that Jorda (2005) summarizes as follow. Firstly, the consistent estimate of impulse response functions by VAR requires the specification of a system of equations and coinciding with data generating process (DGP). While estimation of impulse response function by local projections can be easily done with single equation and "standard regression package". Secondly, it is more robust to misspecification even if the DGP of Wold Decomposition is unknown or proper number of lagged values are not selected. Thirdly, it provides appropriate joint or individual inferences. Fourthly, its estimation is easy in case of high non-linear specification.

Using the Wold Decomposition, Jorda and Kozicki (2007)², express Y_t , a $n \times 1$ time series vector

$$Y_{t+h} = A_1^h Y_t + A_2^h Y_{t-1} + \dots + \epsilon_{t+h} + B_1 \epsilon_{t+h-1} + \dots + B_{h-1} \epsilon_{t+1}$$

$$Y_{t+h} = A_1^h Y_t + A_2^h Y_{t-1} + \dots + A_k^h Y_{t-k+1} + V_{k,t+h}$$

$$V_{k,t+h} = \sum_{j=k+1}^{\infty} A_j^h Y_{t-j} + \epsilon_{t+h} + \sum_{j=1}^{h-1} B_j \epsilon_{t+h-j}$$

where $A_1^h = B_h$ for $h \geq 1$, $A_j^h = B_{h-1} A_j + A^{h-1} j+1$ for $h \geq 1$, $A_{j+1}^0 = 0$, $B_0 = I_n$. Authors

²This mathematical analysis is based on Jorda and Kozicki (2007), equations 12-13

show that A_1^h is a consistent estimate of impulse response coefficient B_h and it can be done with OLS estimation³.

Application of this model in the aid effectiveness, particularly aid and fiscal policy literature is superior to VAR and Co-integrated VAR. So far, those aid related studies that have applied these time series techniques, whether have estimated country specific or panel co-integrated VAR, but for the panel VAR they do not include variables such as government expenditure, tax revenue and public investment. Tarp et al. (2015) estimate a panel co-integrated VAR that mainly includes foreign aid and GDP per capita. Even if all the variables fulfill the requirement of this model, proper estimation of impulse response by co-integrated VAR is a complicated task⁴. Juselius et al.(2013) and Osei et al. (2005) estimate country specific co-integrated VAR and as discussed in the preceding section they have included some macro variables. Panel VAR and development of statistical package could be an option, however it does not accommodate the macro variables. The consistent estimate of IRFs by panel VAR is possible when variables are stationary at level, while most of the macro variables are non-stationary at level.

Using Jorda method I estimate an OLS model by regressing the lead of tax revenue on the first lagged value of ODA grant and a number of control variables. In selection of control variables I follow Gupta et al. (2004) and Creville et al. (2012)⁵

$$T_{t+h} = \alpha^h T_{t-1} + \beta^h G_{t-1} + \Phi^h X_t + \mu + \epsilon_{t+h} \quad (1)$$

T_{t+h} is the lead of ODA-to-GDP ratio and T_{t-1} is its lagged value. The variable G_{t-1} indicates the one-period lagged value of ODA grant, X is a vector of control variables that contains trade openness (import plus export over GDP), GDP per capita, industry and agricultural share in value added. All regressors are as proportion of GDP except the per capita GDP. In this panel dynamic model, I also control for the fixed effect by averaging the variables over time then subtracting it from the original series. μ controls for unobserved fixed effects that is

³For more details on mathematical analysis see the main text

⁴Hansen (2003) provides full details on the mathematical analysis of Co-integrated VAR

⁵Authors provide details on the selection of control variables and their expected relationships with the dependents variables. For further elaboration refer to the main texts

performed by time demeaning of series. Following Wooldridge (2010) application of Fixed Effect Transformation is a way of addressing the panel fixed effects. However, there are some concerns about the suitability of this estimator. The empirical strategy applied here requires balanced unbroken panel data, so the datasets do not permit further specifications. In the first sample, $t = 31$ years and $h = 0, 1, \dots, 5$, is the forecast horizon. In eq(1) the coefficient of interest is β which indicates the response of tax revenue to foreign aid over the specified forecast horizon. Similarly, to compute the response of government expenditure to foreign aid, I estimate an OLS model by regressing the leads of government expenditure-to-GDP ratio on the one year lag of foreign aid and a number control variables. In the selection of control variable I follow Remmer (2004).

$$Y_{t+h} = \alpha^h Y_{t-1} + \theta^h G_{t-1} + \Phi^h X_t + \mu + \epsilon_{t+h} \quad (2)$$

Y_{t+h} is the lead of ODA-to-GDP ratio and Y_{t-1} is its lag. The first lag of ODA grant is indicated by G_{t-1} , X is a vector of control variables that contains trade openness (import plus export over GDP), GDP per capita, log population, tax revenue as proportionate of GDP. In my first sample $t = 31$ years and $h = 0, 1, \dots, 5$ is forecast horizon. The coefficient of interest is θ indicating the response of government recurrent expenditure to foreign aid over the specified forecast horizon. As in the case of tax model, μ allows controlling for the panel fixed effects, details discussed in the tax model, eq(1). This model will also allow us to examine the response of government expenditure to tax revenue.

Impact of foreign aid on public investment has been examined in a few theoretical and empirical works, however it has not attracted considerable attention in the recent empirical papers. Unlike tax and consumption models that are commonly used in the literature, there is a dearth of solid theoretical model for the interaction of foreign aid and public investment. Heller (1975) derived a theoretical model to estimate the response public investment to foreign aid by maximizing a utility function, then it has been extended and applied by a few researchers. The investment model used in the present study has been adopted from Khan and Hoshino (1992), though in the original paper the model is derived from the maximization of a utility function and computing the target value of public investment. The authors have

developed this model based on the seminal work of Heller (1975). I have added all the control variables as in the main paper, however skipped the calculating the target value of public investment, because it is not required for the empirical strategy employed in this paper. Although it is the simplistic form of the model, estimating such model with a different technique may still say something about the response of government investment to foreign aid. Khan and Hoshino (1992) added private investment in the list of control variables and estimated the following model after calculating the target value of public investment.

$$I = \beta_0 + \beta_1 G + \beta_2 Y_{t-1} + \beta_3 I_p + \beta_4 T + \epsilon$$

Using the linear projection method I estimate the following model.

$$I_{t+h} = \alpha^h I_{t-1} + \beta^h G_{t-1} + \psi_1^h Y_{t-1} + \psi_2^h I_p + \psi_3^h T + \mu + \epsilon_{t+h} \quad (3)$$

where I is the public investment as proportion of GDP, the subscript t indicates the time span of 31 years and $h = 0, 1, \dots, 5$ the forecast horizon is five years. The first lag of ODA grant is indicated by G_{t-1} , Y_{t-1} represents the lag of per capita GDP, I_p is private investment and tax revenue is indicated by T . The coefficient of interest is β , and all variables except per capita GDP are as the relative to GDP.

From amongst these three models, the tax and government consumption models have commonly been used in the literature. However, researchers have paid negligible attention to association between public investment and foreign aid, this negligence is very conspicuous specially in the recent studies after 2000s. Given the the presence of tax revenue in the control variables, this model is informative. By estimating this model, in addition to impact of ODA on public investment, we get an idea if tax revenues are invested in the development projects. Heller (1975) formulated the government revenues and expenditure in the presence of foreign aid as follow.

$$C_s + C_c + I_g = B + T + A$$

on the left hand side C_s and C_c are the government civil consumption and socio-economic

consumption respectively. I_g is the public investment in the development projects. On the right hand side B represents domestic borrowing, T indicates tax revenues and the gap between these two sources of revenue is deemed to be filled out by foreign aid A , both grants and loans. In the eq(3) if β and ψ_3 are significant, then it implies that some parts of foreign aid and tax revenues are spent on public investment. Public borrowing in this budgetary constraint is treated as innocuous element, because whether developing hesitate to finance recurrent expenditure out of this revenue source Mosley (1978) or dependence on domestic borrowing is perceived as indicator of imprudent fiscal behavior Heller (1975).

Theoretically, there will be substitutability and adjustability among the revenue elements in the government revenue-expenditure set. Gang and Khan (1991) and Khan and Hoshino (1992) provide some statistics that how much of what revenue go to the expenditures. Heller (1975) provide further theoretical explanation for the above government budget constraint that are worthy of brief comment. Firstly, increase in domestic borrowing, is not a desirable fiscal performance, so with the availability of alternate sources of income, borrowing rate will drop. Secondly, the political and administrative cost of increased revenue mobilization is a decisive factor in determining what revenue sources should be expanded. Clearly the political cost of increased taxation is high and administratively it is less feasible in countries with rampant corruption and poor institutions. Therefore, foreign aid tend to be treated as a boon to defray some costs incurred by public expenditure. On the contrary, donor community is making desperate efforts to preclude the predicament of depressed tax efforts and increased government current expenditure. Fixing revenue target for the recipient governments and structural adjustment programs by IMF and World Bank are parts those efforts initiated by donors. Crivelli et al. (2017) show that aid conditionality proxied by IMF-supported programs "partially offset" the negative impact of ODA grant on tax revenue.

0.3.3 Data

Lack of gapless and fairly long series could be the biggest challenge hindering the application of time series techniques in aid effectiveness literature. Fortunately, remarkable progress has been made in compiling data from various sources to construct long series for tax revenues, consumption and investment. However, because of short time span or data holes, applying time series technique that require long and balanced panel, is not free of challenge. The dataset used in this study contains the annual series covering from 1982 to 2012 and from 1992 to 2012. Since tax revenue is the main variable of interest, observations have been selected based on the availability of balanced panel for tax series. In the first sample with the time span of 31 years, there are 38 aid receiving countries from all continents. International Center for Tax and Development (ICTD)⁶ Government Revenue Database has compiled a comprehensive data set including total revenues, tax revenues and disaggregates of tax revenues, Prichard et al. (2014). The ICTD Government Revenue Dataset (ICTD-GRD) is compiled by collecting data from international sources and IMF Article IV. Since a balanced and gapless panel is required for the present work, only the aggregate tax revenue series fulfill these criteria. The second sample contains 62 countries for the time period of 21 years. The main advantage of this sample is a better representation of diverse aid receiving economies. The third sample with $N = 49$ and $T = 21$ is composed of those countries for which the tax revenue data are available from WoRLD-IFM databases. Sample selection bias could be a concern, but the larger sample is a good representative of the population, thus it allows for robustness check. All tax, consumption and investment series are given as share of GDP, and ICTD has calculated the tax-to-GDP ratio based on the common GDP series.

As noted in the preceding paragraph, tax data have been collected from ICTD Government Revenue Database and IMF databases. The data on GDP, export and import have been obtained from Penn World Table 9. Other variables such as government consumption, per capita GDP, population, agriculture share in value added and industry share in value added have been collected from World Development Indicator, World Bank. Data on the grant

⁶More details on this data set are available on <http://www.ictd.ac/datasets/the-ictd-government-revenue-datasetcore-dataset>

component of foreign aid have have been drawn from QWIDS-OECD database and net aid transfer (NAT) taken from Center for Global Development (Roodman). Most researchers use the ODA disbursement in the form of grants and loans, these series are available on OECD website. However, few researchers employed a slightly different measurement of foreign aid, that is the Net Aid Transfer constructed by David Roodman. Net Aid Transfer (NAT) excludes all debt forgiveness grant, while ODA grants do not, Roodman(2012). Finally, data on public and private investment are pulled from ICSD-IMF database. As discussed in the earlier section, some studies suggest the differential effects of foreign aid, depend on whether it is loan or grant. However, due to the lack of a balanced panel and existence of data hole, examining the response of intended macro variables to ODA loans, is not feasible in this study. In terms of data transformation, foreign aid variable is constructed as aid per capita, aid-to-GDP ratio in the literature. Remmer (2004) used aid-to-GNI ratio, aid-to-government expense ratio and aid-to-import ratio. However, the commonly used transformation is aid-to-GDP ratio, accordingly here I have constructed the aid-to-GDP ratio, the other variables are also as relative to GDP.

0.4 Estimation of Results

0.4.1 Graphical Presentation

In the first sample, with $T = 31$ and $N = 38$, on average the tax revenue is 14.2% of GDP, government consumptions make up 18.4% of GDP and public investment represents 5.7% of GDP. For the measurement of ODA, researchers mainly use the grant component in the study of recipient governments fiscal behavior. However, in the study of foreign aid and income growth some researchers have employed a slightly different measurement called net aid transfer. In this study, I use both measures to study the response of fiscal policy variables to foreign aid. On average, ODA grant and net aid transfer constitute around 2% of GDP.

Figure 14 exhibits an inverse relationship between total tax revenue and ODA over the sample period. Tax revenue rises steadily and ODA experience a precipitous decline following an ephemeral upward trend in the early part of sample period. The pattern of this graphical presentation is analogous to that of Gupta et al. (2017) that covers over 100 aid receiving countries for the period of 1993 through 2012.

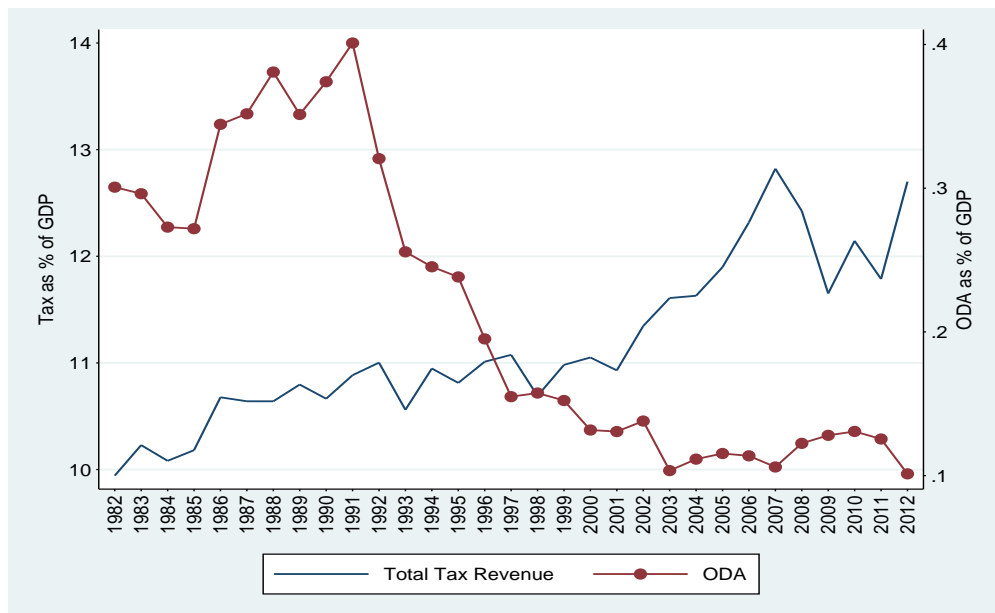


Figure 1: First Sample, Tax Revenue

Figure 2 shows that over the sample period, oscillation of government consumption corresponds to the upward/downward trend in foreign aid. Graphically, there exist a direct

nexus between the aid inflow and level of government consumptions in the aid receiving countries.

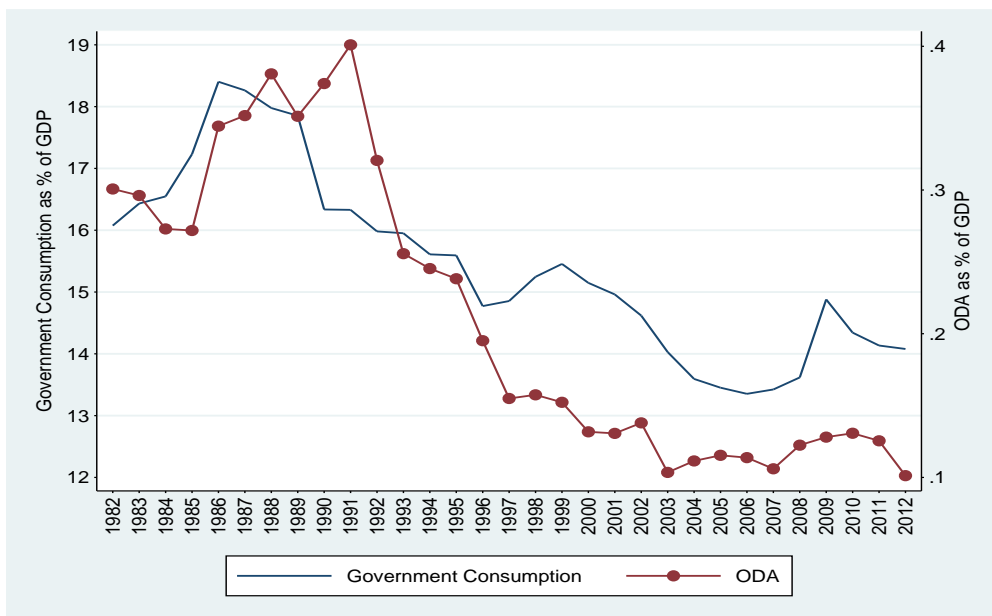


Figure 2: First Sample, Government Recurrent Expenditure

Figure 3 suggests public investment is plummeting for most part of sample period and this trend is reversed after some point and soar faster than foreign aid.

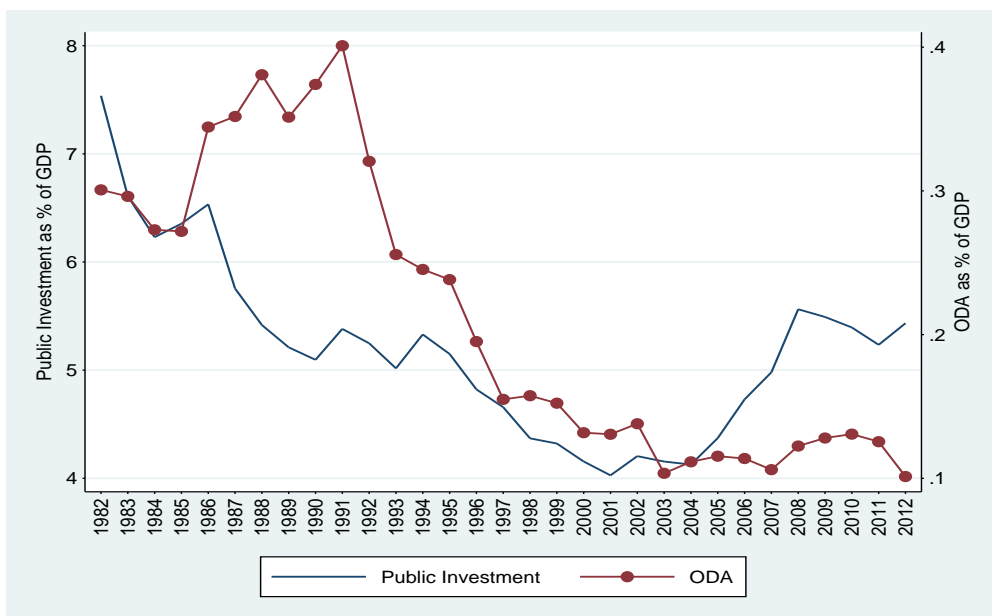


Figure 3: First Sample, Government Investment

0.4.2 Impulse Response Functions (IRFs)

Application of a recent time series technique, estimation of IRFs by Local Projections allows to estimate a dynamic panel model generating the impulse responses by single equation. Jorda (2005) introduced this method as a better alternative to conventional VAR, details discussed in the preceding section. Most of the existing empirical studies on aid effectiveness, specially studies about the putative impact of aid on fiscal policy have used static or dynamic models. However, these conventional models are not capable of illustrating the pattern and magnitude of responses of intended variables to foreign aid over a given time horizon. Therefore, employing this time series empirical strategy will provide a better insight about the future response of fiscal policy variables over a given time period. In this section I present the results of impulse responses generated by local projections.

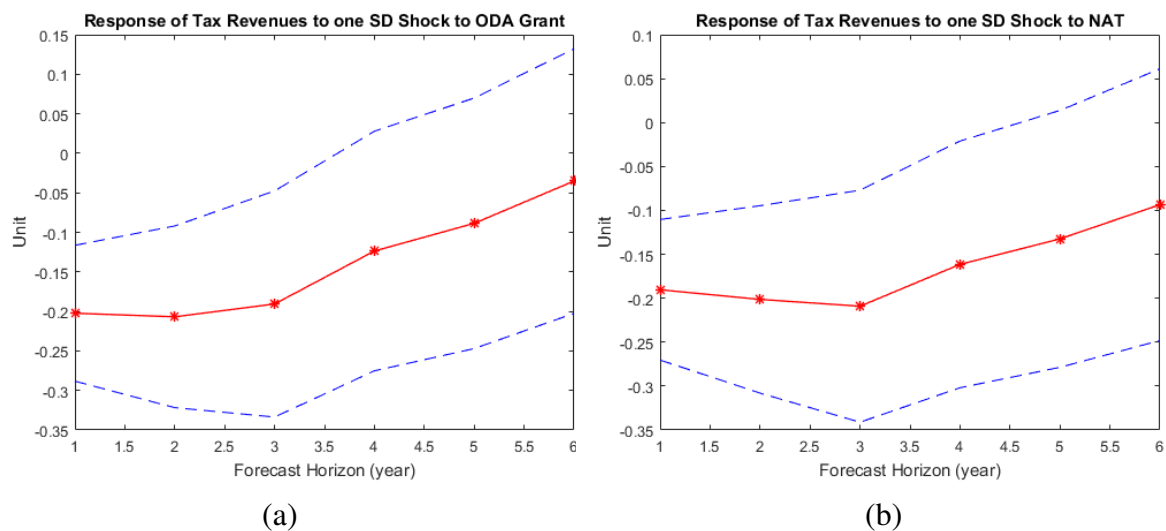


Figure 4: sample period 1982-2012, the solid red line with asterisk shows impulse response surrounded with two standard error bands

Baseline Results

Figure 4 depicts the response of tax revenue of recipient countries in response to one standard deviation shock to aid inflows. As illustrated in panel (a) and (b), I have used two different measures of aid inflows, ODA grant and Net Aid Transfer (NAT). The results suggests that one standard deviation shock to ODA as share of GDP, immediately decreases the tax revenue relative to GDP by almost 0.2 unit. Although the contemporaneous response of both ODA

measures is slightly different, the impulse responses are not significantly different from zero toward the of sample period. This finding does conform to the hypothesis of negative association between ODA grant and tax efforts supported by Khan and Hoshino (1992), Gupta et al (2004), Crivelli (2012), Combes et al. (2016) and Remmer (2004). These findings are in stark contrast with the results shown by researchers on the other end of the spectrum of aid and fiscal policy response behavior. They argue that ODA grants does not undermine the tax revenue generation. Osei et al. (2005), estimating a country specific co-integrated VAR model shows that there is positive relationship between ODA grant and tax revenue in the case of Ghana. Furthermore, Clist and Morrissey (2011) argue for the positive impact of aid on tax revenue, and similarly Morrissey et al. (2014) and Clist (2014) reject the argument that aid depress tax efforts.

Increase in tax revenue of recipient governments is a desirable outcome for donor community and and indication of better revenue performance for the aid receiving governments, while sluggish revenue mobilization suggest otherwise. The government is facing a fixed budget constraint with total expenditures (current expenditure and investment) equal to total revenues. Thus shortage on the revenue side should be compensated either by raising from alternate sources or resorting to austere government consumption. Heller (1975) decomposes the government total expenditure to current expenses on running the the government apparatus; socio-economic consumption intended for schooling and providing health health services; and investment in the long-term development projects. Similarly total revenue is disaggregated into tax and non-tax revenues, domestic borrowing and foreign aid. In the light of this budget constraint, several points are worth mentioning.

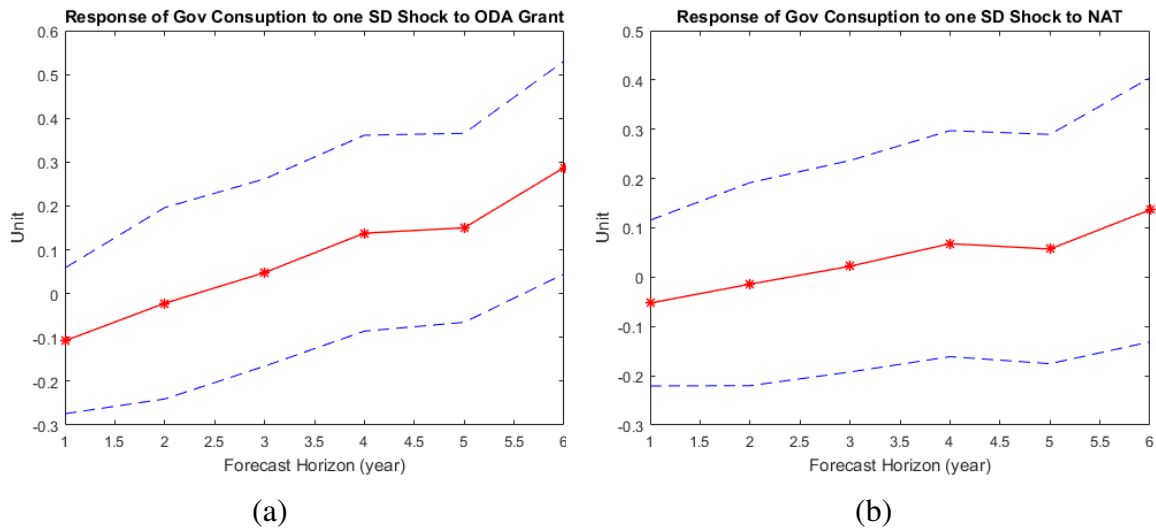


Figure 5: sample period 1982-2012, the solid red line with asterisk shows impulse response surrounded with two standard error bands

Firstly, on the revenue side, aid will partially substitute for shortages in tax revenues or borrowings. The empirical evidence in this study does support the idea of tax displacement. Secondly, ODA may or may not have negative impact on domestic borrowing, the idea of negative impact is supported by Osei et al. (2005). Thirdly, revenue deficit due to declining taxation or borrowing from the local market will adversely affect government expenditures. Theoretically, as noted in the government budget constraint, aid inflows are supposed to partially fill out the revenue gap. However, the mechanism through which aid resources are spent might differ markedly from one country to another. Some recipient governments will allocate the resources for the current expenditure, while others are more provident investing in the long term development projects. Here we will examine the response of government recurrent expenses and public investment to ODA, but dataset does not permit the analysis of public debt.

Figure 5 displays the response of government recurrent expenditure to shocks to foreign aid. The empirical evidence suggests that grants have no significant impact on government recurrent expenditure. The dashed blue lines are representing the two standard error bands and zero is included this band over the forecast horizon. As we observe, panel (a) and (b) do not indicate any differential response of government recurrent expenditure to the different measures of foreign aid. This finding does not supports the argument of aid fungibility and is

consistent with a few of previous empirical studies. Gang and Khan (1991) and Carter (2013) argue that foreign aid has no significant impact on government spending. On the other hand Remmer (2004) that I have followed in the selection of control variables, Osei et al. (2005), Juselius et al. (2013) and Combes et al. (2016) state that foreign aid has stimulative effect on government consumption. The existence of positive relationship between foreign aid and government expenditure is predicated on the assumption that grant is not accompanied with repayment conditions, thus it is pro-consumption Heller (1975).

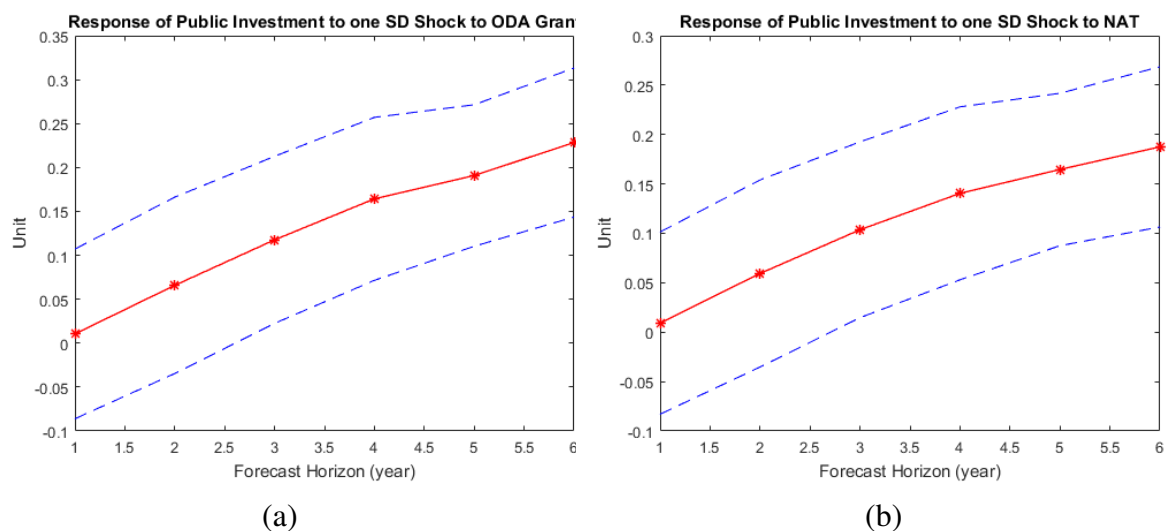


Figure 6: sample period 1982-2012, the solid red line with asterisk shows impulse response surrounded with two standard error bands

The response of public investment to foreign aid is illustrated in figure 6. This evidence suggests that one standard deviation shock in the ODA grant or net aid transfer as proportion of GDP is not significant for almost three years. However the positive response of public investment to innovations to grants increase over the rest of forecast horizon. Unlike the response of tax revenue and government consumption, the response of government investment to both measures of ODA is very similar in terms of magnitude and pattern. This result is in line with Gang and Khan (1991) arguing that foreign aid stimulates public investment. Heller (1975), Khan and Hoshino (1992) also supports the hypothesis of positive association between foreign aid and public investment, however it is mentioned that grant is less pro-investment than loan. On the contrary, White (1994) rejects the hypothesis of positive association between foreign aid and public investment on the ground of improper interpretation of results.

Also the recent finding by Combes et al. (2016) applying propensity score matching (PSM) techniques suggests that upward shift in aid discourages public investment.

0.4.3 Robustness Check

The baseline results presented in the preceding subsections, are stable to variations in the sample of countries, sampling period and data from an alternate sources. However, there is an exception in the case of public investment. More precisely, results stability implies that the over all findings remain the same, though the pattern and magnitude of response slightly differ. The second sample contains more countries representing all continents and covers a shorter time span with $N = 62$ and $T = 21$. To get an idea about critical features of this sample, it will be helpful to present its descriptive statistics. The overall mean of ODA grant is 1.3%, government recurrent expenditure 17.4%, total tax revenue 14.2% and public investment 5.8% of GDP. Interestingly, these statistics are very close to that of first sample. The figures plotting the main variables against the ODA grant are available in the annex. The panel (a) and (b) of figure 7 display the response of tax revenue to positive shocks in foreign aid. Although the pattern of response is more flat compared to the results presented in the earlier section, and also a slight variation in the magnitude, the overall results suggest foreign aid discourage tax revenue mobilization. Similarly, the response of government recurrent expenditure is depicted in the panel (c) and (d). Like the results in the first sample, the response of government spending to foreign is not significant. Like the baseline results, zero is included the two standard error bands. Contrary to the first sample, as indicated by panel (e) and (f), public investment response to foreign aid is markedly different from that of first sample. This variation is conspicuous in switching from positive association between public investment and foreign aid to no significant relationship. As noticed in the baseline results, the initial response of public investment investment is not significant, however after the third year it is moving toward positive.

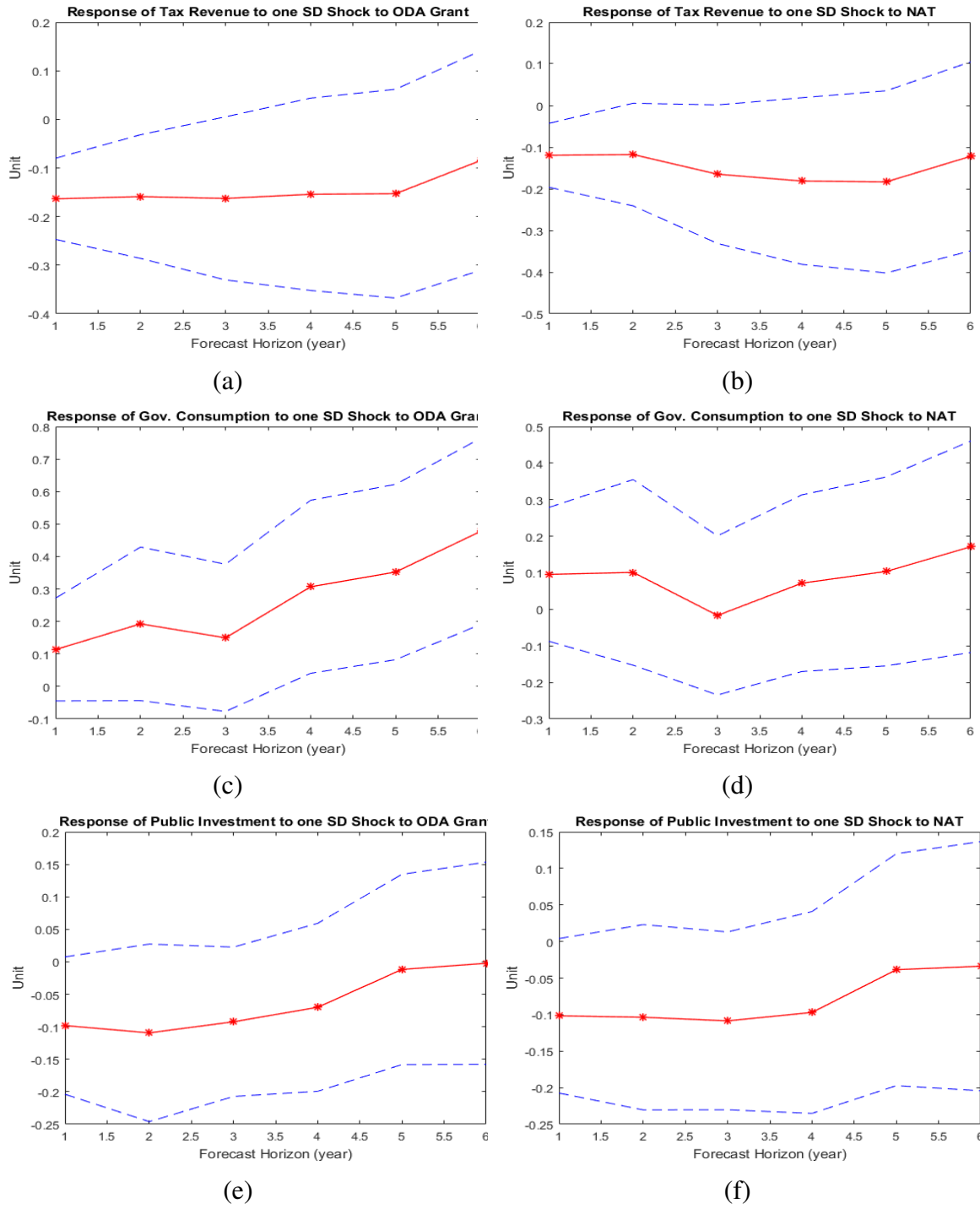


Figure 7: sample period 1992-2012, the solid red line with asterisk shows impulse response surrounded with two standard error bands

0.4.4 Alternate Dataset

Up to this stage the tax series used in the analysis have been obtained from International Center for Tax and Development (ICTD). In this part, I will use the tax data from IMF database to further check the stability of results. In this dataset all things remain the same except for the tax series and sample size. Some countries are dropped from the sample due to lack of adequate data on tax revenues. The main reason for working on this dataset is the availability of tax revenue from a different source. Therefore only the response of tax revenue to foreign aid will be studied here. Figure 8 depicts the plot of tax revenue and ODA grant. Overall, the trend resembles that of figure 3. On average ODA grant is 1.2% and tax revenue is 15.7% of GDP.

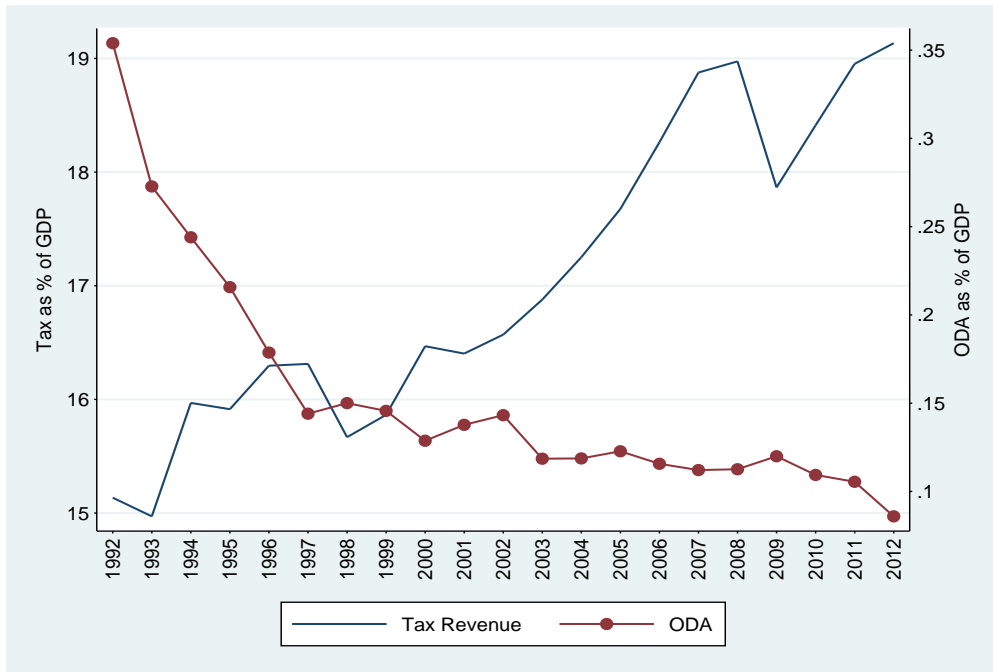


Figure 8: Third Sample, Tax Revenue from IMF

The results from IMF tax revenue data are shown in figure 9, and its consistency with that of first and second samples. It corroborates the stability of results suggesting the existence of negative association between tax revenue and foreign aid. However, one marked difference is the response of tax to net aid transfer. As panel (b) of figure 9 indicates, in the first three years the impulse response is almost flat and after that it rises and reaches the maximum on the fifth year. Again, the overall findings from his dataset suggest the existence of negative association

between tax revenue and foreign aid.

The heterogenous economic structures of aid recipient economies is a concern, because there will exist some incongruous economic factors leading to varying response to foreign aid. Like some of the previous works we have controlled for the fixed effects, apparently it seems that such heterogeneity has not substantialized in the present study. In other words the results are stable to various sample compositions and time periods. However, it is worth mentioning that the results presented in this study are generated from models with the same specifications. Subjecting these models to different specification may accentuate the variation in the pattern and magnitude of impulse responses.

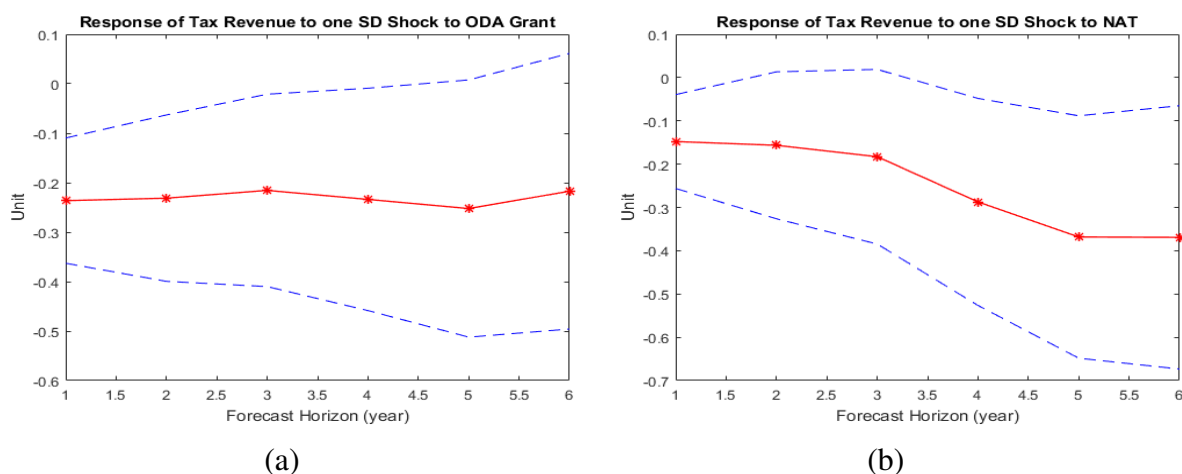


Figure 9: sample period 1992-2012, the solid red line with asterisk shows impulse response surrounded with two standard error bands

0.4.5 Response of Government Spending and Investment to Tax Revenue

The above analysis show that across the three samples of countries with varying time period, foreign is discouraging taxation and no significant impact on government consumption. However, the response of public investment to foreign aid is subject to variation across the the two samples. It responds positively in the first sample and remain unresponsive in the second sample. Since the tax variable is present in the consumption and investment models, eq(2) and eq(3) respectively, it allows us to get an idea about the allocation of increased tax revenue to government recurrent expenditure and public investment.

Figure 10 panel (a) illustrates that the immediate response of government recurrent

expenditure is positive, but not significantly different from zero over the forecast horizon. Similarly, as panel (b) depicts, the response of public investment to ODA grant is positive up to some point, but not significant toward the end of forecast horizon. This finding implies that recurrent expenditure and investment of recipient governments do not increase in response to positive shock to tax revenue. This dynamic does not markedly change in the second second sample, except doubling the immediate response of government expenditure, but the overall results correspond to first sample.

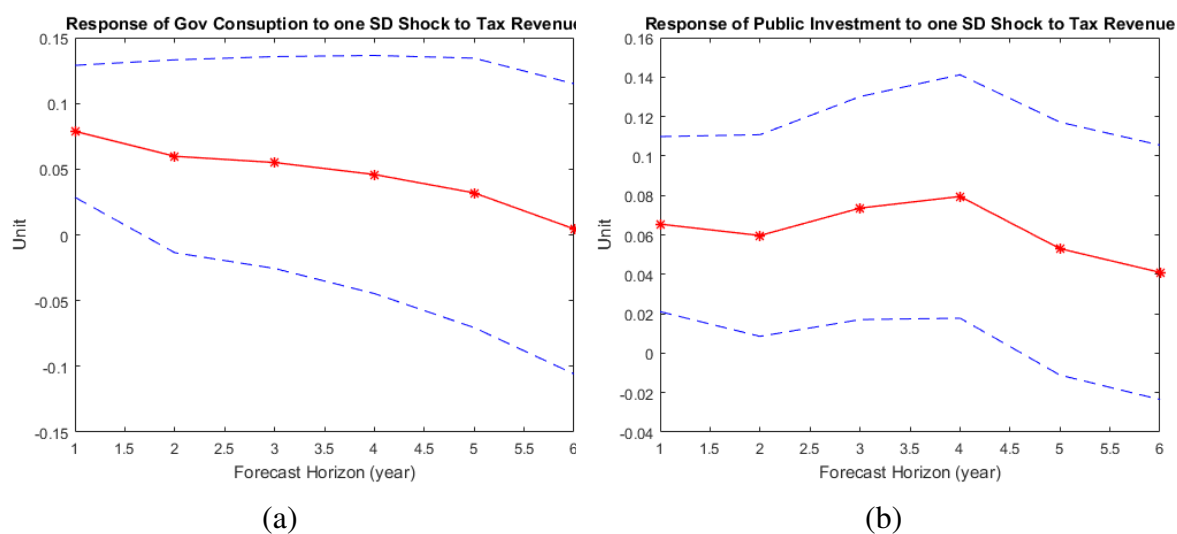


Figure 10: sample period 1982-2012, the solid red line with asterisk shows impulse response surrounded with two standard error bands

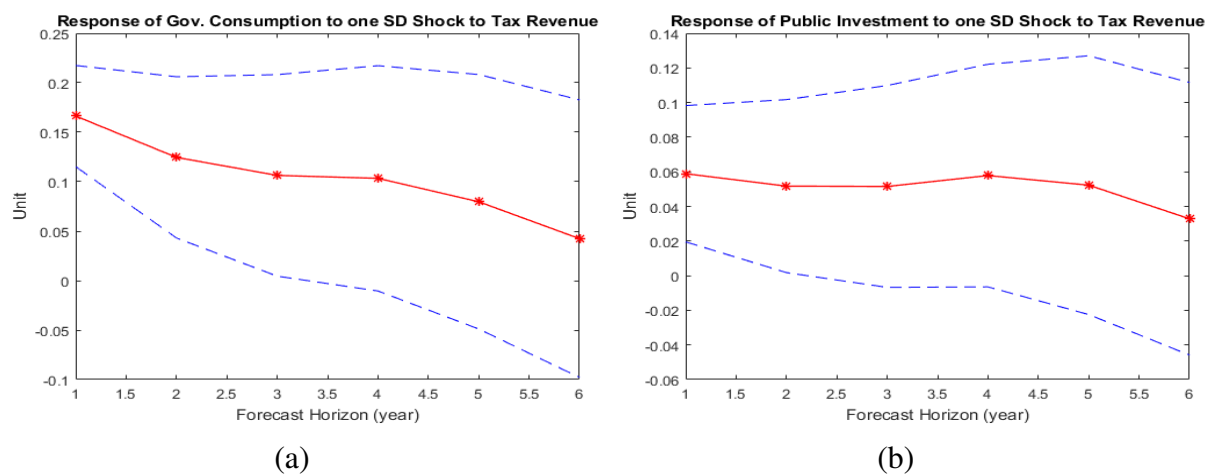


Figure 11: sample period 1992-2012, the solid red line with asterisk shows impulse response surrounded with two standard error bands

0.5 Conclusions

The fiscal behavior of aid receiving governments has been extensively studied in academia. Researchers have employed various empirical strategies to investigate the response of fiscal variables to aid inflows. Applying a new time series technique - computing impulse response functions by Local Projections - for the first time in the aid effectiveness literature generates some interesting results. Response of tax revenue to foreign aid has been a topical issue in the literature particularly with availability of more comprehensive dataset. The findings of this analysis suggest that there is a negative relationship between tax revenue and foreign aid. These results are robust to variation in sampling composition, altering coverage period and alternate source of data. These results support the hypothesis that foreign aid displaces taxation. Response of government expenditure to foreign aid is another important topic in the aid effectiveness literature. The results presented here show that foreign aid has no significant impact on government expenditure and it is consistent across different samples of countries and time period. These findings reject the earlier studies positing the positive response of government expenditure to foreign aid. Lastly, the results presented in this study indicate that foreign aid encourages public investment, however this positive association is vanished by expanding the sample size and truncating the time period. Association between public investment and foreign aid is a relatively neglected theme in the recent studies. So applying a new econometric technique and study of public investment together with tax revenue and government expenditure could be a salient feature that differentiate this study from the existing body of literature. Although here a simple investment model has been estimated, it may be a good step toward the resurgence of interest in this topic.

A relatively detailed survey of empirical and theoretical literature on the association between fiscal policy and foreign aid points out the necessity for further work on this topic. More theoretical work is required to provide a solid modeling foundation so that can support and guide the empirical studies. Lack of such theoretical model is more conspicuous in the case of relationship between foreign aid and public investment. Moreover, the plexiform nature and operation of political economy factors further accentuate the need for theoretical modeling

that can better capture the dynamics of interaction between foreign aid and fiscal policy variables. On the empirical side, there seems to be a unanimous agreement on the superiority of time series techniques that can generate more robust and informative results. Nevertheless, data related challenges and lack of commonly used objective standard for data transformation and sample selection are the major issues faced by empirical researchers. Addressing these theoretical and empirical issues might facilitate achieving a conclusive result that so far has not materialized. The first beneficiary of such results would be the donor community who needs sound empirical evidence for more effective aid allocation and also the recipient governments for better policy making conducive to increased aid effectiveness.

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Appendix

A. List of Countries in the Samples

Table 1: Countries Included in the First Sample, ICTD Tax Data

Belize	Fiji	Madagascar	Sudan
Benin	Gabon	Mauritius	Swaziland
Botswana	Gambia	Mexico	Thailand
Burkina Faso	Guatemala	Morocco	Turkey
Burundi	Guinea-Bissau	Mozambique	Uganda
Cabo Verde	India	Nepal	Uruguay
Central African Republic	Jamaica	Pakistan	Venezuela
Chile	Jordan	Panama	Zimbabwe
Costa Rica	Kenya	Senegal	
Dominican Republic	Lesotho	Sri Lanka	

Table 2: Countries Included in the Second Sample, ICTD Tax Data

Algeria	Gabon	Panama
Antigua and Barbuda	Gambia	Paraguay
Argentina	Grenada	Peru
Bangladesh	Guatemala	Philippines
Belize	Guinea-Bissau	Saint Lucia
Benin	Honduras	Senegal
Botswana	India	Sierra Leone
Brazil	Jamaica	Sri Lanka
Burkina Faso	Jordan	St. Vincent and the Grenadines
Burundi	Kenya	Sudan (Former)
Cabo Verde	Lesotho	Swaziland
Central African Republic	Madagascar	Thailand
Chad	Malawi	Togo
Chile	Mauritania	Tunisia
Colombia	Mauritius	Turkey
Costa Rica	Mexico	Tanzania
Dominican Republic	Morocco	Uganda
Ecuador	Mozambique	Uruguay
Egypt	Namibia	Venezuela
El Salvador	Nepal	Zimbabwe
Fiji	Pakistan	

Table 3: Countries Included in the Third Sample, IMF Tax Revenue Data

Argentina	Guatemala	Panama
Belize	Guinea-Bissau	Paraguay
Benin	Honduras	Peru
Brazil	India	Philippines
Burkina Faso	Jamaica	Saint Lucia
Burundi	Jordan	Sierra Leone
Central African Republic	Kenya	Sri Lanka
Chile	Lesotho	St. Vincent and the Grenadines
Colombia	Madagascar	Sudan (Former)
Costa Rica	Mauritius	Swaziland
Dominican Republic	Mexico	Thailand
Ecuador	Morocco	Togo
Egypt	Mozambique	Tunisia
El Salvador	Namibia	Turkey
Gabon	Nepal	Tanzania:
Grenada	Pakistan	Uruguay
		Venezuela

B. Graphs of the Second Sample

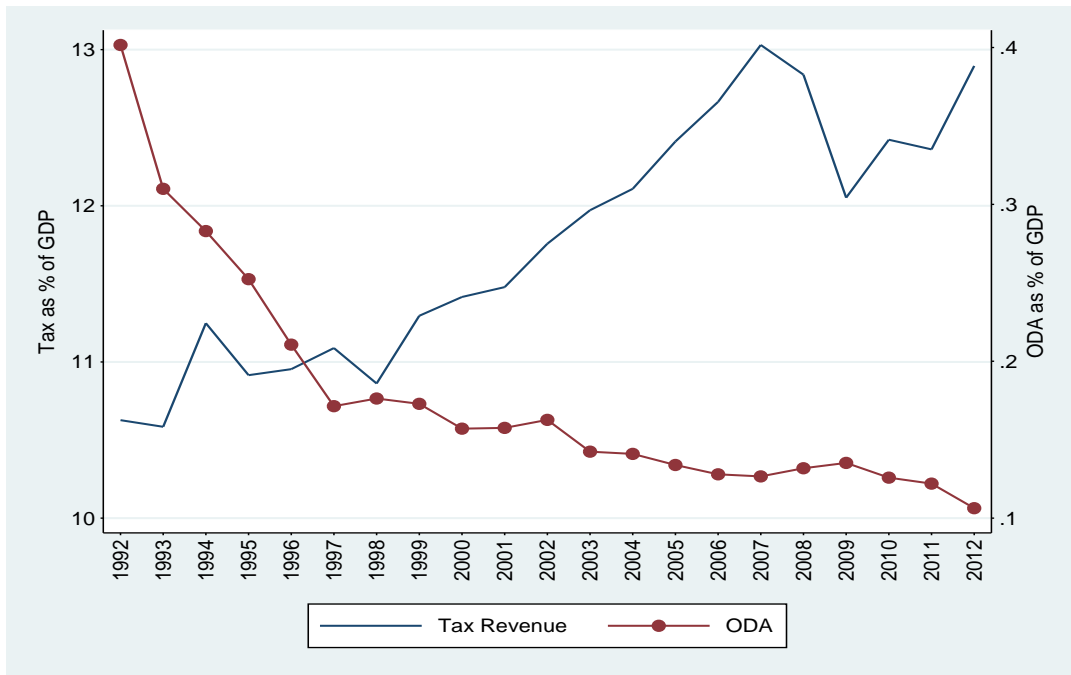


Figure 12: Second Sample, Tax Revenue

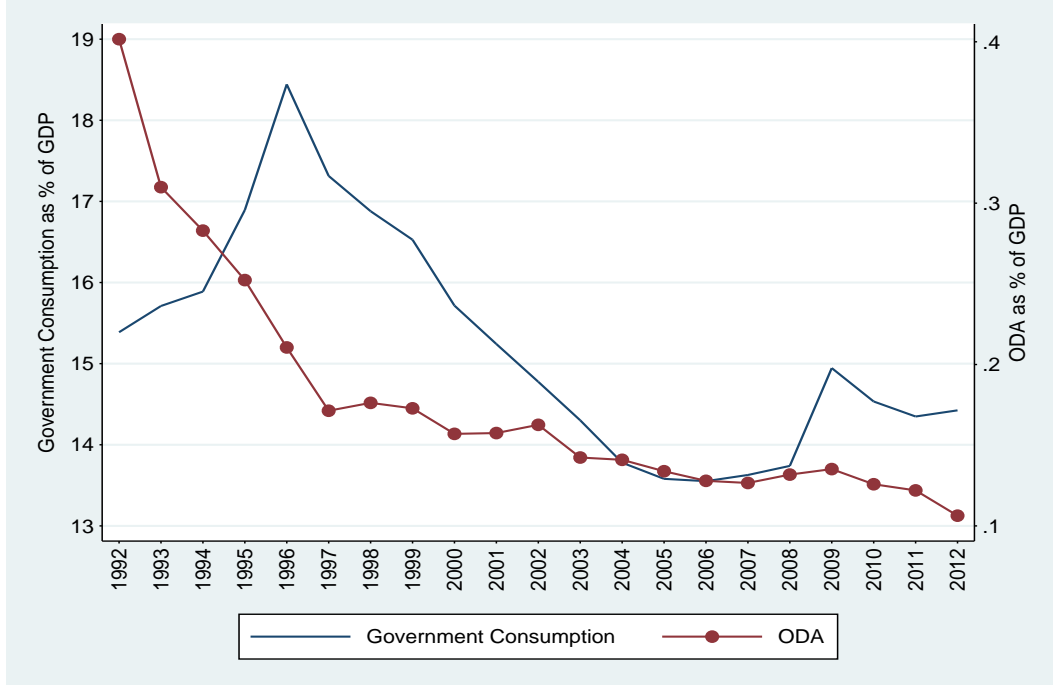


Figure 13: Second Sample, Government Recurrent Expenditure

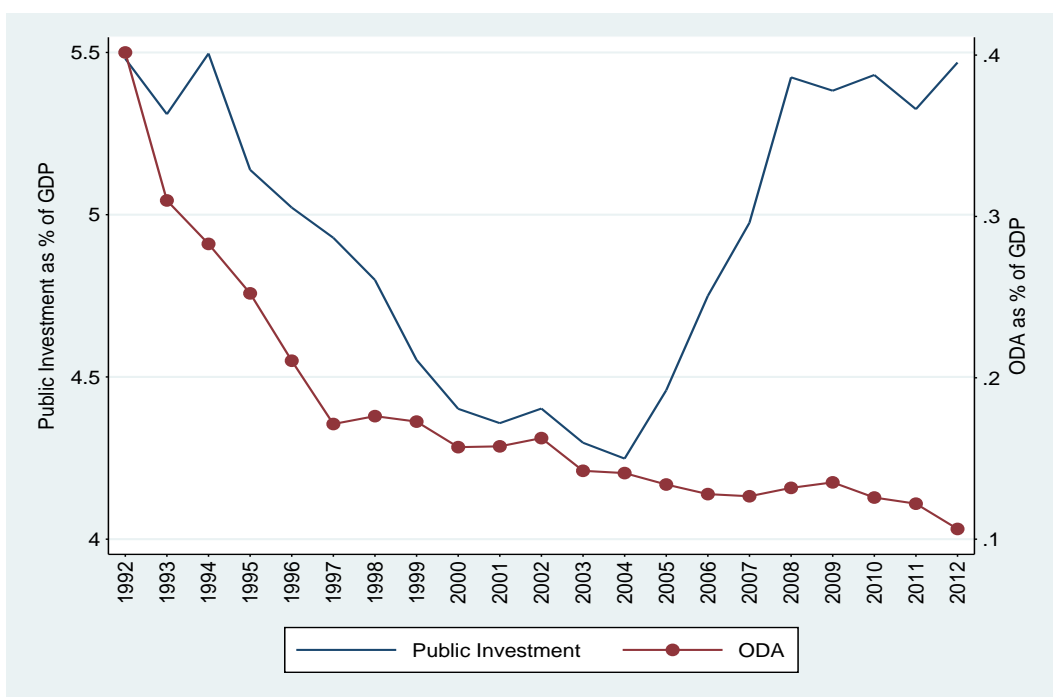


Figure 14: Second Sample, Public Investment